

**PRICE SETTING CONDUCT IN SOUTH AFRICA 2002-2007:  
IMPLICATIONS OF MICRODATA FOR MONETARY POLICY**

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**31 March 2010**

## **Declaration**

I hereby declare that this is my own unaided work, the substance of or any part of which has not been submitted in the past or will be submitted in the future for a degree to any university and that the information contained herein has not been obtained during my employment, or working under aegis of, any other person or organization other than this university.

**Kenneth Creamer**

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**Kenneth Creamer**  
**(electronic signature)**

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**Signature**

To my wife Faranaaz Veriava for her support and  
inspiration and to my dear sons Adam and Reza

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## ABSTRACT

The objective of this research is to test the hypothesis that pricing conduct in South Africa, revealed by studies of pricing microdata, can be shown to have an impact on the modeling and conduct of monetary policy. In order to discern stylised facts about pricing conduct in South Africa, use is made of two unique microdata sets, which are the unit level basis of South Africa's measured CPI and PPI over the period from December 2001 to December 2007. In particular, based on techniques which have been used in comparable studies in other countries, facts have been brought to light concerning *inter alia* the frequency of price changes, the magnitude of price changes, the duration of prices, heterogeneity in pricing, as well as evidence of seasonality, time-dependence and state-dependence in pricing conduct. In order to understand the implications of such pricing conduct, a basic closed economy theoretical model and thereafter an open economy New Keynesian DSGE model are used to compare the impact of various pricing assumptions. In general, but with some qualification regarding difficulties that arise in comparing pricing microdata with pricing conduct estimated in macro models, it is found that prices are more flexible than those estimated in the open economy DSGE model, implying sharper but less persistent interest rate responses to various shocks. Furthermore, the form of the New Keynesian Phillips curve used in the open economy DSGE model is found to be inconsistent with certain facts revealed through the price microdata.

# **CHAPTER 1: INTRODUCTION TO PRICING MICRODATA STUDIES**

## **1.1 Research Objective**

Pricing conduct plays an important role in macroeconomics. Michael Woodford in *Interest & Prices* (2003) compares macroeconomics' perfect case – where there are no pricing rigidities - to a physicist's study of the pure laws of motion in a frictionless environment. He states that: "It may well simplify the analysis [of] basic issues in the theory of monetary policy to start from the frictionless case, just as a physicist does when analyzing the motion of a pendulum or the trajectory of a cannonball" (p.32). But, just as prevailing winds impact on aerodynamics, when monetary policy is studied in the context of actual pricing conduct, then a close analysis of the workings of underlying pricing frictions is important to understanding the impact of such policy.

The objective of this research is to test the hypothesis that pricing conduct in South Africa, revealed by studies of pricing microdata, can be shown to have an impact on the modeling and conduct of monetary policy. In order to advance this objective, the research is structured as follows:

- An introductory Chapter outlines the headline findings about pricing conduct in South Africa over the period December 2001 (2001m12) to December 2007 (2007m12) as revealed by studies of the consumer price index (CPI) and producer price index (PPI) microdata and discusses – using hazard curve analysis and other techniques - how such conduct compares to various theoretical models of pricing conduct.
- Thereafter, a thorough analysis is undertaken of unique micro-level CPI and PPI data sets, which were conditionally released by South Africa's statistical authorities for purposes of this research, in order to identify patterns of pricing conduct and to discern stylised facts regarding such pricing conduct. In Chapter 2, the CPI data set is analysed. In Chapter 3, the PPI data set is analysed. In

- Chapter 4, a regression model is utilised to test for evidence of seasonality and state-dependence in pricing conduct.
- In Chapter 5, use is made of general equilibrium models to test how revealed pricing conduct can be shown to impact on the modeling and conduct of monetary policy. Initially, a basic closed economy theoretical model is utilised. Thereafter, an open economy New Keynesian DSGE model for the South African economy (which was developed by Steinbach et al (2009) at the South African Reserve Bank) is used to discuss the impact of alternative pricing conduct assumptions. Furthermore, the microdata is found to pose certain methodological challenges, including to the form of the New Keynesian Phillips curve utilised in such models.
  - The final Chapter concludes by summarising the key findings of the research, and identifying some potential future avenues of enquiry.

Although research of this nature has not previously been undertaken in South Africa, or using South African data, the current research effort takes place against a backdrop of significant international academic interest in the subject matter. As Olivier Blanchard recently noted in his paper on *The State of Macro* (2008): “The study of nominal price and wage setting is one of the hot topics of research in macro today. It has all the elements needed to make for exciting research. It has newly available microdata sets on prices, either from CPI data bases or from large distributors themselves... It faces delicate aggregation issues. Depending on the specific way prices are set, individual stickiness may build up or instead disappear as we look at more aggregate price indexes” (p.6). Happily, these are some of the very matters that are to be delved into in the Chapters that follow.

## **1.2 Summary of key findings regarding pricing conduct**

The study of pricing microdata is emerging in the literature as an important method for understanding actual pricing conduct. Studies of the large price data sets used to compile CPI and PPI measures have been undertaken in a number of countries including Israel

(Baharad et al (2003), Spain (Alvarez et al (2004)), France (Baudry et al (2004)), the Euro Area (Alvarez et al (2005a)), the United States (Bils and Klenow (2005)), Portugal (Dias et al (2005)), Germany (Stahl (2005)), Luxemburg (Lunnemann (2005)), Austria (Baumgartner et al (2005)), Sierra Leone (Kovanen (2006)), Italy (Sabbatini et al (2006)), Denmark (Hansen et al (2006)), Brazil (Gouvea (2007)), France (Gautier (2007)), Finland (Kurri (2007)), Slovakia (Coricelli and Horvath (2008)) and Colombia (Julio et al (2008)). For South Africa, the results reported in Chapters 2 and 3 have been published in Creamer and Rankin (2008) and in Creamer (2009a). A recent synopsis of a wide range of international results on price microdata research is provided by Klenow and Malin (2010b).

An alternative methodology is to conduct surveys of price setting conduct, such as the seminal survey of price-setters in the United States by Blinder et al (1998). Surveys of price setting behaviour have also been conducted in France (Loupas and Ricart (2004)), Sweden (Apel et al ((2005)), Austria (Kwapil (2005)), Spain (Alvarez et al (2005a)), Portugal (Martins (2005)), Luxemburg (Lunnemann (2006)), Canada (Amirault et al (2006)), Holland (Hoebrichts et al (2006)) and Turkey (Sahinoz et al (2008)).

Some studies of price setting conduct, utilising price data sets based on supermarket scanner data, have also been undertaken, such as, in the United States (Chevalier et al (2000)) and in the United Kingdom (Bunn and Ellis (2009)).

The earlier generation of price studies tended to be based on relatively narrow sets of products, such as, Carlton (1986), Cecchetti (1986) and Kashyap (1995), rather than the larger, wider data sets underlying CPI and PPI data and supermarket data.

It is useful to start with a summary of the key findings on pricing conduct in South Africa, which will be discussed in greater detail in the Chapters that follow. These findings are based on studies of the microdata sets used in compiling South Africa's CPI and PPI measures over the period 2001m12 to 2007m12.

Based on a study of the large CPI data set comprising 3 930 977 price records over the period 2001m12 to 2007m12, there is evidence of:

- a varying frequency of price changes, and related price durations, over time, with an unweighted average monthly price change frequency of 16,8% over the period;
- asymmetry in pricing as price increases (10,8%) occur more frequently than price decreases (6%);
- heterogeneity in pricing across goods and services and across various product categories with the frequency of price changes for goods (17,0%) being higher than that for services (14,9%);
- psychological, or attractive, pricing with 62,7% of all prices ending in either 99 cents, 95 cents, 50 cents or 00 cents;
- sizeable mean magnitudes in price changes, which are larger than the prevailing inflation rate;
- time-dependence in pricing is evidenced by hazard function analysis, and by the fact that the average magnitude of price changes rises with price duration;
- seasonality in pricing is evidenced in that the frequency of price increases rises during the month of March and June, and that March, June, April and January are the months with relatively large magnitudes of price increases, and that the overall magnitude of price changes, including price increases and price decreases, is highest in December; and
- state-dependence is evidenced in the form of the synchronisation of pricing conduct with prevailing inflation levels and with inflation expectations, also in the form of a 'pass through' effect from the exchange rate to pricing conduct and in the form of what can be interpreted as 'cost channel' effects and 'transmission mechanism' effects on pricing conduct as a result of policy rate developments.

Based on a study of the large PPI data set comprising 381 861 price records over the period December 2001 to December 2007, there is evidence of:

- a varying frequency of price changes, and related price durations, over time, with an unweighted average monthly price change frequency of 20,2% over the period;

- asymmetry in pricing as price increases (12,2%) occur more frequently than price decreases (8,1%);
- heterogeneity in pricing across various product categories, with the frequency of price changes for imported products (23,2%) being higher than for local products (18,8%) and for exported products (18,7%);
- sizeable mean magnitudes in price changes, which are larger than the prevailing inflation rate;
- time-dependence in pricing is evidenced by hazard function analysis, and by the fact that the average magnitude of price changes rises with price duration;
- seasonality in pricing is evidenced in that the month of April has the highest frequency of price increases and the frequency of price decreases is highest in July. Furthermore, the magnitude of PPI price increases is significantly larger in June, May and March, with no evident seasonality in the magnitude of price decreases; and
- state-dependence in PPI pricing is evidenced in the form of the synchronisation of pricing conduct with prevailing inflation levels and with inflation expectations, also in the form of a 'pass through' effect from the exchange rate to pricing conduct and in the form of what can be interpreted as 'cost channel' effects and 'transmission mechanism' effects on pricing conduct as a result of policy rate developments.

Overall, PPI prices appear on average to have notably higher price change frequencies than CPI prices. Furthermore, heterogeneity in pricing seems to be more pronounced for PPI prices than for CPI prices. On average PPI prices have somewhat shorter durations than PPI prices. Both PPI prices and CPI prices display an asymmetrical bias toward price increases over price decreases and for both PPI prices and CPI prices, the average magnitude of price changes are larger than the prevailing inflation rate.

For CPI prices, South Africa's unweighted price change frequency for 2001 to 2007 of 16,8% (with CPI and CPIX reweighting it is adjusted to 17,1%) is broadly similar to price change frequency findings for Spain from 1993 to 2001 of 15%, for the Euro Area from

1996 to 2001 of 15,1% and for France from 1994 to 2003 of 18,9%. The United States economy from 1998 to 2003 has been found to have a significantly higher frequency of price changes of 24,8%.<sup>1</sup>

An important technical reason for higher price change frequencies in the United States data, as compared to the Euro Area and South Africa, is that the United States data include a relatively large proportion of temporary sales prices, compared to other jurisdictions. Klenow and Malin (2010a) report that in the United States, 1 in 5 price changes relate to temporary sales prices, whereas in France 1 in 8 price changes relate to temporary sales prices. In other Euro Area countries, sales prices are not recorded in the pricing microdata. In South Africa, in the period under study, the statistical authorities initially gave no indication in the data as to whether prices were related to temporary sales or not, but from 2006m3 it is recorded for the CPI data whether or not a particular price record constitutes a sales price. If the United State experience is anything to go by, such a change in South Africa's price recording methodology is a likely contributor to the higher price change frequencies evident in the second part of the period under review, as the current study does not differentiate between sales prices and non-sales prices.

Apart from such technical matters, Altissimo et al (2006) suggest comparative price stickiness can arise “in a stable macroeconomic environment, where agents trust in price stability [and] there is less need to change prices, [or where] structural inefficiencies... prevent firms from changing prices” (p5-6). They list structural factors limiting immediate price adjustments as including long term relationships with customers, explicit contracts which are costly to renegotiate, and co-ordination problems arising from the fact that firms prefer not to change prices unless their competitors do so.

Such arguments are similar to the survey findings of Blinder et al (1998), in their survey of 200 US-based firms, that price-setters scored highest the following theories for price

---

<sup>1</sup> Data for Euro Area is from Dhyne et al (2005) and for the United States is from Bils and Klenow (2004) and from Klenow et al (2005). Data on Spain is from Alvarez et al (2004). Data on France is from Baudry (2004). Due to the adoption to differing methodologies in the various studies, not all results are strictly equivalent, yet the results allow for general comparisons of pricing conduct in a number of economies.

stickiness (in descending order): (1) coordination failure – where firms hold back on price changes, waiting for other firms to go first (Ball and Romer (1991)), (2) cost-based pricing with lags – where price changes are delayed until costs change (Gordon (1981) and Blanchard (1983)), (3) delivery lags and service variation – where firms prefer to vary other elements of the ‘vector’ such as delivery lags, service or product quality (Carlton (1990)), and (4) implicit contracts – where firms tacitly agree to stabilize prices, perhaps out of ‘fairness’ to customers (Okun (1981)).

Whereas a survey of price-setting conduct in South Africa would need to be undertaken to establish the motives behind the price-setting conduct evidenced by the microdata, it is conceivable that similar structural impediments to more flexible pricing exist within the South African economy, which in certain sectors exhibits high levels of concentration and a lack of competitive forces. A recent report argues that the lack of competition impedes efficient development in terms of productivity and innovation with negative spill-over effects for the whole economy (OECD (2008)).

Another factor that would result in cross-country differences in average price change frequencies is differences in the structure of consumption in various economies. Where food products, which have a relatively high price change frequency enjoy a relatively large weighting in the consumption basket, then *ceteris paribus* higher average price change frequencies would be expected. However, while this factor may explain higher price change frequencies in certain emerging-market economies, this is unlikely to explain the relatively high price change frequency evident in a developed economy such as the United States.

The heterogeneity in pricing conduct across various product categories and across various economic sectors is explained in the literature by a number of factors. Altissimo et al (2006) make the argument that prices change less frequently for products with a larger share of labour input, indicating that persistence in wage developments can be a cause of price stickiness. On the other hand, prices change more frequently with rising shares of



raw material input. Furthermore, it is argued that sectors in which there is a high degree of competition are likely to have less price stickiness.

For South Africa, as in other countries, services prices are more sticky than goods prices, which may be indicative both of high labour input costs in services, as well as low levels of competition in the services sector. However, in the South African context, the high degree of price stickiness for goods such as footwear and clothing (which have amongst the lowest price change and price increase frequencies) may be indicative of increased import competition in those sectors.

The research in the following Chapters does not attempt to investigate or analyse the underlying causes of differential pricing conduct across various sectors, or how factors such as the degree of labour intensity or raw material input are associated with pricing conduct for particular product categories or industrial sectors, although it is recognised that such an investigation would be of significant interest. Rather, the focus is on establishing empirically the stylised facts of pricing conduct in South Africa and thereafter discussing the impact of such findings for the macroeconomic modeling.

### **1.3 Hazard functions – showing the probability of price changes**

An estimated hazard function shows the probability of a change in a price, conditional on the price having been unchanged for a certain number of periods.<sup>2</sup> An upward sloping hazard function would indicate that within a certain timeframe the longer the period of time that has passed since a price has changed, the greater is the likelihood that the price will change. As outlined in *Appendix 2*, for a variety of specific consumer products at specific stores hazard functions are broadly upward sloping, indicating the expected

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<sup>2</sup> More formally, where the hazard rate  $h(k)$  is expressed as the probability that a price ( $p_t$ ) will change after  $k$  periods conditional on it having remained constant during the previous  $k-1$  periods, that is:  $h(k) = Pr\{p_{t+k} \neq p_{t+k-1} | p_{t+k-1} = p_{t+k-2} = \dots = p_t\}$ . The methodology (using Stata code) for estimating the CPI and PPI hazard functions is outlined in *Appendix 1*.

result that within a certain timeframe the likelihood of price changes increases with the passing of time.

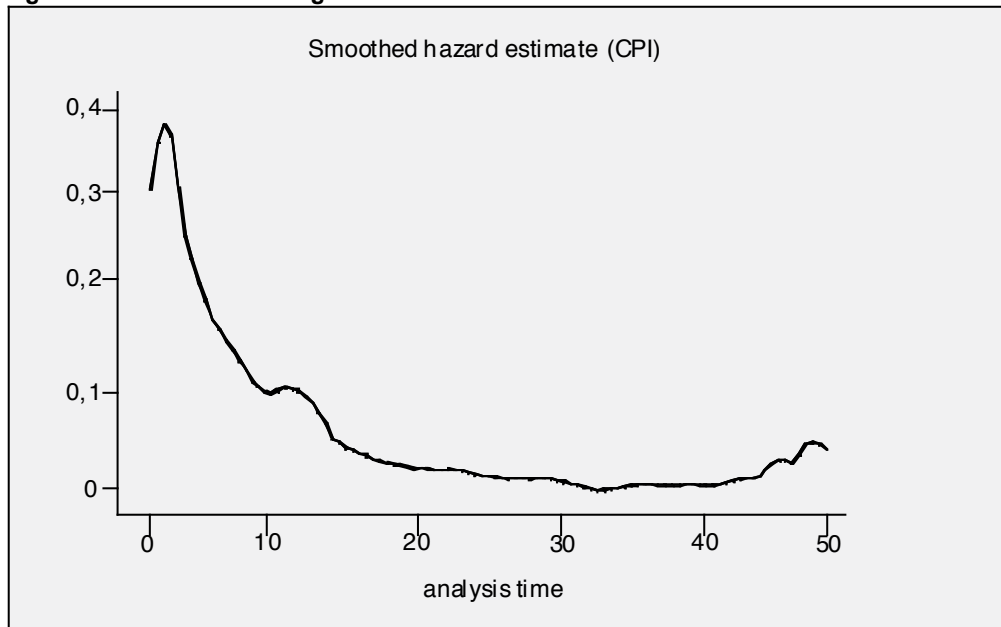
However, at an aggregated level, for the South African CPI and PPI microdata (see Fig.1 and Fig.2), and in the literature more widely, it is found that estimated hazard functions tend to be downward sloping. Alvarez et al (2005b) have shown that such downward sloping hazard functions occur as a result of the aggregation of a wide range of heterogeneous data. Intuitively this is because: “The probability of observing price changes is lower for firms with sticky price schemes than for firms following flexible pricing rules, while the aggregate hazard considers price changes for all firms. Therefore, when the aggregate hazard function is obtained, the share of price changes corresponding to firms with more flexible pricing rules decreases as the horizon increases and, consequently, the hazard rate also decreases” (p.9).

For the CPI data, the hazard function (Fig.1) shows the probability of a price change for each price duration.<sup>3</sup> The hazard function is downward sloping with an uptick at 12 months. The slope of the hazard function would indicate heterogeneity in pricing conduct and the uptick in the probability of price changes at 12 months would indicate a degree of time-dependence in pricing conduct, in the form of annual pricing for consumer prices. The small peak at between 40 and 50 months is based on a very small sample, and is unlikely to indicate any significant generalised finding on pricing conduct in South Africa.

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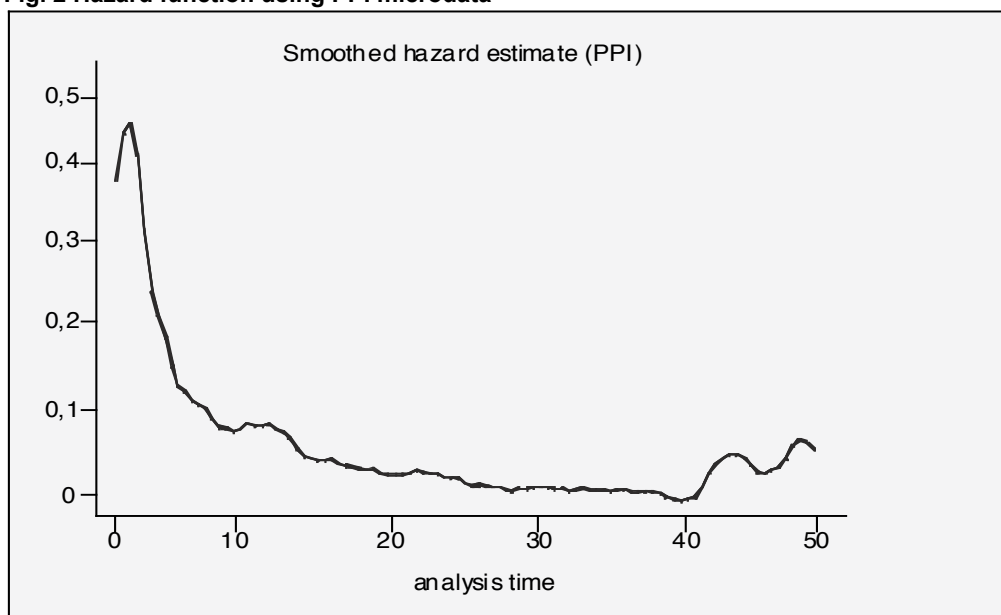
<sup>3</sup> Both censored price spells and uncensored price spells are used in deriving the hazard functions in Fig. 1 and Fig. 2. Censored price spells include those spells that are censored at the beginning or end of the spell by a break in the data, such as, for monthly price records, as follows: commence, R1,00, R2,00, R2,00, R2,00, R2,00, break (amounting to a censored price spell of 4 months, underlined). Whereas, uncensored price spells would not include the above as they would only include price spells that are not censored by a break in the data. Uncensored spells must include both the beginning and the end of the price spell, such as, for monthly price records, as follows: commence, R1, R2,00, R2,00, R2,00, R2,00, R3, break (amounting to an uncensored price spell of 4 months, underlined). In Chapters two and three, in directly measuring and computing the average durations of CPI and PPI prices respectively, only uncensored spells are used, following Alvarez et al (2006).

**Fig. 1 Hazard function using CPI microdata**



For the PPI data, the hazard function (Fig. 2) is also downward sloping with an uptick at 12 months. This again offers evidence of heterogeneity in PPI pricing conduct, as well as a degree of annual pricing conduct. As with the CPI data, the small peak at between 40 and 50 months is based on a very small sample, and is unlikely to be of any significance.

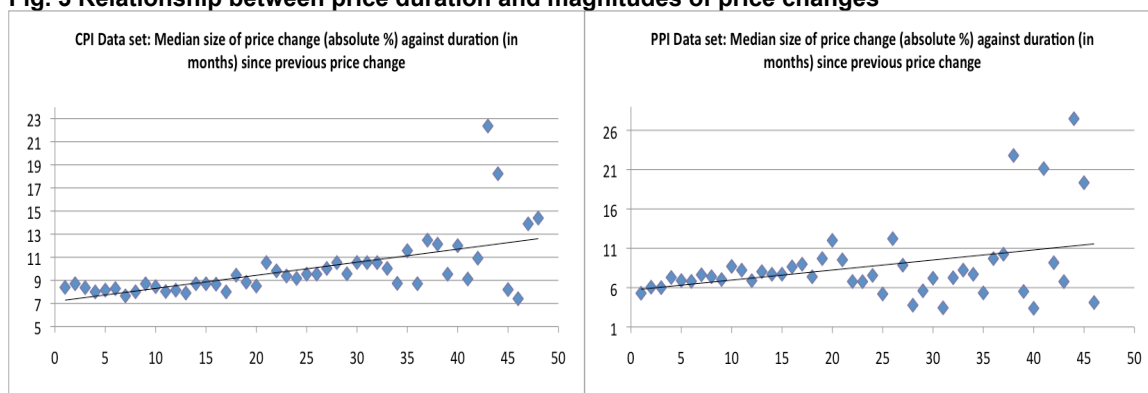
**Fig. 2 Hazard function using PPI microdata**



## 1.4 Relationship between duration and the magnitude of changes

For both the CPI and PPI micro data there is a positive relationship between the duration of prices and the magnitude of price changes, as per Fig.3 below. Such a positive relationship – where price changes are found to be of a larger magnitude if a longer period has passed since the previous price change – is regarded as being indicative of price stickiness and time-dependence in pricing conduct.

**Fig. 3 Relationship between price duration and magnitudes of price changes**



As Bunn and Ellis (2009) note: “If prices can be set in each period there is no reason to expect price changes to be larger if more time has passed since the price last changed. But if some constraint exists which allows or incentivises firms to set prices at infrequent intervals, there is more scope for a firm’s actual price to differ from its optimal price as the duration since the previous price change increases. Examples of such constraints might include contracts of fixed length or costs of price adjustment” (p.34).

## 1.5 Outline of various theoretical models of price setting

The various pricing models used in the macroeconomic literature can be grouped into six broad categories. The sticky information models, menu costs models, time dependent models, costs of adjustment models and customer anger models are briefly outlined here.<sup>4</sup>

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<sup>4</sup> This taxonomy broadly follows Alvarez (2007) in which a review of theoretical literature on price setting is outlined.

### **1.5.1 Sticky information models**

Sticky information models, such as, those developed by Lucas (1973), Fischer (1977), Mankiw and Reis (2002), Reis (2006) and Mackowiack and Wiederholt (2007) imply continuous price adjustment. Therefore, the hazard rate, or probability of price changes, is one for each period, and there is no heterogeneity across firms in the frequency of price changes.

In Lucas (1973) – sometimes referred to as the ‘islands model’ due to the focus on price-output responses in a number of separate product markets - price setters are required to solve a signal extraction problem as they cannot be sure whether to interpret price increases for their product as resulting from general or relative price changes, hence rising prices are associated with rising output. There is some increase in output in partial response to a positive price signal, which may be interpreted as providing an increase in relative demand. This partial response in a multitude of product markets, aggregates to a generalized increase in aggregate demand.

In Fischer (1977) and Mankiw and Reis (2002) prices are assumed to be pre-determined rather than fixed. The key difference being that for Fischer prices are deterministically pre-specified for a number of periods, such as contracts which fix prices and state price adjustments over a number of periods, whereas for Reis and Mankiw prices change stochastically for each period. In both models, a given fraction of price setters computes a new path of optimal prices in each period based on past and current information about the economy.

In Reis (2006) price setters must pay a cost to acquire, absorb and process information. In Mackowiack and Wiederholt (2007) firms decide what to observe. When what the writers term “idiosyncratic conditions” – or conditions pertaining to a particular product market - are more relevant than aggregate conditions, then firms pay more attention to idiosyncratic conditions.

### 1.5.2 Menu Costs models and Ss models

The key characteristic of menu cost models is that firms must incur a cost to change nominal prices. Firms, therefore, do not change prices continuously, but will change prices when such price changes are profitable.

In Danziger (1999) the expected duration of prices is positively associated with higher menu costs, but negatively associated with increased idiosyncratic shocks and increased money supply. Sinclair (2003) summarises that, for a firm with pricing power, “menu costs would make a policy of continuous tiny price increases [where the rate of inflation is known and constant] prohibitively expensive. Instead, the nominal price of its product would be raised by a discrete proportion infrequently, and remain fixed between revisions... The firm would presumably choose both the size and the frequency of its nominal price changes to maximize its stream of discounted net profit” (p.347).

In the model developed by Dotsey et al (1999), firms face different menu costs, but for all firms there is a positive relationship between inflation and the benefit of adjusting prices. The hazard rate is increasing up to a point  $t^*$ . At  $t^*$  the probability of a price change equals one. Furthermore,  $t^*$  is negatively related to the trend inflation, that is, the value of the  $t^*$  threshold is lower for higher levels of trend inflation, such that in Fig. 4  $t_2^* < t_1^*$  as the prevailing inflation rate at  $t_2^*$  is assumed to be higher than at  $t_1^*$ .

Similarly, Ss pricing models, which are state-dependent pricing models, provide that whenever a price setter makes a price adjustment, he or she sets the price so that the difference between the actual price ( $p_i$ ) and the optimum price ( $p_i^*$ ) at that time,  $p_i - p_i^*$ , equals a target level  $S$ , that is,  $S = p_i - p_i^*$ . The nominal price is then kept fixed at  $p_i$  until economic conditions, such as a money stock increase and related inflation, have raised  $p_i^*$  to the point at which  $p_i - p_i^*$  falls to a trigger level  $s$ . The price-setter then resets  $p_i - p_i^*$  to equal  $S$  and the process begins again, with prices remaining fixed until economic conditions require that prices are reset, as outlined in Romer (2001).

### 1.5.3 Time dependent models

Taylor (1980) and Calvo (1983) provide the seminal models of time dependent pricing. For Taylor, prices are set by multiperiod contracts and remain fixed for the period of the contract duration. As a result, the hazard rate is zero up to the end of the contract at time  $t^{\#}$ , at which time the price must change so that the hazard is one.

For Calvo,  $\theta$  is used as a measure of the degree of price stickiness, with  $\theta$  rising as price stickiness rises (where  $0 < \theta < 1$ ). This implies a constant probability  $(1 - \theta)$  that any given price setter will change its price in any period and, therefore, there is a constant hazard rate at  $(1 - \theta)$ . At the level of specific firms the probability that a firm will change its prices in any given period is not dependent on pricing conduct in previous periods, as the  $(1 - \theta)$  price change probability is randomly distributed amongst firms in each period. Clearly,  $(1 - \theta)$  falls as  $\theta$  rises, that is, the proportion of firms re-setting prices in each period falls as the degree of price stickiness rises. Wolman (1999) modifies this, and introduces a truncated Calvo model, by stipulating that after a given period of Calvo-like constant probability of price change all firms must adjust their prices and the hazard rate becomes one.

Heterogeneity can be introduced into time dependent models by allowing different groups of firms to experience different durations of price contracts (Taylor (1993)), or through an annualised model where a constant hazard rate is introduced every 12 months, 24 months and 36 months (Alvarez et al (2005)).

In the Dynamic Stochastic General Equilibrium (DSGE) models developed by Smets and Wouters (2003) and Christiano et al (2005), as with the DSGE model developed for the South African economy by Steinbach et al (2009) and discussed in some detail in Chapter 5 of this study, prices adjust continuously. In each period, a fraction of price changes, given by  $(1 - \theta)$ , are re-optimised and the remaining prices are indexed (fully or partially) to the prevailing inflation rate.

In the Gali and Gertler (1999) model, it is assumed that certain firms change prices optimally, certain firms change their prices by a ‘rule of thumb’ (indexing price changes to the previous period’s inflation) and certain firms do not change their prices at all. This model will be discussed in greater detail in Chapter 5 as it offers a structure that is compatible to important aspects of the evidence on pricing conduct provided by the microdata.

#### **1.5.4 Cost of adjustment models**

In Rotemberg (1982) prices are set so as to minimise deviations from an optimal price subject to the frictional costs of price adjustment. As a result, the hazard rate is one as all firms are assumed to adjust prices continuously and there is no heterogeneity in the frequency of price adjustments.

#### **1.5.5 Customer Anger models**

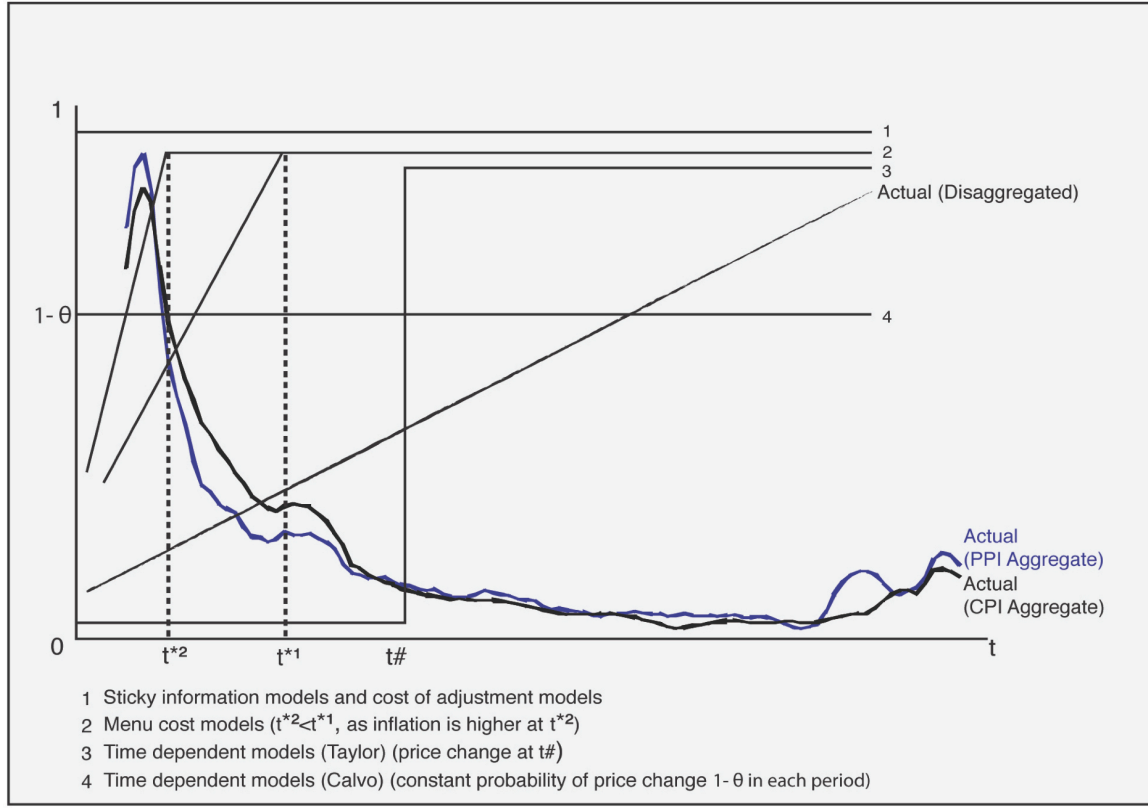
In Rotemberg (2005) firms are reluctant to change prices as customers react negatively to price increases which they perceive to be unfair. The model depends on the evolution of customers’ beliefs on fair pricing. If customer beliefs are constant then pricing in the model is equivalent to Calvo style pricing, but when customer beliefs vary then firms price setting varies over time. As a result, the hazard rate depends on the time-varying distribution of consumer beliefs.

### **1.6 Conclusion**

By way of a conclusion, it is instructive to compare the hazard functions suggested by various theoretical models of price setting conduct to the empirical hazard functions for South Africa’s CPI and PPI microdata sets. The schematic comparison of the various theoretical hazard functions and the empirically measured hazard functions is presented in Fig. 4.



**Fig. 4 Schematic of various theoretical and empirical hazard functions**



In Fig. 4, the hazard functions for the aggregate CPI and PPI data are downward sloping (based on Fig. 2 and Fig. 3). The hazard functions for the disaggregated data are generally upward sloping, as, within a specific time frame, the probability of price changes increases as the period since the last price change lengthens (see *Appendix 2*). Theoretical hazard function 1 indicates the continuous price change probability implied by the sticky information and cost of adjustment models. Theoretical hazard function 2 indicates how, for menu cost models, a higher rate of inflation is associated with a shorter time period ( $t^*_2 < t^*_1$ ) in which the cost of changing prices is larger than the benefit of changing prices. Theoretical hazard function 3 indicates how for a Taylor-style time dependent model, the probability of price changes rises from 0 to 1 at the specific time period  $t^\#$ . Theoretical hazard function 4 indicates the Calvo model assumption that there is constant probability ( $1 - \theta$ ) of price changes in each period. The value of  $\theta$ , where  $0 < \theta < 1$ , rises, and the value of  $(1 - \theta)$  falls, with the degree of price stickiness.

It is clear that as there is a disjuncture between the various theoretical models of pricing conduct and the evidence on pricing conduct gleaned from South Africa's price microdata, there are a number of issues that require further investigation:

- Firstly, whereas a number of the theoretical models assume continuous price evaluations by price-setters, the relatively low frequency of price changes in evidence in the CPI and PPI microdata would indicate that price-setters do not review their pricing plans on a continuous basis.
- Secondly, whereas a number of models are based on the assumption of homogeneity of pricing conduct across firms, the data reveal significant heterogeneity in pricing across various sectors. In addition to direct evidence of heterogeneity of pricing conduct across the numerous sub-categories of the CPI and PPI, the downward sloping aggregate hazard functions also provide evidence of heterogeneity in pricing conduct amongst firms.
- Thirdly, a number of pricing models do not incorporate time-dependence, or seasonality. The hazard function analysis in this Chapter offers evidence, at the aggregate level, of annual price changes. The regression analysis undertaken in Chapter 4 reveals evidence of seasonality in pricing conduct.

In the spirit of Angeloni et al (2006), the ultimate objective of the price microdata research undertaken in the following Chapters is “to use the knowledge about price-setting behaviour at the micro level to improve currently used structural models of inflation, which can then in turn be used to derive policy implications and policy advice... Several of the most commonly used assumptions in micro-founded macro models are seriously challenged by the new findings.” (p.563)

## **CHAPTER 2:     STYLISTED FACTS FROM CONSUMER PRICE MICRODATA**

### **2.1     Introduction**

Inflation, mostly thought of as a macroeconomic variable, is underpinned by microeconomic data. The overall inflation rate is an aggregate measure of changes in prices at the unit level. The analysis of unit level CPI microdata facilitates an understanding of actual price setting conduct at the most basic level. This is important, since pricing conduct, or price rigidity, is incorporated into macroeconomic models that are used to guide monetary and other types of policies that have real effects. It also matters because aggregate inflation rates may disguise different underlying patterns of price changes which policy makers may be concerned about, such as, across various sectors or impacting in a differential manner across different household income categories.

This Chapter finds considerable heterogeneity of pricing conduct in South Africa during the period 2001m12 to 2007m12 both in terms of changes in pricing conduct over time and variations in pricing conduct across product categories. There is also evidence of pricing asymmetry as, across all product categories over the period, prices were more likely to rise than they were likely to fall. In absolute value terms, the magnitude of price decreases is larger than the magnitude of price increases, although price decreases occur less frequently than price increases. Variations in the magnitude of price changes are less pronounced over time than frequency variations, but there is considerable heterogeneity in the magnitude of price changes (both increases and decreases) across various product categories.

The structure of the Chapter is as follows. In section 2.2 an overview of the data issues associated with using the unit level CPI data set is provided. Section 2.3 outlines the findings on the frequency of price changes and section 2.4 reports the findings on the magnitude of price changes. An analysis of the duration of prices is presented in Section 2.5, and the prevalence and effects of attractive pricing or psychological pricing in South

Africa is discussed in Section 2.6. Section 2.7 offers a brief outline of comparative analyses using price data studies from other countries and Section 2.8 concludes with a summary of the key findings from the CPI microdata.

## 2.2 Description of the data

This Chapter uses a large microdata sample at the unit level of South Africa's Consumer Price Index (CPI) for the period 2001m12 to 2007m12 to analyse pricing conduct in South Africa. The data allows findings to be made for the sample on the following issues: the frequency of price changes, the frequency of price increases and the frequency of price decreases, the magnitude of price changes, the magnitude of price increases and the magnitude of price decreases, and the duration of price spells. Results are presented at both an aggregate and a disaggregated level based on the CPI's major product categories.

The following definitions are fundamental:

- The frequency of price changes (increases or decreases) is defined as the percentage of prices that change (increase or decrease) as a proportion of all price records, in the aggregate or for a specific product category, in a particular month.<sup>5</sup>
- The magnitude of price changes is defined as the absolute value of the one period difference, month on month, of the natural log of prices. The magnitude of price increases is the differenced natural log of price changes that are greater than zero and the magnitude of price decreases is the differenced natural log of price decreases.
- The duration of prices is a measure of uncensored periods during which prices do not change. Price duration is measured in months.<sup>6</sup>

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<sup>5</sup> For example,  $f = \frac{\sum_{i=1}^N \omega_{it} pc_{it}}{N}$  where  $pc_{it} = 1$  if  $p_t \neq p_{t-1}$ , or  $pc_{it} = 0$  otherwise, where  $f$  is the monthly frequency of price change ( $pc_t$ ),  $\omega_t$  are the CPI or PPI weights (where there is reweighting) and  $N$  is the total number of observations.

<sup>6</sup> Uncensored periods of price duration are periods of constant price which begin with a change in price and end with a change in price, as opposed to censored periods in which specific price records commence or cease without a change in price. As in the current study, the study of the Spanish CPI microdata

This study is based on the large data sets at unit level of South Africa's CPI data. This comprises 3 930 977 price records gathered over a 73 month period from 2001m12 to 2007m12.

In terms of this approach, each individual price record corresponds to a precisely defined item sold in a particular outlet at given point in time, therefore the pricing of individual items can be followed over time within the same outlet. Along with each individual price record the following additional information is provided: the year and month of the record; the item code (indicating the type of product), a unit code (indicating the specific variety of the product), a capture code (indicating the capture status of the item), and a numeric outlet code (which in terms of relevant legal confidentiality requirements does not enable the name of the outlet to be identified, but which enables the tracking of pricing activity at specific anonymous outlets). Furthermore, a complementary data-set was integrated into the main data-set which enabled the identification of whether specific items were classified as goods or services.

Due to the price collection methodology of Statistics South Africa having changed from a fax-based approach to one of direct price collection by enumerators over the period and due to related systems changes, there is a break in the data at 2006m3. The reason for this break is that there is no equivalence in the numeric outlet codes for the two price collection systems so it is not possible to compare price changes at store level during the first month of the new collection methodology. Fortunately, this does not prevent comparable analysis of the frequency and magnitude of price changes at aggregated and disaggregated levels for the other months included in the study. One noteworthy implication of the break in the data which will be discussed is that it impacts on the analysis of the duration of prices, biasing price duration downwards.

The unit level data for the first period, 2001m12 to 2006m2, comprised 3 710 573 price

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undertaken by Alvarez et al (2004) also makes use of uncensored price spells only. In Alvarez et al (2004) it is suggested that the inclusion of censored spells would potentially have the effect of increasing price durations as "long-lasting price spells are more likely to be censored" (p.22).

records. For the second period, 2006m3 to 2007m12, there were 1 221 333 price records. From this total of nearly 5 million price records, 3 930 977 price records were included in the study based on the following criteria:

- Only data that were recorded with an acceptable capture status were included.<sup>7</sup>
- Only data that were collected at a monthly frequency were included.<sup>8</sup>

There are 1 124 goods and services in the CPI basket used in the period. The CPI basket is further divided into 18 categories.<sup>9</sup> The dataset of monthly price data used in this study comprises the breakdown by product category outlined in Table 1, in which there are effectively 16 categories, as housing and education price data are excluded. Accordingly, price data are included for product categories which constitute a total weighting of 84,8% of the products included in the Consumer Price Index excluding interest rates on mortgage for historical metropolitan and other urban areas (CPIX) and 74,3% of the products included in the CPI.<sup>10</sup>

As indicated by Table 1, even though the same basic price data are used to construct the various published inflation indices, there are important differences between the sample data set and the constructed indices. There is not a one-to-one mapping between the price data sample and proportion of product sub-categories in the CPIX.

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<sup>7</sup> In the first data set capture codes 0, 1, 4, 5 and 6 were used and in the second data set, item status codes included were 20, 21, 23 and 24. Excluded were such capture codes as those for out of stock goods and incomparable goods due to changes in quality.

<sup>8</sup> Given that the study is based on monthly price change frequencies and magnitudes, prices collected quarterly, annually, or at other non-monthly intervals have been excluded from the data to be analysed. This is also the approach adopted in other microdata studies (see Alvarez et al (2004)). Housing prices were excluded due the fact that certain housing sub-sector price information – including the prices of rental stock of housing, flats and townhouses – is based on a frequently updated price index rather than on actual pricing conduct. Hence, there is a tendency for small, but frequent changes in price. This is as a result of a practice by the statistical authorities during the period under review, but subsequently discontinued, that any observed price change over a quarter was distributed over the three months of the following quarter.

<sup>9</sup> From 2009 the basket of goods and services in the CPI has been reduced to fewer than 400 goods. From 2009 the Classification of Individual Consumption by Purpose (COICOP) system was introduced, which resulted in some changes to the categorisation of the CPI basket. At the same time, new weights for the goods and services in the CPI have also been introduced, based mainly on the consumption patterns found in the Income and Expenditure Survey of 2005/2006.

<sup>10</sup> *Appendix 3* outlines the Stata code for selecting and setting up the portion of the CPI data set to be included in the current study.

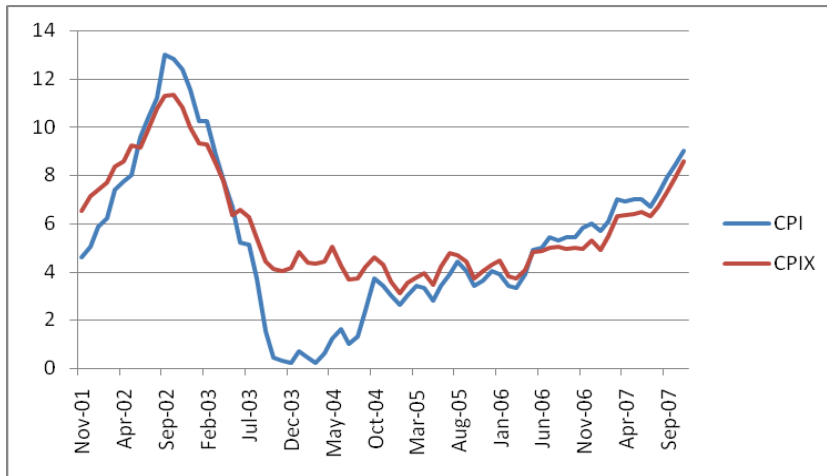
**Table 1 Price records by product category**

| <i>Product Category</i>                 | <i>Number of<br/>Price records</i> | <i>% of<br/>total</i> | <i>Weighting in<br/>CPIX</i> | <i>Weighting<br/>in CPI</i> |
|-----------------------------------------|------------------------------------|-----------------------|------------------------------|-----------------------------|
| <b>FOOD</b>                             | 1769419                            | 45                    | 25.7                         | 21                          |
| <b>NON ALCOHOLIC BEVERAGES</b>          | 80980                              | 2.1                   | 1.3                          | 1.1                         |
| <b>ALCOHOLIC BEVERAGES</b>              | 143971                             | 3.7                   | 1.7                          | 1.4                         |
| <b>CIGARETTES TOBACCO AND CIGARS</b>    | 60538                              | 1.5                   | 1.4                          | 1.1                         |
| <b>CLOTHING</b>                         | 250243                             | 6.4                   | 2.5                          | 2                           |
| <b>FOOTWEAR</b>                         | 91283                              | 2.3                   | 1.5                          | 1.2                         |
| <b>HOUSING</b>                          | 0                                  | 0                     | 11.6                         | 22.1                        |
| <b>FUEL AND POWER</b>                   | 16796                              | 0.4                   | 4.3                          | 3.5                         |
| <b>FURNITURE AND EQUIPMENT</b>          | 298409                             | 7.6                   | 3.2                          | 2.5                         |
| <b>HOUSEHOLD OPERATION</b>              | 270694                             | 6.9                   | 5.2                          | 4.8                         |
| <b>MEDICAL CARE AND HEALTH EXPENSES</b> | 104537                             | 2.7                   | 7.7                          | 7.2                         |
| <b>TRANSPORT</b>                        | 283838                             | 7.2                   | 15.3                         | 14.8                        |
| <b>COMMUNICATION</b>                    | 7326                               | 0.2                   | 3.2                          | 3                           |
| <b>RECREATION AND ENTERTAINMENT</b>     | 139551                             | 3.6                   | 3.4                          | 3.3                         |
| <b>READING MATTER</b>                   | 21971                              | 0.6                   | 0.4                          | 0.4                         |
| <b>EDUCATION</b>                        | 0                                  | 0                     | 3.8                          | 3.5                         |
| <b>PERSONAL CARE</b>                    | 363368                             | 9.2                   | 4.4                          | 3.7                         |
| <b>OTHER GOODS AND SERVICES</b>         | 28053                              | 0.7                   | 3.6                          | 3.3                         |
| <b>TOTAL</b>                            | 3930977                            | 100                   | 100                          | 100                         |

In comparison to the weighting of product sub-categories in the CPI and CPIX, the specific sample of price data used in the current study contains a higher proportion of price information on food, clothing, furniture and equipment, alcoholic beverages and personal care. Conversely, in comparison to the weighting of product sub-categories in the CPI and CPIX, the data sample contains a low proportion of price information on fuel and power, medical care and health expenses, communication and other goods and services.

As indicated in Fig. 5, during the period under study there was a shift from a period of relatively high inflation (from mid 2002 to mid 2003) to a period of lower inflation (mid 2003 to the end of 2006) and back to relatively high inflation (from the end of 2006 to the end of 2007). This means that the current study of pricing conduct is undertaken both during periods of relatively high inflation and low inflation periods.

**Fig. 5 CPI and CPIX in South Africa 2001 to 2007**



Source: SARB CPI data series 7112A, CPIX Data Series 7113A

## 2.3 Findings on frequency of price changes

### 2.3.1 Aggregate frequency of price changes, price increases and price decreases

The frequency of price changes (increases or decreases) is defined as the percentage of prices that change (increase or decrease) as a proportion of all price records, in the aggregate or for a specific product category, in a particular month.

With regard to the unweighted frequency of price changes, the headline finding of the study of unit level consumer prices over the period 2001m12 to 2007m12, is that an average of 16,8% of prices change each month.<sup>11</sup>

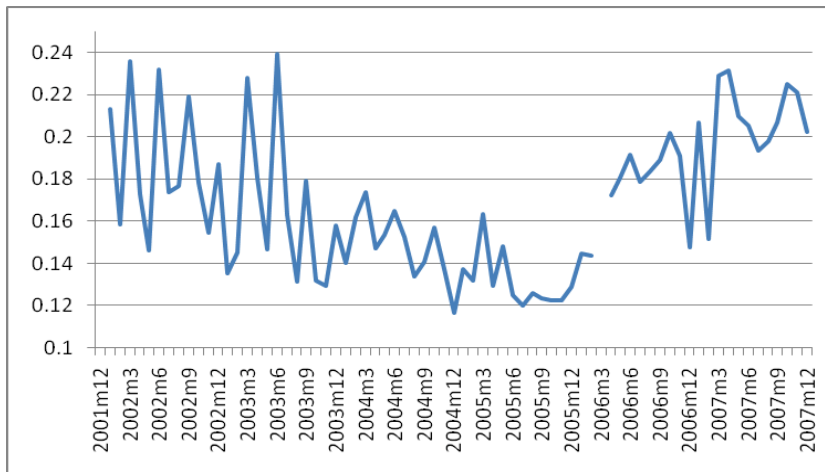
It is interesting to note that over the 73 month period under consideration there was a significant degree of differentiation in the frequency of price changes with the highest frequency of price changes occurring in 2003m6 at 23,9% and the lowest frequency of price changes occurring in 2004m12 at 11,6%. Figure 6 broadly indicates an initial downward trend in the frequency of price changes, followed by an upward trend in the frequency of price changes from the end of 2005. As expected, such shifts in the

<sup>11</sup> Appendix 4 outlines the Stata code for the analysis of the CPI data set.



frequency of price changes broadly follow the increases and decreases in the rate of inflation, with higher frequencies of price changes being associated with higher inflation rates and reduced frequencies of price changes being associated with lower inflation rates. The higher frequency of price changes, price increases and price decreases after the break in the data in 2006m3 (as in Figs. 6 – 8) is likely also to be associated with the inclusion of “sales” price data in the CPI microdata set from that time on.

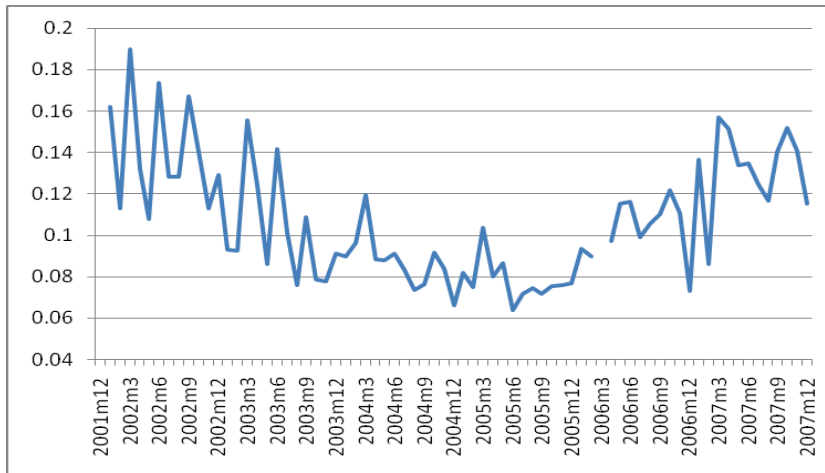
**Fig. 6 Frequency of price changes per month**



Price increases occurred with an average monthly frequency of 10,8% and price decreases with a frequency of 6,0%. This indicates a significant degree of asymmetry in price setting in favour of price increases over price decreases.

Until mid-2005, there was a downward trend in the frequency of price increases, followed by an increasing frequency of price increases associated with increasing inflationary pressures in the economy during 2006 and 2007, as reported in Fig. 7.

**Fig. 7 Frequency of price increases per month**



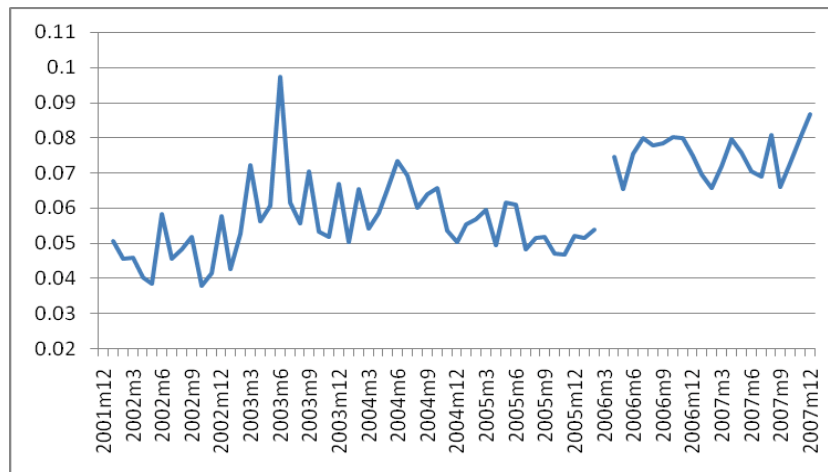
The month with the highest recorded frequency of price increases was 2002m3 with 19,0% of prices increasing in that month (a lagged effect of the sharp currency depreciation in the last months of 2001) and the month with lowest frequency of price increases was 2005m6 with 6,3% of prices increasing in that month (associated with the low prevailing CPI rate from mid-2003 to mid-2006). Shifts in the frequency of price increases broadly follow the increases and decreases in the rate of inflation, with higher frequencies of price increases being associated with higher inflation rates and reduced frequencies of price increases being associated with lower inflation rates, associations which are formally considered using regression analysis in Chapter 4.

With regard to the frequency of price decreases, there is broadly an upward trend over the entire period, with a sharp peak during the slowdown in inflation during mid 2003. The highest frequency of price decreases was recorded in 2003m6 (9,7%) and the lowest frequency of price decreases in 2002 m10 (3,8%).

Shifts in the frequency of price decreases broadly follow an inverse relationship with changes in the rate of inflation, with higher frequencies in price decreases being associated with lower inflation rates and reduced frequencies in price decreases being associated with higher inflation rates. Although this relationship appears to break down in 2006 and 2007 where the frequency of price decreases rises even in the context of rising inflation, this is likely influenced by the inclusion of ‘sales’ prices in the data set, with the

introduction of new methodologies by the statistical authorities in 2006m3.

**Fig. 8 Frequency of price decreases per month**



### 2.3.2 Alternative weighting procedures

The above findings are not weighted, but offer a description of the frequency of price changes for the data set as a whole and for the various product categories in the data set. The weighting of various product categories in the data set is not aligned to the weightings given to such product categories in the construction of the CPI and the CPIX, which in turn is based on surveys of household consumption patterns.

Re-weighting of the data according to the various product category weights underlying the CPI and CPIX provides alternative perspectives on pricing conduct, which more closely reflects the proportional significance of various product categories in the wider economy (Table 2). Such measures are useful for considering aggregate pricing conduct. Relative to the CPI and CPIX weights, the sample contains a large proportion of food price data, which experiences relatively frequent price adjustments. Nevertheless, the re-weighting results in an increased aggregate frequency of price adjustments since the weighting of other product categories with high frequencies of price changes, such as, transport and other goods and services, increases with re-weighting.

The aggregate frequency of price changes is 17,1% for both the CPI and CPIX weightings. Both of these estimates are larger than the estimate for the aggregate

frequency of price change in unweighted sample of 16,8% due mainly to the increased weighting of transport and other goods and services.

**Table 2 Frequency of price changes with alternative weightings**

|                                     | <i>Unweighted</i> | <i>CPI<br/>weighted</i> | <i>CPIX<br/>weighted</i> |
|-------------------------------------|-------------------|-------------------------|--------------------------|
| <b>FREQUENCY OF PRICE CHANGES</b>   | 16.8              | 17.1                    | 17.1                     |
| <b>FREQUENCY OF PRICE INCREASES</b> | 10.8              | 11.1                    | 11.1                     |
| <b>FREQUENCY OF PRICE DECREASES</b> | 6.0               | 6.0                     | 6.0                      |

There are similar changes for the re-weighted frequencies of price increases and price decreases. The frequency of price increases based on both the CPI and CPIX weightings is 11,1% (10,8% unweighted). The frequency of price decreases for both is 6,0%, a similar finding as for the unweighted sample.

### **2.3.2 Comparison between goods and services**

Well over 90% of price records are classified as goods rather than services and as a result there is a close similarity between the findings for pricing conduct for goods and findings for the aggregate data. Table 3 indicates that the prices of services generally change less frequently than the prices of goods. However, services prices increase more frequently than goods prices but decrease less frequently than goods prices.

**Table 3 Average frequency of price changes for goods and services**

|                                     | <i>Aggregate</i> | <i>Goods</i> | <i>Services</i> |
|-------------------------------------|------------------|--------------|-----------------|
| <b>FREQUENCY OF PRICE CHANGES</b>   | 16,8%            | 17,0%        | 14,9%           |
| <b>FREQUENCY OF PRICE INCREASES</b> | 10,8%            | 10,8%        | 11,4%           |
| <b>FREQUENCY OF PRICE DECREASES</b> | 6,0%             | 6,1%         | 3,5%            |

Where goods and services are given a weighting such as the weighting for the CPIX, where goods are weighted at 66,24% and services are weighted at 33,76%, then the aggregate frequency of price changes decreases to 16,3%, the frequency of price increases rises to 11,0% and the frequency of price decreases declines to 5,2%, as reported in Table 4.

**Table 4 Average frequency of price changes (with a larger weighting of services as per the CPIX)**

|                                     | <b>Aggregate (reweighted)</b> |
|-------------------------------------|-------------------------------|
| <b>FREQUENCY OF PRICE CHANGES</b>   | 16.3%                         |
| <b>FREQUENCY OF PRICE INCREASES</b> | 11.0%                         |
| <b>FREQUENCY OF PRICE DECREASES</b> | 5.2%                          |

### 2.3.3 Comparison of frequency of price changes of different product categories

The findings on the frequency of price changes by product category show that there is significant heterogeneity in pricing conduct for different product categories. Table 5 shows, by product category, the average frequency of price changes, the average frequency of price increase and the average frequency of price decreases.

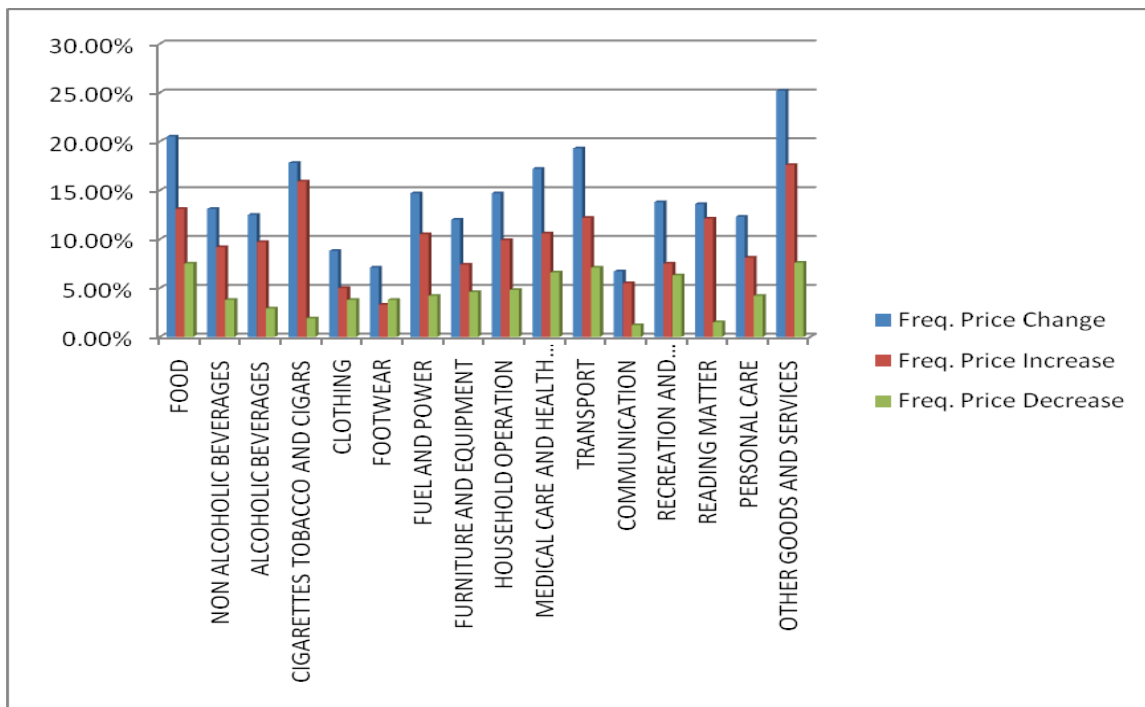
**Table 5 Average Frequency of price changes by Product Categories**

| <i>Product Category</i>                   | <i>Frequency of Price Change</i> | <i>Frequency of Price Increase</i> | <i>Frequency of Price Decrease</i> |
|-------------------------------------------|----------------------------------|------------------------------------|------------------------------------|
| <b>FOOD</b>                               | 20.5%                            | 13.1%                              | 7.5%                               |
| <b>NON ALCOHOLIC BEVERAGES</b>            | 13.1%                            | 9.2%                               | 3.8%                               |
| <b>ALCOHOLIC BEVERAGES</b>                | 12.5%                            | 9.7%                               | 2.9%                               |
| <b>CIGARETTES TOBACCO AND CIGARS</b>      | 17.8%                            | 15.9%                              | 1.9%                               |
| <b>CLOTHING</b>                           | 8.8%                             | 5.0%                               | 3.8%                               |
| <b>FOOTWEAR</b>                           | 7.1%                             | 3.3%                               | 3.8%                               |
| <b>FUEL AND POWER</b>                     | 14.7%                            | 10.5%                              | 4.2%                               |
| <b>FURNITURE AND EQUIPMENT</b>            | 12.0%                            | 7.4%                               | 4.6%                               |
| <b>HOUSEHOLD OPERATION</b>                | 14.7%                            | 9.9%                               | 4.8%                               |
| <b>MEDICAL CARE &amp; HEALTH EXPENSES</b> | 17.2%                            | 10.6%                              | 6.6%                               |
| <b>TRANSPORT</b>                          | 19.3%                            | 12.2%                              | 7.1%                               |
| <b>COMMUNICATION</b>                      | 6.7%                             | 5.5%                               | 1.2%                               |
| <b>RECREATION AND ENTERTAINMENT</b>       | 13.8%                            | 7.5%                               | 6.3%                               |
| <b>READING MATTER</b>                     | 13.6%                            | 12.1%                              | 1.5%                               |
| <b>PERSONAL CARE</b>                      | 12.3%                            | 8.1%                               | 4.2%                               |
| <b>OTHER GOODS AND SERVICES</b>           | 25.2%                            | 17.6%                              | 7.6%                               |

For all products categories, except for footwear, the frequency of price increases is greater than the frequency of price decreases.<sup>12</sup> These results are outlined graphically in Fig. 9.

<sup>12</sup> In addition to being the only category of goods with a higher frequency of price decreases than price increases, it is also noteworthy that ‘footwear’ is the product category with the largest magnitude of price increases and largest magnitude of price decreases.

**Fig. 9 Average Frequency of price changes by Product Categories**



### 2.3.4 Analysis of frequency of price changes by product category

Table 6 lists product categories from those with the least frequently changed prices, to those with the most frequently changed prices.

**Table 6 Frequency of Price Changes (ascending)**

| <i>Product Category</i>          | <i>Frequency of Price Change</i> |
|----------------------------------|----------------------------------|
| COMMUNICATION                    | 6.7%                             |
| FOOTWEAR                         | 7.1%                             |
| CLOTHING                         | 8.8%                             |
| FURNITURE AND EQUIPMENT          | 12.0%                            |
| PERSONAL CARE                    | 12.3%                            |
| ALCOHOLIC BEVERAGES              | 12.5%                            |
| NON ALCOHOLIC BEVERAGES          | 13.1%                            |
| READING MATTER                   | 13.6%                            |
| RECREATION AND ENTERTAINMENT     | 13.8%                            |
| HOUSEHOLD OPERATION              | 14.7%                            |
| FUEL AND POWER                   | 14.7%                            |
| MEDICAL CARE AND HEALTH EXPENSES | 17.2%                            |
| CIGARETTES TOBACCO AND CIGARS    | 17.8%                            |
| TRANSPORT                        | 19.3%                            |
| FOOD                             | 20.5%                            |
| OTHER GOODS AND SERVICES         | 25.2%                            |

Communication (6,7%), footwear (7,1%) and clothing (8,8%) prices change at relatively low frequency and are thus relatively sticky. Prices of other goods and services (25,2%), food (20,5%), transport (19,3%), cigarettes, tobacco and cigars (17,8%) and medical care and health expenses (17,2%) all change relatively frequently.

Upon delving deeper it is found that the main reasons that Other goods and services experiences a high frequency of price changes are the high frequency of price changes of meals consumed in hotels and restaurants, take-away meals and meals in staff cafeterias (where prices are recorded as changing 97% of the time with price increases at 68% and price decreases at 29%), and the high frequency of price changes of the cost of funerals and cost of gravestones (where prices change 95% of the time with price increases at 73% and price decreases at 22%).

### 2.3.5 Analysis of frequency of price increases by product category

The most frequent price increases occurred in Other goods and services (17,6%), cigarettes, tobacco and cigars (15,9%) and food (13,1%). The least frequent price increases occurred in footwear (3,3%), clothing (5,0%) and communication (5,5%), as reported in Table 7.

**Table 7 Frequency of price increases (ascending)**

| <i>Product category</i>          | <i>Frequency of Price Increases</i> |
|----------------------------------|-------------------------------------|
| FOOTWEAR                         | 3.3%                                |
| CLOTHING                         | 5.0%                                |
| COMMUNICATION                    | 5.5%                                |
| FURNITURE AND EQUIPMENT          | 7.4%                                |
| RECREATION AND ENTERTAINMENT     | 7.5%                                |
| PERSONAL CARE                    | 8.1%                                |
| NON ALCOHOLIC BEVERAGES          | 9.2%                                |
| ALCOHOLIC BEVERAGES              | 9.7%                                |
| HOUSEHOLD OPERATION              | 9.9%                                |
| FUEL AND POWER                   | 10.5%                               |
| MEDICAL CARE AND HEALTH EXPENSES | 10.6%                               |
| READING MATTER                   | 12.1%                               |
| TRANSPORT                        | 12.2%                               |
| FOOD                             | 13.1%                               |
| CIGARETTES TOBACCO AND CIGARS    | 15.9%                               |
| OTHER GOODS AND SERVICES         | 17.6%                               |

### 2.3.6 Analysis of frequency of price decreases by product category

The most frequent price decreases have been in Other goods and services (7,6%) and food (7,5%) and transport (7,1%). The least frequent price decreases have been in communication (1,2%), reading matter (1,5%) and cigarettes tobacco and cigars (1,9%),

as outlined in Table 8.

**Table 8 Frequency of price decreases (ascending)**

| <i>Product category</i>          | <i>Frequency of Price<br/>Increases</i> |
|----------------------------------|-----------------------------------------|
| COMMUNICATION                    | 1.2%                                    |
| READING MATTER                   | 1.5%                                    |
| CIGARETTES TOBACCO AND CIGARS    | 1.9%                                    |
| ALCOHOLIC BEVERAGES              | 2.9%                                    |
| CLOTHING                         | 3.8%                                    |
| FOOTWEAR                         | 3.8%                                    |
| NON ALCOHOLIC BEVERAGES          | 3.8%                                    |
| FUEL AND POWER                   | 4.2%                                    |
| PERSONAL CARE                    | 4.2%                                    |
| FURNITURE AND EQUIPMENT          | 4.6%                                    |
| HOUSEHOLD OPERATION              | 4.8%                                    |
| RECREATION AND ENTERTAINMENT     | 6.3%                                    |
| MEDICAL CARE AND HEALTH EXPENSES | 6.6%                                    |
| TRANSPORT                        | 7.1%                                    |
| FOOD                             | 7.5%                                    |
| OTHER GOODS AND SERVICES         | 7.6%                                    |

### **2.3.7 Price change frequency analysis at product level**

In order to identify which specific products experience the most frequent price changes, price increases and price decreases, it is necessary to set a minimum threshold for an acceptable number of observations, as a number of the high and low frequency occurrences are due to very small sample sizes or even single observations.

Setting an essentially arbitrary threshold of a sample of at least 0,1% of the total number of observations (that is items with a minimum sample of 3 617 observations or more), prices with the highest frequency of price changes – and related frequencies of price increases and price decreases - are outlined in Table 9.

Other than diesel, which has the highest frequency of price change over the period, all the other high frequency items are fresh food stuffs, which have high price-increase and high price-decrease ratios. The finding of high price-decrease frequencies for fresh produce is similar to the finding of equivalent studies in other countries and is understood to be linked to price reductions which occur due to the perishable nature of these goods - prices are decreased in order to sell goods while they are still usable.



**Table 9 Products with the highest frequency of price changes**

| <i>Product</i>     | <i>Frequency of price change</i> | <i>Frequency of price increase</i> | <i>Frequency of price decrease</i> |
|--------------------|----------------------------------|------------------------------------|------------------------------------|
| <b>DIESEL</b>      | 89.3%                            | 57.1%                              | 32.2%                              |
| <b>BANANAS</b>     | 47.2%                            | 26.3%                              | 20.9%                              |
| <b>TOMATOES</b>    | 41.8%                            | 19.8%                              | 22.0%                              |
| <b>AVOCADO 'S</b>  | 40.0%                            | 23.2%                              | 16.8%                              |
| <b>CABBAGE</b>     | 39.3%                            | 21.8%                              | 17.5%                              |
| <b>LETTUCE</b>     | 38.5%                            | 20.8%                              | 17.7%                              |
| <b>CAULIFLOWER</b> | 38.0%                            | 19.9%                              | 18.1%                              |
| <b>APPLES</b>      | 37.5%                            | 22.7%                              | 14.8%                              |
| <b>PEARS</b>       | 37.0%                            | 21.0%                              | 16.0%                              |
| <b>PINEAPPLES</b>  | 35.9%                            | 19.7%                              | 16.2%                              |

Using the same threshold of a sample of at least 0,1% of total observations (3 617 observations or more), prices with the lowest frequency of price changes – and related frequencies of price increases and price decreases - are outlined in Table 10. It is mainly personal care products and services, such as hair cuts, which have the lowest price change frequencies.

**Table 10 Products with the lowest frequency of price changes**

| <i>Product</i>                 | <i>Frequency of price change</i> | <i>Frequency of price decrease</i> | <i>Frequency of price decrease</i> |
|--------------------------------|----------------------------------|------------------------------------|------------------------------------|
| <b>EYE SHADOW</b>              | 7.3%                             | 5.5%                               | 1.8%                               |
| <b>BLUSHER</b>                 | 6.8%                             | 5.2%                               | 1.6%                               |
| <b>UNDERPANTS, SHORT</b>       | 5.3%                             | 3.2%                               | 2.1%                               |
| <b>CUT AND BLOW-WAVE</b>       | 5.0%                             | 4.5%                               | 0.5%                               |
| <b>HIGHLIGHTS</b>              | 4.9%                             | 4.6%                               | 0.3%                               |
| <b>SET</b>                     | 4.9%                             | 4.3%                               | 0.6%                               |
| <b>COLOUR SHAMPOO</b>          | 4.7%                             | 4.4%                               | 0.3%                               |
| <b>HAIR CUT (MEN)</b>          | 4.5%                             | 4.2%                               | 0.3%                               |
| <b>HAIR CUT (BOYS)</b>         | 4.5%                             | 3.8%                               | 0.7%                               |
| <b>PERMANENT WAVE ("PERM")</b> | 4.3%                             | 3.9%                               | 0.4%                               |

*Appendix 16* provides a full report of price change frequencies, the frequency of price increases and the frequency of price decreases by product. It also reports the number of price records for each product, and although it is rather tedious reading it offers a sense of the wide extent of price information that was gathered during the period under review. From 2009 the change in methodology adopted by the statistical authorities has meant that pricing information is gathered for a smaller number of products each month.

## **2.4 Findings on magnitudes of price changes**

### **2.4.1 Magnitude of price changes, price increases and price decreases for the aggregate data**

The magnitude of price changes is defined as the absolute value of the one period difference, month on month, of the natural log of prices. The magnitude of price increases is the differenced natural log of price changes that are greater than zero and the magnitude of price decreases is the differenced natural log of price decreases.

For the overall magnitude of price changes, the headline finding for the monthly data over the period 2001m12 to 2007m12, is that, conditional on the occurrence of a price change, the unweighted average absolute value magnitude of price changes was 13,1%. For prices that rose, the average magnitude of price increases was 12,1%. For prices that declined, the average magnitude of price decreases was -14,9%. The comparative medians values were: an 8,7% magnitude of price changes, an 8,2% magnitude of price increases, and a -10,1% magnitude of price decreases. These median values are lower than the means since they limit the impact of extreme price increases and decreases.<sup>13</sup>

It should be noted that these findings record the monthly average size of price changes of those prices that changed in the period. This is distinct from the more familiar inflation-type measure of the monthly average size of price change, taking into account a weighted combination of all recorded prices, that is, including both those prices that changed and those prices that did not change.

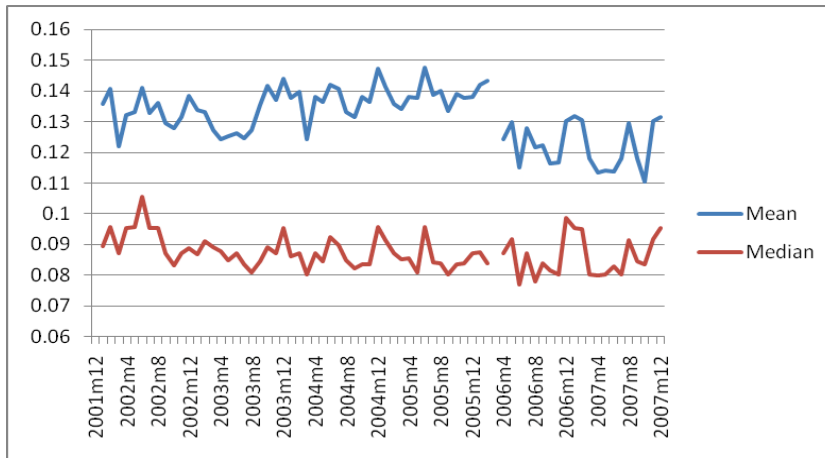
Over the period the largest average absolute monthly price change (including both prices that increased and decreased) was 14,7% in 2005m6 and the smallest average price change was 11,0% in 2007m10. The month with the highest median price change of 10,5% was 2002m6, and with the lowest median price change of 7,7% was 2006m6, as

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<sup>13</sup> In symmetric distributions the mean and the median are the same. However, the distributions of the variables of interest in this paper – frequency, magnitude and duration – are unlikely to be symmetric. These variables should all have distributions where most of the observations are concentrated around or towards zero. They will thus be skewed towards values larger in absolute magnitude and thus, even in a large sample, the mean will be larger in absolute value than the median.

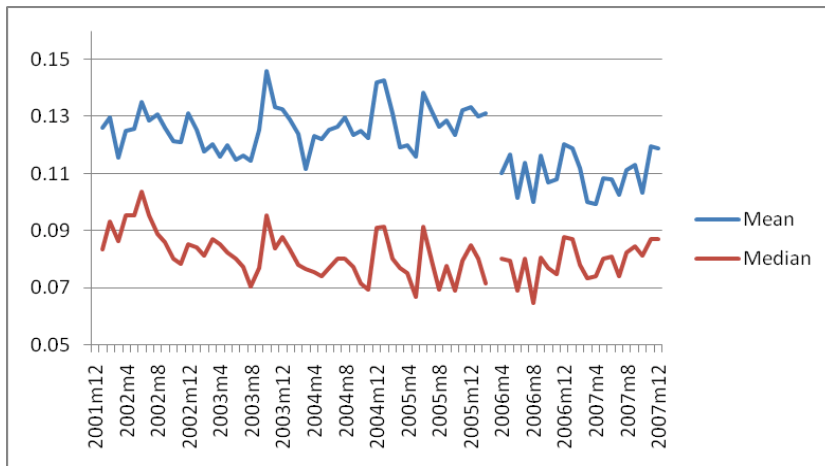
shown in Fig. 10.

**Fig. 10 Magnitude of price changes (absolute value)**



The month with the largest average price increase was 2003m10 at 14,6% and the month with the smallest average price increase was 2007m4 at 9,9%. Monthly median price increases were considerably lower peaking in 2002m6 at 10,4%, with a lowest value of 6,5% in 2006m8, as shown in Fig. 11.

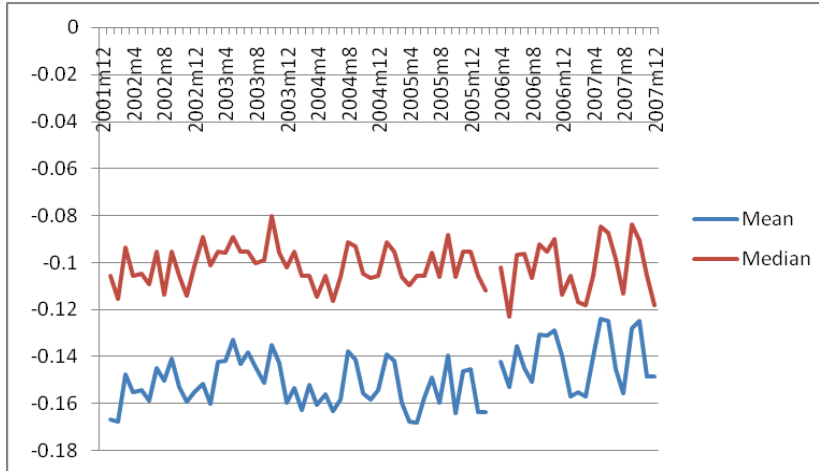
**Fig. 11 Magnitude of price increases**



The month with the largest average price decrease was 2005m5 at -16,8% and the month with the smallest average price decrease was 2007m5 at -12,4%. Monthly median price decreases were largest in 2006m5 at -12,3% and smallest in 2003m10 at -8,0%, as outlined in Fig. 12. In absolute value terms, the magnitude of price decreases is greater

than the magnitude of price increases, although price increases generally occur more frequently.

**Fig. 12 Magnitude of Price Decreases**



#### 2.4.2 Alternative weighting procedures

The above findings for the magnitudes of price changes are not weighted, but offer a description of the magnitude of price changes for the data set as a whole and for the various product categories in the data set. Re-weighting of the data, based on the various product category weights underlying the CPI and CPIX during the period under review assists in offering alternative findings for pricing conduct, which more closely reflects the proportional significance of various product categories in the wider economy.

In Table 11, using CPI weightings, the average absolute value magnitude of price increases is lower at 11,4%, as compared to the unweighted value of 13,1%. The CPIX weighted absolute value magnitude of price changes is 11,5%.

**Table 11 Magnitude of price changes with alternative weightings**

|                                     | <i>Unweighted</i> | <i>CPI<br/>weighted</i> | <i>CPIX<br/>weighted</i> |
|-------------------------------------|-------------------|-------------------------|--------------------------|
| <b>MAGNITUDE OF PRICE CHANGES</b>   | 13.1%             | 11.4%                   | 11.5%                    |
| <b>MAGNITUDE OF PRICE INCREASES</b> | 12.1%             | 10.7%                   | 10.9%                    |
| <b>MAGNITUDE OF PRICE DECREASES</b> | -14.9             | -12.3%                  | -12.5%                   |

The consequence of the reweighting is a muting of the price change magnitudes, as the weights shift from high to lower price change magnitude product categories. The weighting on the food category, which is characterised by relatively high magnitudes of price changes, is reduced, and the weighting on transport, which has relatively lower magnitudes of price changes, is increased. The magnitude of the average price increase falls from 12,1% for the unweighted data to 10,7% for the CPI weighted data and 10,9% for the CPIX weighted data. The average magnitude for price decreases falls from -14,9% for the unweighted data to -12,3% for the CPI weighted data and -12,5% for the CPIX weighted data.

### 2.4.3 Comparison of the magnitude of price changes between goods and services

The magnitude of price changes is significantly greater for goods than for services. The average size of both price increases and price decreases is larger for goods than for services. The average size of price increases for goods is 12,3%, whereas for services it is 5,7%. The average size of price decreases for goods is -15,0%, whereas for services it is -4,7%. Due to the large proportion of goods prices in the sample, the size of goods price changes are broadly similar to the aggregate size of price increases, which average 12,1% and the size of price decreases which average -14,9% per month, as reported in Table 12.

**Table 12 Average size of price changes for goods and services**

|                                       | <i>Aggregate</i> | <i>Goods</i> | <i>Services</i> |
|---------------------------------------|------------------|--------------|-----------------|
| <b>ABSOLUTE SIZE OF PRICE CHANGES</b> | 13,1%            | 13,2%        | 5,5%            |
| <b>SIZE OF PRICE INCREASES</b>        | 12,1%            | 12,3%        | 5,7%            |
| <b>SIZE OF PRICE DECREASES</b>        | -14,9%           | -15,0%       | -4,7%           |

When goods and services are given a weighting such as the weighting for the CPIX in the metro and other urban areas, where goods are weighted at 66,24% and services are weighted at 33,76%, then the aggregate average magnitude of price increases declines to 10,1% from 12,1% for the unweighted data, and the average magnitude of price decreases declines to -11,5% from -14,9% for the unweighted data, as reported in Table 13.

**Table 13 Average magnitude of price changes (with a larger weighting of services as per the CPIX)**

|                                     | <i>Aggregate (reweighted)</i> |
|-------------------------------------|-------------------------------|
| <b>MAGNITUDE OF PRICE INCREASES</b> | 10.1%                         |
| <b>MAGNITUDE OF PRICE DECREASES</b> | -11.5%                        |

#### **2.4.4 Analyses of magnitude of price changes by product category**

The findings on the magnitude of price changes by product category are outlined in Table 14, which reports the overall average absolute value magnitude of price changes where prices change; the average magnitude of price increases where prices rose; and the average magnitude of price decreases where prices decline. There is considerable heterogeneity in the magnitude of price changes across various products.

**Table 14 Magnitude of price changes**

| <i>Product Category</i>                 | <i>Magnitude of Change</i> | <i>Magnitude of Increases</i> | <i>Magnitude of Decreases</i> |
|-----------------------------------------|----------------------------|-------------------------------|-------------------------------|
| <b>FOOD</b>                             | 14.2%                      | 13.3%                         | -15.8%                        |
| <b>NON ALCOHOLIC BEVERAGES</b>          | 11.5%                      | 10.8%                         | -13.2%                        |
| <b>ALCOHOLIC BEVERAGES</b>              | 8.2%                       | 8.2%                          | -8.2%                         |
| <b>CIGARETTES TOBACCO AND CIGARS</b>    | 5.7%                       | 5.7%                          | -5.9%                         |
| <b>CLOTHING</b>                         | 17.8%                      | 12.6%                         | -24.7%                        |
| <b>FOOTWEAR</b>                         | 24.1%                      | 18.9%                         | -28.5%                        |
| <b>FUEL AND POWER</b>                   | 10.6%                      | 10.8%                         | -10.3%                        |
| <b>FURNITURE AND EQUIPMENT</b>          | 15.2%                      | 13.8%                         | -17.5%                        |
| <b>HOUSEHOLD OPERATION</b>              | 11.8%                      | 11.3%                         | -12.7%                        |
| <b>MEDICAL CARE AND HEALTH EXPENSES</b> | 10.1%                      | 10.5%                         | -9.5%                         |
| <b>TRANSPORT</b>                        | 8.7%                       | 8.8%                          | -8.5%                         |
| <b>COMMUNICATION</b>                    | 1.7%                       | 1.8%                          | -1.3%                         |
| <b>RECREATION AND ENTERTAINMENT</b>     | 15.8%                      | 14.4%                         | -17.4%                        |
| <b>READING MATTER</b>                   | 7.6%                       | 6.1%                          | -20.0%                        |
| <b>PERSONAL CARE</b>                    | 12.2%                      | 11.9%                         | -12.9%                        |
| <b>OTHER GOODS AND SERVICES</b>         | 3.5%                       | 3.0%                          | -4.4%                         |

#### **2.4.5 Analysis of magnitude of price increases by product category**

The largest magnitude of average price increases have been in footwear (18,9%), recreation and entertainment (14,4%), furniture and equipment (13,8%) and food (13,3%). The smallest magnitude of average price increases have been in communication (1,8%), and other goods and services (3,0%), as reported in Table 15.

**Table 15 Mean magnitude of price increases (descending)**

| <i>Product Category</i>          | <i>Magnitude of price increase</i> |
|----------------------------------|------------------------------------|
| FOOTWEAR                         | 18.9%                              |
| RECREATION AND ENTERTAINMENT     | 14.4%                              |
| FURNITURE AND EQUIPMENT          | 13.8%                              |
| FOOD                             | 13.3%                              |
| CLOTHING                         | 12.6%                              |
| PERSONAL CARE                    | 11.9%                              |
| HOUSEHOLD OPERATION              | 11.3%                              |
| FUEL AND POWER                   | 10.8%                              |
| NON ALCOHOLIC BEVERAGES          | 10.8%                              |
| MEDICAL CARE AND HEALTH EXPENSES | 10.5%                              |
| TRANSPORT                        | 8.8%                               |
| ALCOHOLIC BEVERAGES              | 8.2%                               |
| READING MATTER                   | 6.1%                               |
| CIGARETTES TOBACCO AND CIGARS    | 5.7%                               |
| OTHER GOODS AND SERVICES         | 3.0%                               |
| COMMUNICATION                    | 1.8%                               |

#### 2.4.6 Analysis of magnitude of price decreases by product category

The largest average price decreases have been for footwear (-28,5%), clothing (-24,7%), and reading matter (-20,0%). The smallest average price decreases have been in communication (-1,3%), and other goods and services (-4,4%), as reported in Table 16.

**Table 16 Mean Magnitude of Price Decreases (absolute value descending)**

| <i>Product Category</i>          | <i>Magnitude of price decrease</i> |
|----------------------------------|------------------------------------|
| FOOTWEAR                         | -28.5%                             |
| CLOTHING                         | -24.7%                             |
| READING MATTER                   | -20.0%                             |
| FURNITURE AND EQUIPMENT          | -17.5%                             |
| RECREATION AND ENTERTAINMENT     | -17.4%                             |
| FOOD                             | -15.8%                             |
| NON ALCOHOLIC BEVERAGES          | -13.2%                             |
| PERSONAL CARE                    | -12.9%                             |
| HOUSEHOLD OPERATION              | -12.7%                             |
| FUEL AND POWER                   | -10.3%                             |
| MEDICAL CARE AND HEALTH EXPENSES | -9.5%                              |
| TRANSPORT                        | -8.5%                              |
| ALCOHOLIC BEVERAGES              | -8.2%                              |
| CIGARETTES TOBACCO AND CIGARS    | -5.9%                              |
| OTHER GOODS AND SERVICES         | -4.4%                              |
| COMMUNICATION                    | -1.3%                              |

### 2.4.7 Analysis of magnitude of price changes at product level

In order to identify which specific products experience the largest magnitude of price changes, it is necessary to set a minimum threshold for an acceptable number of observations, as a number of the high and low frequency occurrences are due to very small sample sizes or even single observations.

As with the analysis of the frequency of price changes, in order to avoid the distortionary effect of small samples, a threshold is set which includes products where the sample of price increases or price decreases comprise at least 0,1% of total observations of such increases and price decreases. Based on this threshold, prices with the largest magnitude of price increases and decreases are outlined in Table 17 and Table 18, respectively.

**Table 17 Products with the 10 highest and 10 lowest magnitudes of price increases (descending)**  
**Highest Magnitude of price increases**

| <i>Product Category</i> | <i>Average<br/>Magnitude of<br/>increases</i> |
|-------------------------|-----------------------------------------------|
| GRAPEFRUIT              | 45.5%                                         |
| ORANGES                 | 36.2%                                         |
| AVOCADO'S               | 33.1%                                         |
| NAARTJIES               | 31.2%                                         |
| PUMPKIN                 | 29.8%                                         |
| WATERMELON              | 29.5%                                         |
| PAWPAWS                 | 29.3%                                         |
| GEM SQUASH              | 29.2%                                         |
| CAULIFLOWER             | 28.8%                                         |
| GRAPES                  | 28.7%                                         |
| GRAPEFRUIT              | 45.5%                                         |

**Smallest Magnitude of price increases**

| <i>Product Category</i>         | <i>Average<br/>Magnitude of<br/>increases</i> |
|---------------------------------|-----------------------------------------------|
| MAGAZINES                       | 0.8%                                          |
| GRAVESTONE                      | 0.7%                                          |
| REPAIRS TO CLOTHING             | 0.7%                                          |
| WAGES FOR MAKING OF CLOTHING    | 0.7%                                          |
| COST FOR THE HIRE OF CLOTHING   | 0.7%                                          |
| OTHER REPAIR COSTS TO FURNITURE | 0.7%                                          |
| UPHOLSTERING                    | 0.7%                                          |
| COST OF FUNERAL                 | 0.7%                                          |
| REPAIRS TO HOUSEHOLD TEXTILES   | 0.5%                                          |
| BLINDS                          | 0.5%                                          |



**Table 18 Products with the 10 highest and 10 lowest magnitude of price decreases (descending absolute value)**

| <b>Highest Magnitude of price decreases</b> |                                      |
|---------------------------------------------|--------------------------------------|
| <i>Product Category</i>                     | <i>Average Magnitude of decrease</i> |
| NAARTJIES                                   | -48.7%                               |
| APPLES                                      | -39.3%                               |
| PINEAPPLES                                  | -38.1%                               |
| GUAVAS                                      | -38.0%                               |
| PEACHES                                     | -36.8%                               |
| MANGOES                                     | -36.1%                               |
| ORANGES                                     | -35.6%                               |
| CARROTS                                     | -31.9%                               |
| VEGETABLE MARROW                            | -31.4%                               |
| BANANAS                                     | -31.2%                               |

| <b>Smallest Magnitude of price decreases</b> |                                      |
|----------------------------------------------|--------------------------------------|
| <i>Product Category</i>                      | <i>Average Magnitude of decrease</i> |
| FOR MEMBERS OF MEDICAL-AID SCHEMES           | -0.6%                                |
| FOR PRIVATE PATIENTS                         | -0.6%                                |
| FOR MEMBERS OF MEDICAL-AID SCHEMES           | -0.6%                                |
| FOR PRIVATE PATIENTS                         | -0.6%                                |
| TAKE-AWAY MEALS                              | -0.6%                                |
| IN STAFF CAFETERIAS                          | -0.6%                                |
| CONSUMED IN HOTELS, RESTAURANTS              | -0.6%                                |
| AEROPLANE (AIR TRANSPORT TARIFFS)            | -0.6%                                |
| COST OF FUNERAL                              | -0.4%                                |
| GRAVESTONE                                   | -0.4%                                |

Fresh fruit produce dominates the larger magnitude of price changes, both in the form of the largest price increase and the largest price decreases, whereas most of the moderate changes in prices are for services.

## 2.5 Duration of Prices

Based on the assumptions of stationarity and homogeneity of price change behaviour, it has been shown that the inverse of the frequency of the price changes converges, in a

large sample, to the mean duration of prices, that is:  $T^F = \frac{1}{F}$ , where  $T^F$  represents the average duration of price spells and  $F$  represents the frequency of price changes. Where

the assumptions of stationarity and homogeneity of pricing conduct are unlikely to hold as is the case in this study, it is necessary directly to compute price durations.<sup>14</sup>

Using the direct computation method outlined in *Appendix 5*, it is found that the average duration of prices for uncensored price spells is 3,9 months at the aggregate level. But due to the fact that there is a break in the data, which results in a situation where it is not possible to track pricing at specific stores, the direct computation of price durations means a sharp decrease in durations at the beginning of 2006. The effect of the break – which results in the loss of certain long duration prices from the sample – is to bring down the average duration of prices over the full period. The average duration of prices for uncensored price spells for the period before the break in the data is 4,2 months. Even during this reduced period the average duration of prices increases over time, as longer data periods lend themselves to the measurement of longer price durations.

As per Table 19, over the full period alcoholic beverages (6,0 months), footwear (5,4 months), non-alcoholic beverages (4,8 months) and personal care items (4,8 months) have the longest unweighted and uncensored average price durations, whereas other goods and services (1,7 months), reading matter (3,4 months) and food (3,5 months) have the shortest such average price durations.

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<sup>14</sup> Alvarez et al (2006) note that the direct computation of the average duration of price spells is based on uncensored spells, that is, only those spells that start and end with a price change. A consequence of this is that “[i]n addition to discarding some available information, this procedure may be affected by selection bias, since longer price spells are more likely to be censored and, hence, to be discarded” (p. 702). The break in the South African data sets used in the current study also has the effect of censoring price spells resulting in a bias toward shorter price duration.

**Table 19 Mean duration (uncensored) of prices by product category (in months)**

| Product Category                 | Months |
|----------------------------------|--------|
| ALCOHOLIC BEVERAGES              | 6.0    |
| FOOTWEAR                         | 5.4    |
| NON ALCOHOLIC BEVERAGES          | 4.8    |
| PERSONAL CARE                    | 4.8    |
| FURNITURE AND EQUIPMENT          | 4.6    |
| MEDICAL CARE AND HEALTH EXPENSES | 4.6    |
| COMMUNICATION                    | 4.6    |
| RECREATION AND ENTERTAINMENT     | 4.6    |
| CIGARETTES TOBACCO AND CIGARS    | 4.5    |
| FUEL AND POWER                   | 4.4    |
| HOUSEHOLD OPERATION              | 4.4    |
| CLOTHING                         | 3.9    |
| TRANSPORT                        | 3.7    |
| FOOD                             | 3.5    |
| READING MATTER                   | 3.4    |
| OTHER GOODS AND SERVICES         | 1.7    |

Re-weighting by CPI and CPIX weights, as has been done for the frequency and magnitude of price changes, increases the average duration to 4 months, as reported in Table 20.

**Table 20 Duration of price with alternative weightings**

|                               | <i>Unweighted</i> | <i>CPI<br/>weighted</i> | <i>CPIX<br/>weighted</i> |
|-------------------------------|-------------------|-------------------------|--------------------------|
| <b>DURATION OF<br/>PRICES</b> | 3.9               | 4.0                     | 4.0                      |

## 2.6 Attractive Prices

A detailed analysis of the data reveals the prevalence of attractive or psychological pricing.<sup>15</sup> Prices which end in 99 cents or 95 cents have a number of psychological attributes either hinting at price reductions, or are favoured by price setters as they require change to be drawn from the till which assists in recording transactions and thus reducing the possibility of theft by till operators. Prices that end in 00 cents or 50 cents appeared rounded and simpler to communicate. This is largely determined by factors of history and culture and the types and sizes of coins adopted by a particular country – as countries with 25 cents coins would likely find a different set of psychological prices than a

<sup>15</sup> Appendix 6 outlines the Stata code for analysing attractive prices.

country without a 25 cent coin (in South Africa less than 1% of prices are found to end with 25 cents). What constitutes the set of attractive prices is also likely to change over time. For example, smaller coins may become less prevalent or may be discontinued after their value is eroded by inflation so that pricing that ends in 99 cents comes to be replaced by pricing that ends in 95 cents.

*A priori*, it is to be expected that where attractive pricing is used then pricing may be more sticky, or have a lower price change frequency, as price setters would wait for prices to approach another attractive price before making the price change. For similar reasons, it is to be expected that the magnitude of price changes should be larger where attractive pricing is prevalent. The impact of attractive pricing on the frequency and magnitude of price changes is also likely to be heterogeneous across various product categories, due to varying transaction practices across various markets segments.

It is found that 26,2% of prices in the data set end with 99 cents, 14,3% of prices end with 95 cents and 4,1% of prices end in 50 cents. It is found that 18,1% of prices end in 00 cents. Remarkably, 62,7% of prices end in either 99 cents, 95 cents, 50 cents or 00 cents. Prices that have a last digit of 9 cents (that is 99 cent, 89 cents, 79 cents down to 9 cents) constitute about 38,7% of all prices.

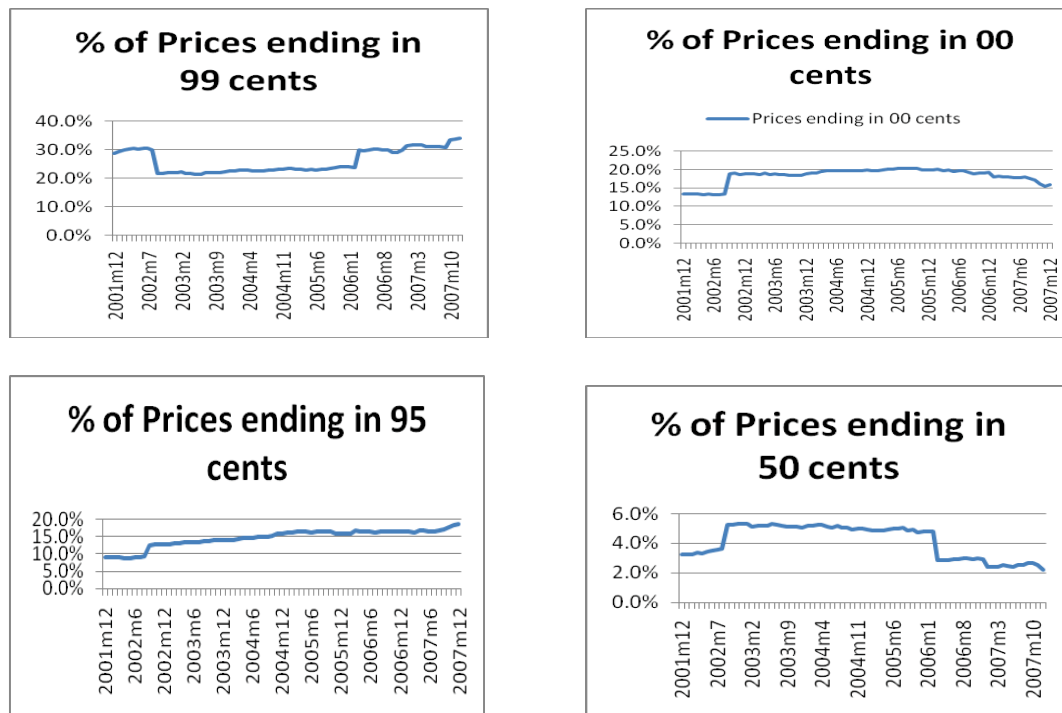
**Table 21 Attractive prices by product category**

|                                         | <b>99<br/>cents</b> | <b>95<br/>cents</b> | <b>50<br/>cents</b> | <b>00<br/>cents</b> | <b>Total</b> |
|-----------------------------------------|---------------------|---------------------|---------------------|---------------------|--------------|
| <b>FOOD</b>                             | 35.1%               | 10.8%               | 4.4%                | 5.3%                | 55.5%        |
| <b>NON ALCOHOLIC BEVERAGES</b>          | 16.8%               | 7.5%                | 10.3%               | 11.0%               | 45.7%        |
| <b>ALCOHOLIC BEVERAGES</b>              | 8.3%                | 32.6%               | 11.4%               | 10.9%               | 63.2%        |
| <b>CIGARETTES TOBACCO AND CIGARS</b>    | 13.3%               | 8.5%                | 10.7%               | 17.5%               | 50.0%        |
| <b>CLOTHING</b>                         | 23.2%               | 29.1%               | 1.9%                | 39.5%               | 93.7%        |
| <b>FOOTWEAR</b>                         | 31.9%               | 33.9%               | 0.3%                | 31.5%               | 97.8%        |
| <b>FUEL AND POWER</b>                   | 35.0%               | 8.6%                | 7.1%                | 15.4%               | 66.0%        |
| <b>FURNITURE AND EQUIPMENT</b>          | 30.5%               | 19.5%               | 0.8%                | 42.6%               | 93.5%        |
| <b>HOUSEHOLD OPERATION</b>              | 32.8%               | 9.9%                | 5.1%                | 8.9%                | 56.7%        |
| <b>MEDICAL CARE AND HEALTH EXPENSES</b> | 12.8%               | 13.3%               | 4.5%                | 4.9%                | 35.6%        |
| <b>TRANSPORT</b>                        | 0.6%                | 1.1%                | 2.1%                | 47.9%               | 51.6%        |
| <b>COMMUNICATION</b>                    | 0.2%                | 0.1%                | 0.2%                | 65.3%               | 65.9%        |
| <b>RECREATION AND ENTERTAINMENT</b>     | 22.2%               | 14.0%               | 2.1%                | 39.9%               | 78.2%        |
| <b>READING MATTER</b>                   | 1.6%                | 29.7%               | 5.0%                | 40.0%               | 76.3%        |
| <b>PERSONAL CARE</b>                    | 14.9%               | 20.8%               | 4.0%                | 22.5%               | 62.1%        |
| <b>OTHER GOODS AND SERVICES</b>         | 9.1%                | 9.3%                | 6.4%                | 30.2%               | 55.0%        |
| <b>TOTAL</b>                            | <b>26.2%</b>        | <b>14.3%</b>        | <b>4.1%</b>         | <b>18.1%</b>        | <b>62.7%</b> |

As reported in Table 21, footwear (97,8%), clothing (93,7%) and furniture and equipment (93,5%) are the product categories with the highest prevalence of attractive pricing. Medical care and health expenses (35,6%), non-alcoholic beverages (45,7%) and cigarettes, tobacco and cigars (50,0%) have the lowest prevalence of attractive pricing. Furthermore, 35,1% of food prices end with 99 cents, which makes food the leading product category making use of this attractive price. As food prices change relatively frequently, this has implications for the *a priori* assumption that attractive prices would change less frequently.

During the period under review, there is a mildly increasing prevalence of prices ending in 99 cents and the prevalence of prices ending in 00 cents remains broadly similar throughout the period. There is a definitely increasing trend of the prevalence of prices ending in 95 cents and there is something of a decline in prices ending in 50 cents, as outlined in the accompanying diagrams outlined in Fig. 13.

**Fig. 13 Percentage of prices ending in various attractive prices over time**



In line with *a priori* theory, it is found in Table 22 that prices that end in 00 cents, 95

cents and 50 cents have a lower frequency of price change than prices which do not end with these attractive prices. Compared to an overall unweighted average price change frequency of 16,8%, if a price ends with 00 cents then it is found to have a change frequency of 12,6%. If a price ends in 95 cents then its change frequency is 12,7%. If a price ends in 50 cents then its change frequency is 13,9%. For all other non-attractive prices the price change frequency is 19,8%.

**Table 22 Frequency of price changes (attractive prices vs. non-attractive prices)**

| <b>Price</b> | <b>Freq. of changes</b> | <b>Freq. of Increases</b> | <b>Freq. of Decreases</b> |
|--------------|-------------------------|---------------------------|---------------------------|
| <b>00</b>    | 12.6%                   | 7.5%                      | 5.1%                      |
| <b>50</b>    | 13.9%                   | 9.6%                      | 4.3%                      |
| <b>95</b>    | 12.7%                   | 8.1%                      | 4.6%                      |
| <b>99</b>    | 18.0%                   | 11.2%                     | 6.8%                      |
| <b>Other</b> | 19.8%                   | 13.2%                     | 6.6%                      |
| <b>Total</b> | 16.8%                   | 10.8%                     | 6.0%                      |

Intriguingly, prices that end in the attractive price of 99 cents tend not to be more sticky – changing at a frequency of 18,0% - than the overall average for prices (16,8%), although prices ending in 99 cents change less frequently than other prices (19,8%). This appears to contradict the *a priori* assumption that attractive prices would be more sticky, but is driven by the high proportion of food items (that is 35,1%) that are priced ending in 99 cents, combined with the fact that food items are recorded as having an above average frequency of price changes at 20,5%.

In line with this overall finding, the frequency of price increases and price decreases are lower for attractive prices ending in 00 cents, 50 cent and 95 cents than for other prices and the overall averages for increase and decreases. Yet, prices ending in 99 cents increase less frequently than other prices, but more frequently than the overall average for price increases. With regard to the frequency of price decreases, prices that end in 99 cents decrease more frequently than other prices and than the overall average for price decreases. This is likely due to the effect of food, which has a high prevalence of 99 cents prices and experiences frequent price increases and price decreases.

*A priori* the magnitude of price changes should be larger for prices moving from attractive prices. This is because price setters who have shown a predilection for

attractive pricing may look to increase or decrease prices from one attractive price to another attractive price. In fact, Table 23 presents some evidence that price-setters act in this manner.

**Table 23 Cross tabulation of price setting (attractive prices) (% and totals)**

| <i>Lag / price</i> | <i>00</i> | <i>50</i> | <i>95</i> | <i>99</i> | <i>Other</i> | <i>Total</i> |
|--------------------|-----------|-----------|-----------|-----------|--------------|--------------|
| <b>00</b>          | 76        | 6         | 5         | 4         | 10           | 81,382       |
| <b>50</b>          | 22        | 20        | 16        | 5         | 37           | 20,921       |
| <b>95</b>          | 6         | 5         | 55        | 11        | 23           | 63,705       |
| <b>99</b>          | 2         | 1         | 4         | 59        | 34           | 166,764      |
| <b>Other</b>       | 3         | 3         | 6         | 21        | 67           | 274,055      |
| <b>Total</b>       | 82,408    | 21,367    | 64,976    | 167,815   | 270,261      | 606,827      |

Attractive prices ending in 00 cents change 76% of the time to a new price also ending in 00 cents. For prices ending in 99 cents 59% of the time they change to a price ending in 99 cents, and for prices ending in 95 cents the ratio is 55%. Interestingly, prices ending in 50 cents only change to prices ending in 50 cents 20% of the time, but these prices relatively often change to other attractive prices such as 00 cents (20%) or 95 cents (16%). Other – non-attractive – prices tend to change to other non-attractive prices when they change (67% of the time).

As outlined in Table 24, the magnitudes of price increases – where prices increase – tend to be larger for attractive prices. Prices ending in 99 cents tend to change with a mean magnitude of 14,5% as compared to an overall average size of price increase of 12,1% and average price increases of other non-attractive prices of 10,0%. Similarly, prices ending in 00 cents increased with an average magnitude of 13,5%, prices ending in 95 cents with an average magnitude of 13,3% and prices ending in 50 cents with an average magnitude of 12,6%.

All are above the mean magnitudes for non-attractive prices and the overall mean magnitude of price increases over the period. The magnitude of price decreases was also larger in absolute terms for attractive prices than for non-attractive prices and for the overall average magnitude of price decreases over the period. Prices ending in 99 cents averaged decreases of -18,5% when prices were reduced, whereas the overall average size of price decreases was -14,9% and non-attractive prices that decreased, fell by an

average of -11,5%.

**Table 24 Average magnitude of price changes (attractive prices vs. non-attractive prices)**

| <i>Price</i> | <i>Magnitude of change</i> | <i>Magnitude of Increase</i> | <i>Magnitude of Decrease</i> |
|--------------|----------------------------|------------------------------|------------------------------|
| <b>00</b>    | 14.6%                      | 13.5%                        | -16.1%                       |
| <b>50</b>    | 14.0%                      | 12.6%                        | -17.2%                       |
| <b>95</b>    | 14.2%                      | 13.3%                        | -15.8%                       |
| <b>99</b>    | 16.0%                      | 14.5%                        | -18.5%                       |
| <b>Other</b> | 10.5%                      | 10.0%                        | -11.5%                       |
| <b>Total</b> | 13.1%                      | 12.1%                        | -14.9%                       |

## 2.7 Comparative Analysis

A brief summary of similar studies of unit level price data in other countries allows a comparison to be made with the findings for South Africa reported in this Chapter.<sup>16</sup>

**Table 25 Comparison of findings of CPI microdata analyses**

|                                  | <i>Frequency of price changes</i> | <i>Frequency of price increases</i> | <i>Frequency of price decreases</i> | <i>Average size of price increases</i> | <i>Average size of price decreases</i> |
|----------------------------------|-----------------------------------|-------------------------------------|-------------------------------------|----------------------------------------|----------------------------------------|
| <b>SOUTH AFRICA (2001–2007)</b>  | 17.1%                             | 11.1%                               | 6.0%                                | 10.9%                                  | -12.5%                                 |
| <b>EURO AREA (1996–2001)</b>     | 15.1%                             | 8.3%                                | 5.9%                                | 8.2%                                   | -10%                                   |
| <b>UNITED STATES (1998–2003)</b> | 24.8%                             | 16.1%                               | 13.2%                               | 12.7%                                  | -14.1%                                 |
| <b>SPAIN (1993–2001)</b>         | 15%                               | 9%                                  | 6%                                  | 8.2%                                   | -10.3%                                 |
| <b>FRANCE (1994–2003)</b>        | 18.9%                             | 9.7%                                | 6.5%                                | 12.5%                                  | -10%                                   |
| <b>BRAZIL (1996–2006)</b>        | 37%                               | 22.2%                               | 19%                                 | 16%                                    | -12.6%                                 |
| <b>SIERRA LEONE (1998–2003)</b>  | 51%                               | 20.1%                               | 21.4%                               |                                        |                                        |

With regard to the frequency of price changes at the aggregate level, the finding for South Africa 17,1% using CPI and CPIX weighted data, would appear to be broadly similar to findings for Spain (15%), the Euro Area (15,1%) and France (18,9%). The United States economy would appear to have a significantly greater frequency of price changes (24,8%), including higher frequencies both of price increases and price decreases.<sup>17</sup> Similarly, Brazil has experienced a significantly higher frequency of price changes (37%)

<sup>16</sup> Data for South Africa is based on the results of the current study. Data for the Euro Area is from Dhyne *et al.*, (2005) and for the United States from Bils and Klenow (2004) and from Klenow *et al.*, (2005). Data for Spain is from Alvarez *et al.*, (2004), for France from Baudry (2004), for Brazil from Gouvea (2007) and for Sierra Leone from Kovanen (2006). Due to the adoption of differing methodologies in the various studies, not all results are strictly equivalent, yet the results allow for general comparisons of pricing conduct in a number of economies.

<sup>17</sup> Again, as discussed in the first Chapter, the high prevalence of ‘sales’ prices in the United States price microdata provides a technical justification for the tendency for relatively high price change frequencies in that country.



than South Africa, and a higher frequency of both price increases and price decreases.

The average magnitude of price increases in South Africa is 10,9%. This is larger than for the Euro Area (8,2%) and Spain (8,2%). In the United States the average size of price increases is 12,7%. The average size of South Africa's price increases (10,9% for the CPIX weighted data) is smaller than those of Brazil (16%), the United States (12,7%) and France (12,5%). The average size of price decreases in South Africa (-12,5%) is similar to the average size of price decreases in Brazil (-12,6%), is larger than for the Euro Area (-10%), France (-10%) and Spain (-10,3%) but smaller than for the United States (-14,1%).

Price setting conduct in South Africa bears little resemblance to high-inflation Sierra Leone where the frequency of price change averaged 51% in the period between 1999 and 2003. In Sierra Leone's case the frequency of price changes declined from 90% in 1999 to about 40% in 2003.

## **2.8 Conclusion: Summary of findings**

Based on a study of the large CPI microdata set over the period 2001m12 to 2007m12, there is evidence at the aggregate level of:

- a varying frequency of price changes, and related price durations, over time, with an unweighted average monthly price change frequency of 16,8% over the period, and a maximum monthly price change frequency of 23,9% in 2003m6 and a minimum monthly price change frequency of 11,6% in 2004m12;
- asymmetry in pricing as price increases (10,8%) occur more frequently than price decreases (6%);
- heterogeneity in pricing across goods and services and across various product categories, with goods prices increasing with a frequency of 10,8% and decreasing with a frequency of 6,1%, and services prices increasing with a frequency of 11,4% and decreasing with a frequency of 3,5%;

- psychological, or attractive, pricing with 62,7% of all prices ending in either 99 cents, 95 cents, 50 cents or 00 cents; and
- sizeable magnitudes in price changes, which are larger than the prevailing inflation rate, as for those prices that rose, the average magnitude of price increases was 12,1% and for those prices that declined, the average magnitude of price decreases was -14,9%.

In order to provide insight into the heterogeneity in pricing conduct that exists amongst various product categories, Table. 26 provides a summary of findings on pricing conduct at the level of product categories, with reference to the aggregate findings for price change frequencies and magnitudes.

**Table 26 Summary of pricing conduct at CPI product category level**

| <i>Pricing metric</i>                                                                 | <i>Result</i>                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Aggregate frequency of price changes</b>                                           | 16,8% of prices change each month (unweighted), price increases (10,8%) occur more frequently than price decreases (6%)                                                                                     |
| <b>Product categories with highest price change frequency</b>                         | Other goods and services (25,2%), food (20,5%), transport (19,3%), cigarettes, tobacco and cigars (17,8%) and medical care and health expenses (17,2%)                                                      |
| <b>Product categories with lowest price change frequency</b>                          | Communication (6,7%), footwear (7,1%) and clothing (8,8%)                                                                                                                                                   |
| <b>Product categories with shortest measured price durations</b>                      | Other goods and services (1,7 months), reading matter (3,4 months) and food (3,5 months)                                                                                                                    |
| <b>Product categories with longest measured price durations</b>                       | Alcoholic beverages (6,0 months), footwear (5,4 months), non-alcoholic beverages (4,8 months) and personal care items (4,8 months)                                                                          |
| <b>Aggregate magnitude of price changes</b>                                           | 13,1% is the unweighted average absolute value magnitude of price changes, for price increases the average magnitude of price increases was 12,1%, and for price decreases the average magnitude was -14,9% |
| <b>Product categories with largest magnitude of price increases</b>                   | Footwear (18,9%), recreation and entertainment (14,4%), furniture and equipment (13,8%) and food (13,3%)                                                                                                    |
| <b>Product categories with smallest magnitude of price increases</b>                  | Communication (1,8%), and other goods and services (3,0%)                                                                                                                                                   |
| <b>Product categories with largest magnitude of price decreases (absolute value)</b>  | Footwear (-28,5%), clothing (-24,7%), and reading matter (-20,0%)                                                                                                                                           |
| <b>Product categories with smallest magnitude of price decreases (absolute value)</b> | Communication (-1,3%), and other goods and services (-4,4%)                                                                                                                                                 |

## **Chapter 3: Stylised facts from Producer Price microdata**

### **3.1 Introduction**

Similar to the work of the previous Chapter for the CPI microdata, an empirical analysis of the large microdata sample at the unit level of South Africa's Producer Price Index (PPI) for the period 2001m12 to 2007m12 is undertaken in this Chapter.

There are obvious similarities between the CPI and PPI microdata analyses, but it has been suggested by Nakamura and Steinsson (2008) for United States PPI data and by Vermeulen et al (2007) for Euro Area PPI data that interpreting evidence on producer prices may be somewhat more complicated than interpreting evidence on consumer prices. Firstly, it is noted that PPI data is typically collected through firm surveys instead of off the shelf prices.<sup>18</sup> Secondly, it is noted that intermediate prices may be part of explicit or implicit long-term contracts. Thirdly, it is noted that in wholesale markets the seller may be more likely to vary quality margins, such as delivery lags, rather than varying the price.

Notwithstanding these distinctions, this Chapter will present stylised facts for the PPI microdata, as for the CPI microdata, on the following issues: the frequency of price changes and the related duration of price spells, the frequency of price increases and the frequency of price decreases, as well as findings on the magnitude of price changes, the magnitude of price increases and the magnitude of price decreases. Results are presented at both an aggregate and a disaggregated level based on the PPI's 23 major product sub-categories.

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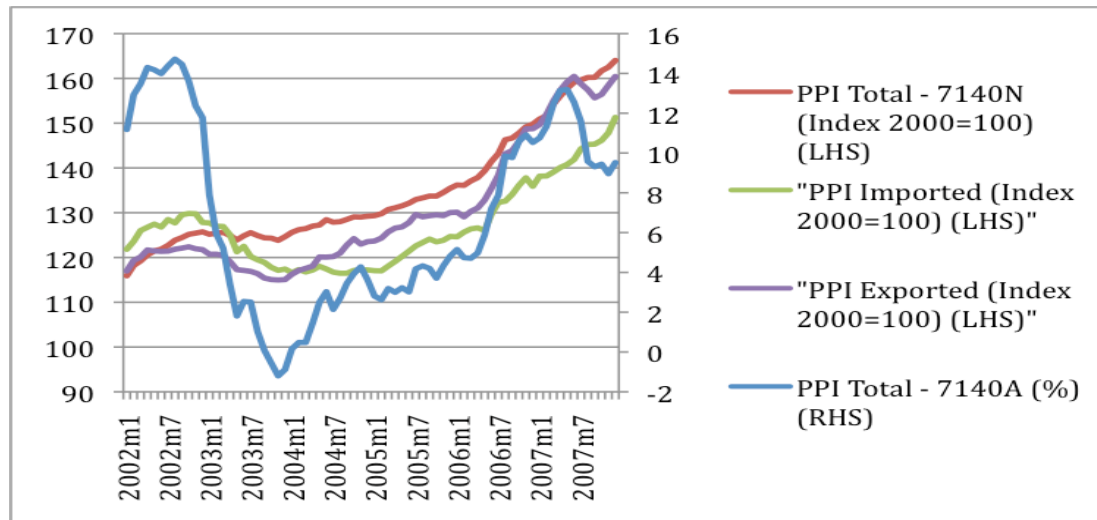
<sup>18</sup> In the South African context, CPI data collection has only recently (during the years 2008 and 2009) moved from a survey method to an off the shelf data collection method. In line with international practice, the South African PPI data continues to be gathered using a survey method. The recent process of re-weighting the various sub-categories of the CPI and PPI in South Africa has brought to the fore an additional distinction between the CPI and PPI data sets. Whereas the weights given to the various CPI sub-categories are based on surveyed household consumption patterns (revealed through what is known as the Income and Expenditure Survey), the weights given to the PPI sub-categories are not based on survey data, but are based on a decomposition of the national accounts to discern the appropriate weighting for the various components of the PPI.

The structure of the Chapter is as follows. In section 3.2 an overview of the data issues associated with using the unit level PPI data set is provided. Section 3.3 outlines the findings on the frequency of price changes and section 3.4 reports the findings on the magnitude of price changes. An analysis of the duration of prices is presented in Section 3.5. Section 3.6 presents a comparison between the findings for the South African PPI microdata and the findings for other countries. Section 3.7 concludes with a summary of key findings.

## 3.2 Description of data

The current study is based on the large data sets at unit level of South Africa's PPI data comprising 432 527 price records for the 73 month period from 2001m12 to 2007m12. Fig. 14 gives an indication of the movements in the measured PPI and its imported and exported components over the period. Initially, the 12-month change in the PPI fell from a high of around 14% in mid 2002 to below 0% (a period of PPI deflation) in late 2003, before trending upward once more for most of the remaining period under review.

**Fig. 14 PPI (and its components) in South Africa 2001 to 2007**



Source: SARB PPI data series 7140A, PPI index 7140N, PPI imported index 7141N, PPI exported index 7142N

In the current study, two data sets of unit level price records were merged to create the larger PPI data set. The first data set runs from 2001m12 to 2006m3 (comprising 303 381 price records) and the second from 2006m3 to 2007m12 (comprising 129 146 price records). Due to the fact that non-comparable firm identification numbers are used between the two data sets, there is a break in the data in 2006m3. The break in the data means that price duration cannot be measured over the month 2006m3 resulting in a downward bias in measured price duration, as prices of particular items at particular firms cannot be properly tracked over this period. However, as both data sets contain 6 739 identical price records for 2006m3 (albeit with different firm identification numbers), there is no break in the measurement of monthly price change frequencies and magnitudes. The first data set gives correct frequency and magnitude results for 2006m3 as compared to 2006m2, and the second data set gives correct results for 2006m4 as it uses its own consistently numbered stores from 2006m3.

Each individual price record corresponds to a precisely defined item sold by a particular enterprise at given point in time, therefore the pricing of individual items can be followed over time. Along with each individual price quote the following additional information is provided: whether the product was produced locally for the local market, imported or exported, the year and month of the record; an item code (indicating the type of product), a unit code (indicating the specific variety of the product), a capture code (indicating the capture status of the item), and a numeric outlet code (which in terms of the relevant legal confidentiality requirements does not enable the name of the outlet to be identified, but which enables the tracking of pricing activity by specific anonymous enterprises).

Before using the 432 527 price records in the large data set, it is necessary to analyse the data and where necessary exclude price records for which the capture code indicates that the price information has not been properly received and captured.

The bulk of the price records, 250 265 or about 57,9% of the total sample, are described as being correctly received and captured (code 1) and there is no question that these should be included in the study. Similarly, there appears to be no reason to exclude the

420 prices which have been provided for the first time by an existing respondent (code 5) or the 1 420 prices from new respondents (code 6). The 6 101 code 4 prices are also included in the study, as even though there is some ambiguity as to whether the code indicates a change in the quality of the product, the code has also been used when prices are given for previously out of stock items.

With regard to the 123 654 (code 0) price records that are classified as having a questionnaire outstanding (28,6% of the total sample), the convention of the statistical authorities has been to assume that the price from the most recently recorded previous period has remained unchanged until up-to-date price information is acquired. Such price records have been included in the study, as although based on an imperfect assumption, these records serve to provide an approximate account of the frequency and size of price changes, although they do not provide a precise account of the timing of price changes.

A further 11,7% of the price records are recorded as being out of stock or no longer stocked (code 8) and these are recorded as having a zero price or a price of R0,00 price. As such, it is necessary to exclude these 50 581 price records from the study. The exclusion of these price records is necessary, as the inclusion of such price records, for which a captured price of R0,00 was entered into the data base, would have a significant distorting impact on analyses of the frequency and magnitude of price changes.

The 71 prices classified as pricing outliers that could not be confirmed with the price setter (code 3) have also been excluded from the data set to be studied. Capture codes 2, 7 and 9 were listed as not in use by the statistical authorities over the period of the study.

In summary, as outlined in Table 27, a total of 381 861 prices have been included in the data set to be studied, that is, prices classified with codes 0, 1, 4, 5 and 6. As described above, a total of 50 652 price records have been excluded from the study, that is, prices classified with codes 3 and 8. Finally, a further 14 price records were excluded due to an anomaly in the data where these 14 price records have no capture code provided.

**Table 27 Description of PPI microdata set**

| <i>Code</i>  | <i>Status</i>                                                                                                                                                                    | <i>Number of observations</i> | <i>% of total observations</i> |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|--------------------------------|
| 0            | Questionnaire still outstanding                                                                                                                                                  | 123655                        | 28.59%                         |
| 1            | Questionnaire received and captured                                                                                                                                              | 250265                        | 57.86%                         |
| 2            | Estimated price - currently not used                                                                                                                                             | 0                             | 0.00%                          |
| 3            | Prices that fall outside the allowed range and could not be confirmed with respondent - Outliers                                                                                 | 71                            | 0.02%                          |
| 4            | Price confirmed by respondent but quality and/or unit of product changed and so price is not comparable. Also used for items that were out of stock when prices are given again. | 6101                          | 1.41%                          |
| 5            | Price provided for first time on this product by an existing respondent                                                                                                          | 420                           | 0.10%                          |
| 6            | New respondent                                                                                                                                                                   | 1420                          | 0.33%                          |
| 7            | Currently not used                                                                                                                                                               | 0                             | 0.00%                          |
| 8            | Respondent is out of stock or no longer sells product                                                                                                                            | 50581                         | 11.69%                         |
| 9            | Shop closed                                                                                                                                                                      | 0                             | 0.00%                          |
| <b>Total</b> |                                                                                                                                                                                  | <b>432513</b>                 | <b>100%</b>                    |

Note: There are 432 527 price records in the merged data set, but a handful of the price records (14) have no capture codes provided, therefore the actual merged data set used comprises 432 513 price records of which 6 739 price records are repeated in each of the two data sets for 2006m3 with different firm identification numbers. On average the selected data set contains 5 230 price records per month for 73 months with a maximum of 5 371 records in 2005m2 and a minimum of 4 885 price records in 2007m12.

The PPI data set contains pricing information divided into 23 Standard Industrial Classification (SIC) subcategories. Each of these SIC subcategories is then given a weight in determining the overall PPI. The number of observations and percentage of overall price records contained in the sample under study in each product subcategory is outlined in Table 28 below.

**Table 28 PPI microdata set by industrial sector**

| <i>Sector</i>                      | <i>SIC Codes</i> | <i>Number of Observations (with selected capturecodes)</i> | <i>% of total observations</i> | <i>Weight in PPI</i> |
|------------------------------------|------------------|------------------------------------------------------------|--------------------------------|----------------------|
| AGRICULTURE                        | 10000 to 10410   | 12895                                                      | 3.38                           | 8.55                 |
| FORESTRY AND FISHING               | 12100 to 30110   | 794                                                        | 0.21                           | 2.22                 |
| MINING AND QUARRYING               | 10411 to 12099   | 11943                                                      | 3.13                           | 8.92                 |
| FOOD AT MANUFACTURING              | 30000 to 30499   | 51628                                                      | 13.52                          | 10.77                |
| BEVERAGES                          | 30500 to 30599   | 12957                                                      | 3.39                           | 3.58                 |
| TOBACCO PRODUCTS                   | 30600 to 30999   | 710                                                        | 0.19                           | 1.22                 |
| TEXTILES AND MADE-UP GOODS         | 31000 to 31999   | 41477                                                      | 10.86                          | 4.97                 |
| WOOD AND WOOD PRODUCTS             | 32000 to 32299   | 13079                                                      | 3.43                           | 1.2                  |
| PAPER, PAPER PRODUCTS AND PRINTING | 32300 to 32599   | 14147                                                      | 3.70                           | 8.36                 |
| PRODUCTS OF PETROLEUM AND COAL     | 33000 to 33399   | 3891                                                       | 1.02                           | 3.27                 |
| CHEMICALS AND CHEMICAL PRODUCTS    | 33400 to 33699   | 51023                                                      | 13.36                          | 7.41                 |
| RUBBER AND PLASTIC PRODUCTS        | 33700 to 33899   | 10038                                                      | 2.63                           | 2.48                 |
| NON-METALLIC MINERAL PRODUCTS      | 34000 to 34999   | 20536                                                      | 5.38                           | 2.11                 |

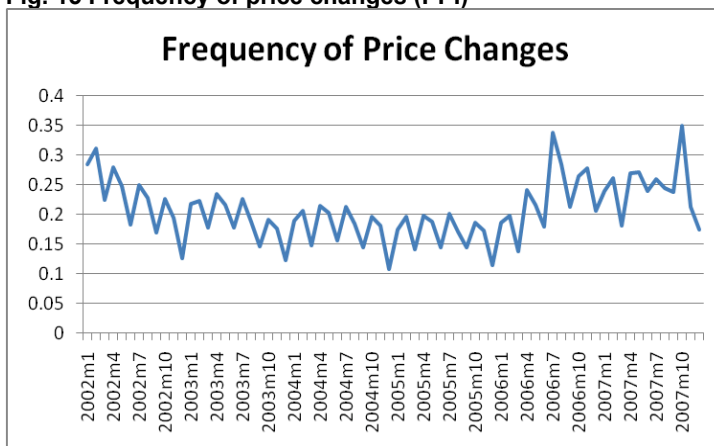
|                                                         |                |               |            |            |
|---------------------------------------------------------|----------------|---------------|------------|------------|
| <b>BASIC METALS</b>                                     | 35000 to 35399 | 10245         | 2.68       | 8.68       |
| <b>METAL PRODUCTS</b>                                   | 35400 to 35599 | 20795         | 5.45       | 3.23       |
| <b>NON-ELECTRICAL MACHINERY AND EQUIPMENT</b>           | 35600 to 35999 | 38043         | 9.96       | 3.57       |
| <b>ELECTRICAL MACHINERY AND APPARATUS</b>               | 36000 to 36699 | 17338         | 4.54       | 2.04       |
| <b>RADIO, TV, COMMUNICATION EQUIPMENT AND APPARATUS</b> | 37000 to 37999 | 14246         | 3.73       | 1.66       |
| <b>TRANSPORT EQUIPMENT</b>                              | 38000 to 38999 | 14212         | 3.72       | 8.32       |
| <b>FURNITURE</b>                                        | 39000 to 39199 | 5008          | 1.31       | 1.39       |
| <b>OTHER MANUFACTURES</b>                               | 39200 to 39599 | 15593         | 4.08       | 1.37       |
| <b>ELECTRICITY</b>                                      | 40000 to 49999 | 425           | 0.11       | 4.68       |
| <b>CONSTRUCTION</b>                                     | 50000 to 59999 | 838           | 0.22       |            |
| <b>TOTAL OBSERVATIONS</b>                               |                | <b>381861</b> | <b>100</b> | <b>100</b> |

### 3.3 Findings on the frequency of price changes

With regard to the frequency of price changes, the headline finding of the study of unit level PPI prices over the period 2001m12 to 2007m12, is that an average of 20,23% of prices changed each month.

It is interesting to note that over the 73 month period under consideration there was a significant degree of differentiation in the frequency of price changes with the highest frequency of price changes occurring in 2007m10 at 34,9% and the lowest frequency of price changes occurring in 2004m12 at 10,8 %, as reported in Fig. 15.

**Fig. 15 Frequency of price changes (PPI)**



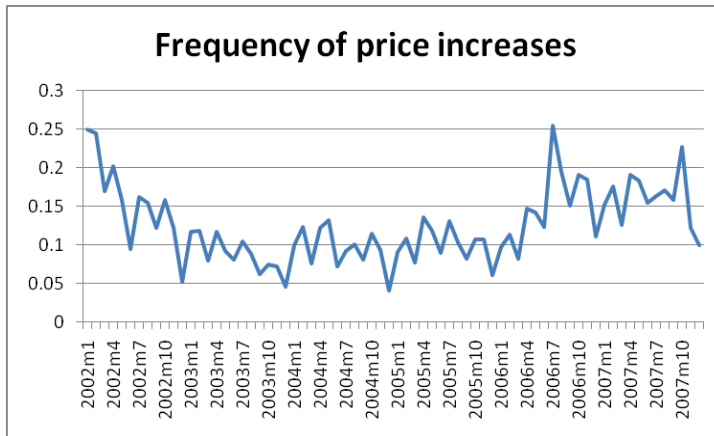


### 3.3.1 Aggregate frequency of price increases and price decreases

Price increases occurred with an average monthly frequency of 12,18% and price decreases with a frequency of 8,05%, indicating a degree of asymmetry in price setting in favour of price increases over price decreases.

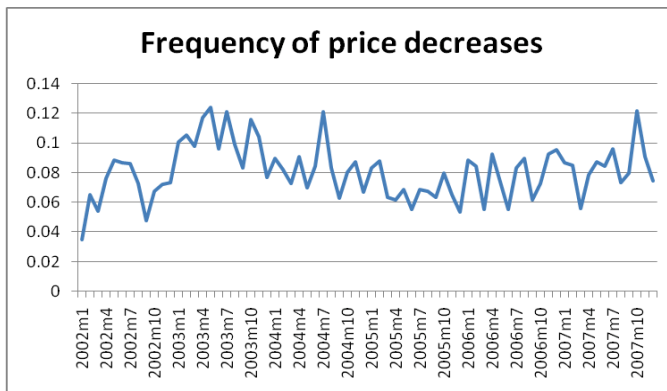
Over the period, an initial decrease in the frequency of price increases was followed by an increased in the frequency of price increases over the period from 2006m3 onwards, as reported in Fig. 16. The month that recorded the highest frequency of price increases was 2006m7, with 25,47% of prices increasing, and the month with lowest frequency of price increases was 2004m12 with 4,08% of prices increasing.

**Fig. 16 Frequency of price increases (PPI)**



With regard to the frequency of price decreases, as reported in Fig. 17, the month with the highest frequency of price decreases was 2003m5 with 12,41% of prices decreasing. The month with the lowest frequency of price decreases was 2002m1 when 3,5% of prices decreased.

**Fig. 17 Frequency of price decreases (PPI)**



### **3.3.2 Alternative weighting procedures**

The above findings are not weighted, in the sense that the weighting of the various industry subcategories in the data set is not aligned to the weightings given to these industry subcategories in the construction of the PPI.

Re-weighting the data according to the various product category weights underlying the PPI provides an alternative analysis of pricing conduct that more closely reflects the proportional significance of various product categories in the wider economy. This analysis is useful in considering aggregate pricing conduct.

As reported in Table 29, the aggregate frequency of price changes is 27,77% for the PPI weightings. This is larger than the estimate for the aggregate frequency of price change in unweighted sample of 20,23%. There are similar increases in the re-weighted frequencies of price increases and price decreases. The frequency of price increases based on the PPI weightings is 16,38%, up from 12,18% for the unweighted sample. The frequency of price decreases is 11,39% when PPI weightings are applied, up from 8,05% for the unweighted sample.

The reason for the increase in price change frequencies when PPI-weightings are followed is likely due to the heavier weighting of items such as products of petroleum and coal, agricultural products and mining and quarrying products, which are all rated as

experiencing relatively high price change and price increase frequencies.

**Table 29 Frequency of price changes with alternative weightings**

|                              | <i>Unweighted</i> | <i>PPI weighted</i> |
|------------------------------|-------------------|---------------------|
| FREQUENCY OF PRICE CHANGES   | 20.23%            | 27.77%              |
| FREQUENCY OF PRICE INCREASES | 12.18%            | 16.38%              |
| FREQUENCY OF PRICE DECREASES | 8.05%             | 11.39%              |

### 3.3.3 Comparison of the frequency of price changes of different industry categories

The findings on the frequency of price changes by industry category are outlined in Table 30, which shows the overall frequency of price changes, the average frequency of price increases and the average frequency of price decreases.

**Table 30 PPI price changes by industrial sector**

| Sector                                           | Frequency of price changes | Frequency of price increases | Frequency of price decreases |
|--------------------------------------------------|----------------------------|------------------------------|------------------------------|
| AGRICULTURE                                      | 50.76%                     | 27.52%                       | 23.24%                       |
| FORESTRY AND FISHING                             | 11.91%                     | 10.99%                       | 0.92%                        |
| MINING AND QUARRYING                             | 50.55%                     | 27.01%                       | 23.55%                       |
| FOOD AT MANUFACTURING                            | 26.11%                     | 15.65%                       | 10.46%                       |
| BEVERAGES                                        | 10.36%                     | 8.00%                        | 2.36%                        |
| TOBACCO PRODUCTS                                 | 16.89%                     | 12.33%                       | 4.57%                        |
| TEXTILES AND MADE-UP GOODS                       | 13.15%                     | 7.86%                        | 5.29%                        |
| WOOD AND WOOD PRODUCTS                           | 13.60%                     | 10.15%                       | 3.45%                        |
| PAPER, PAPER PRODUCTS AND PRINTING               | 21.33%                     | 11.88%                       | 9.45%                        |
| PRODUCTS OF PETROLEUM AND COAL                   | 67.82%                     | 40.09%                       | 27.73%                       |
| CHEMICALS AND CHEMICAL PRODUCTS                  | 16.55%                     | 10.26%                       | 6.30%                        |
| RUBBER AND PLASTIC PRODUCTS                      | 15.25%                     | 10.44%                       | 4.81%                        |
| NON-METALLIC MINERAL PRODUCTS                    | 16.91%                     | 11.05%                       | 5.86%                        |
| BASIC METALS                                     | 33.44%                     | 19.86%                       | 13.58%                       |
| METAL PRODUCTS                                   | 15.94%                     | 9.96%                        | 5.99%                        |
| NON-ELECTRICAL MACHINERY AND EQUIPMENT           | 15.46%                     | 9.06%                        | 6.40%                        |
| ELECTRICAL MACHINERY AND APPARATUS               | 15.32%                     | 10.22%                       | 5.10%                        |
| RADIO, TV, COMMUNICATION EQUIPMENT AND APPARATUS | 13.41%                     | 7.16%                        | 6.25%                        |

|                            |        |        |        |
|----------------------------|--------|--------|--------|
| <b>TRANSPORT EQUIPMENT</b> | 18.23% | 10.63% | 7.60%  |
| <b>FURNITURE</b>           | 8.32%  | 6.80%  | 1.52%  |
| <b>OTHER MANUFACTURES</b>  | 11.14% | 6.92%  | 4.22%  |
| <b>ELECTRICITY</b>         | 46.90% | 30.19% | 16.71% |
| <b>CONSTRUCTION</b>        | 26.49% | 14.73% | 11.76% |

### 3.3.4 Analysis of the frequency of price changes by industry category

Table 31 ranks industry categories from those with the least frequently changed prices, to those with the most frequently changed prices.

**Table 31 Frequency of price changes in ascending order (PPI)**

| <b>Sector</b>                                           | <b>Frequency of price changes</b> |
|---------------------------------------------------------|-----------------------------------|
| <b>FURNITURE</b>                                        | 8.32%                             |
| <b>BEVERAGES</b>                                        | 10.36%                            |
| <b>OTHER MANUFACTURES</b>                               | 11.14%                            |
| <b>FORESTRY AND FISHING</b>                             | 11.91%                            |
| <b>TEXTILES AND MADE-UP GOODS</b>                       | 13.15%                            |
| <b>RADIO, TV, COMMUNICATION EQUIPMENT AND APPARATUS</b> | 13.41%                            |
| <b>WOOD AND WOOD PRODUCTS</b>                           | 13.60%                            |
| <b>RUBBER AND PLASTIC PRODUCTS</b>                      | 15.25%                            |
| <b>ELECTRICAL MACHINERY AND APPARATUS</b>               | 15.32%                            |
| <b>NON-ELECTRICAL MACHINERY AND EQUIPMENT</b>           | 15.46%                            |
| <b>METAL PRODUCTS</b>                                   | 15.94%                            |
| <b>CHEMICALS AND CHEMICAL PRODUCTS</b>                  | 16.55%                            |
| <b>TOBACCO PRODUCTS</b>                                 | 16.89%                            |
| <b>NON-METALLIC MINERAL PRODUCTS</b>                    | 16.91%                            |
| <b>TRANSPORT EQUIPMENT</b>                              | 18.23%                            |
| <b>PAPER, PAPER PRODUCTS AND PRINTING</b>               | 21.33%                            |
| <b>FOOD AT MANUFACTURING</b>                            | 26.11%                            |
| <b>CONSTRUCTION</b>                                     | 26.49%                            |
| <b>BASIC METALS</b>                                     | 33.44%                            |
| <b>ELECTRICITY</b>                                      | 46.90%                            |
| <b>MINING AND QUARRYING</b>                             | 50.55%                            |
| <b>AGRICULTURE</b>                                      | 50.76%                            |
| <b>PRODUCTS OF PETROLEUM AND COAL</b>                   | 67.82%                            |

Furniture (8,32%), beverages (10,36%) and other manufactures (11,14%) prices change at a relatively low frequency. The most flexible prices are products of petroleum and coal, which change at a frequency of 67,82%. Agriculture prices (50,76%), mining and quarrying prices (50,55%), and electricity prices (46,90%) also change relatively frequently.

### 3.3.5 Analysis of the frequency of price increases by industry category

The most frequent price increases have occurred in products of petroleum and coal (40,09%), electricity (30,19%), agriculture (27,52%), and mining and quarrying (27,01%). The least frequent price increases occurred in furniture (6,80%), other manufactures (6,92%), radio, TV, communication equipment and apparatus (7,16%) and textiles and made-up goods (7,86%), as outlined in Table 32.

**Table 32 Frequency of price increases in ascending order (PPI)**

| <i>Sector</i>                                    | <i>Frequency of price increases</i> |
|--------------------------------------------------|-------------------------------------|
| FURNITURE                                        | 6.80%                               |
| OTHER MANUFACTURES                               | 6.92%                               |
| RADIO, TV, COMMUNICATION EQUIPMENT AND APPARATUS | 7.16%                               |
| TEXTILES AND MADE-UP GOODS                       | 7.86%                               |
| BEVERAGES                                        | 8.00%                               |
| NON-ELECTRICAL MACHINERY AND EQUIPMENT           | 9.06%                               |
| METAL PRODUCTS                                   | 9.96%                               |
| WOOD AND WOOD PRODUCTS                           | 10.15%                              |
| ELECTRICAL MACHINERY AND APPARATUS               | 10.22%                              |
| CHEMICALS AND CHEMICAL PRODUCTS                  | 10.26%                              |
| RUBBER AND PLASTIC PRODUCTS                      | 10.44%                              |
| TRANSPORT EQUIPMENT                              | 10.63%                              |
| FORESTRY AND FISHING                             | 10.99%                              |
| NON-METALLIC MINERAL PRODUCTS                    | 11.05%                              |
| PAPER, PAPER PRODUCTS AND PRINTING               | 11.88%                              |
| TOBACCO PRODUCTS                                 | 12.33%                              |
| CONSTRUCTION                                     | 14.73%                              |
| FOOD AT MANUFACTURING                            | 15.65%                              |
| BASIC METALS                                     | 19.86%                              |
| MINING AND QUARRYING                             | 27.01%                              |
| AGRICULTURE                                      | 27.52%                              |
| ELECTRICITY                                      | 30.19%                              |
| PRODUCTS OF PETROLEUM AND COAL                   | 40.09%                              |

### 3.3.6 Analysis of the frequency of price decreases by industry category

The most frequent price decreases have been in products of petroleum and coal (27,73%), mining and quarrying (23,55%) and agriculture (23,24%). The least frequent price decreases have been in forestry and fishing (0,92%), furniture (1,52%), beverages (2,36%), and wood and wood products (3,45%), as outlined in Table 33.

**Table 33 Ascending frequency of price decreases (PPI)**

| <i>Sector</i>                                    | <i>Frequency of decreases</i> |
|--------------------------------------------------|-------------------------------|
| FORESTRY AND FISHING                             | 0.92%                         |
| FURNITURE                                        | 1.52%                         |
| BEVERAGES                                        | 2.36%                         |
| WOOD AND WOOD PRODUCTS                           | 3.45%                         |
| OTHER MANUFACTURES                               | 4.22%                         |
| TOBACCO PRODUCTS                                 | 4.57%                         |
| RUBBER AND PLASTIC PRODUCTS                      | 4.81%                         |
| ELECTRICAL MACHINERY AND APPARATUS               | 5.10%                         |
| TEXTILES AND MADE-UP GOODS                       | 5.29%                         |
| NON-METALLIC MINERAL PRODUCTS                    | 5.86%                         |
| METAL PRODUCTS                                   | 5.99%                         |
| RADIO, TV, COMMUNICATION EQUIPMENT AND APPARATUS | 6.25%                         |
| CHEMICALS AND CHEMICAL PRODUCTS                  | 6.30%                         |
| NON-ELECTRICAL MACHINERY AND EQUIPMENT           | 6.40%                         |
| TRANSPORT EQUIPMENT                              | 7.60%                         |
| PAPER, PAPER PRODUCTS AND PRINTING               | 9.45%                         |
| FOOD AT MANUFACTURING                            | 10.46%                        |
| CONSTRUCTION                                     | 11.76%                        |
| BASIC METALS                                     | 13.58%                        |
| ELECTRICITY                                      | 16.71%                        |
| AGRICULTURE                                      | 23.24%                        |
| MINING AND QUARRYING                             | 23.55%                        |
| PRODUCTS OF PETROLEUM AND COAL                   | 27.73%                        |

### 3.3.7 Frequency of price changes for local products, imported products and exported products

Each price record in the PPI data set indicates whether a particular price is for a locally produced product for the local market, an imported product, or an exported product. The frequency of price changes for imported products over the period (23,15%) is higher than the frequency of price changes for local products (18,75%) and for exported products (18,71%), as outlined in Table 34.

**Table 34 Comparing price change frequencies for local, imported and exported products**

|                              | <i>Aggregate</i> | <i>Local products</i> | <i>Imported Products</i> | <i>Exported Products</i> |
|------------------------------|------------------|-----------------------|--------------------------|--------------------------|
| FREQUENCY OF PRICE CHANGES   | 20.23%           | 18.75%                | 23.15%                   | 18.71%                   |
| FREQUENCY OF PRICE INCREASES | 12.18%           | 12.34%                | 12.25%                   | 11.13%                   |
| FREQUENCY OF PRICE DECREASES | 8.05%            | 6.41%                 | 10.90%                   | 7.58%                    |

This is mainly due to the relatively high frequency of price decreases for imported goods (10,9%) as compared to exported goods (7,58%) and local products (6,41%). The relatively high frequency of price decreases for imported goods is consistent with the currency appreciation during the period under review which would have had the effect of

making imports cheaper. The frequency of price increases for local (12,34%) and imported goods (12,25%) is very similar, with the frequency of price increases for exported products being somewhat lower (11,13%) possibly hinting at competitive pressures facing exporters.

### **3.4 Magnitude of price changes**

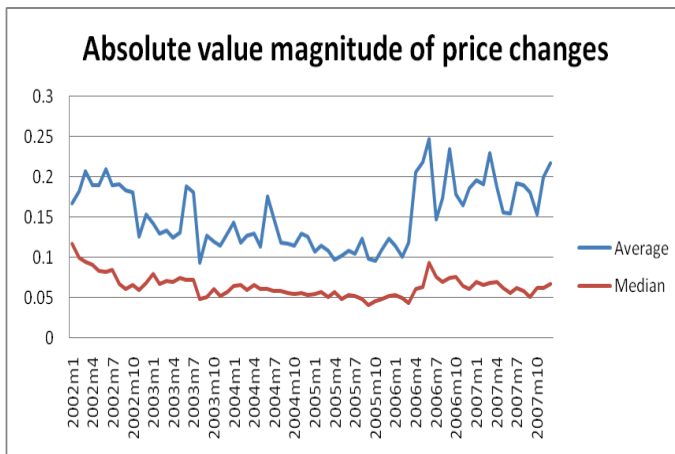
With regard to the magnitude of price changes, the headline findings for the monthly data over the period 2001m12 to 2007m12 is that, conditional on the occurrence of a price change, the weighted average absolute value magnitude of price changes was 15,44%.

For those prices that rose, the average magnitude of price increases was 14,57%. For those prices that declined, the average magnitude of price decreases was -16,75%. The comparative medians, which exclude the impact of extreme price increases and decreases, were: a 6,45% absolute value magnitude of price changes, a 6,74% magnitude of price increases, and a -6,06% magnitude of price decreases.

Once again this analysis is distinct from the more familiar inflation-type measure of the monthly average size of price change, taking into account all recorded prices, that is, including both those price that have changed and those prices that did not change.

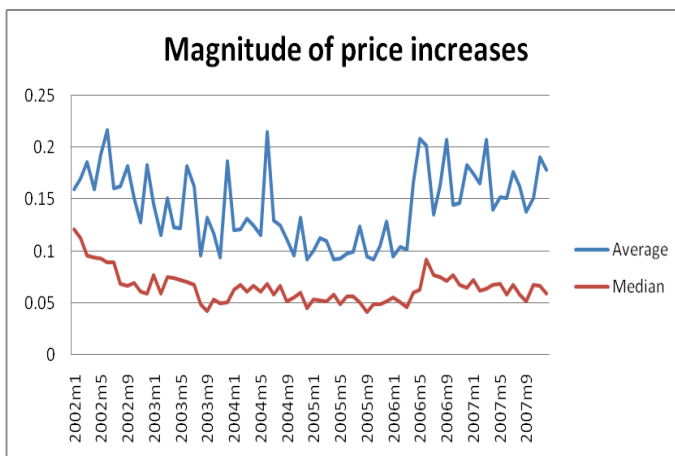
Over the period the largest overall absolute value average size of price change (including both prices that increased and decreased) was 24,69% in 2006m6 and the smallest overall absolute value average size of price change was 9,3% in 2003m8. The month with the highest median price change of 11,73% was 2002m1, and with the lowest median price change of 4,1% was 2005m9, as per Fig. 18.

**Fig. 18 Magnitude of price changes (PPI)**



The month with the largest average price increase was 2002m6 at 21,71% and the month with the smallest average price increase was 2005m4 at 9,19%. Monthly median price increases were considerably lower peaking in 2002m1 at 12,06%, with a low median of 4,14% in 2005m9, as per Fig. 19.

**Fig. 19 Magnitude of price increases (PPI)**

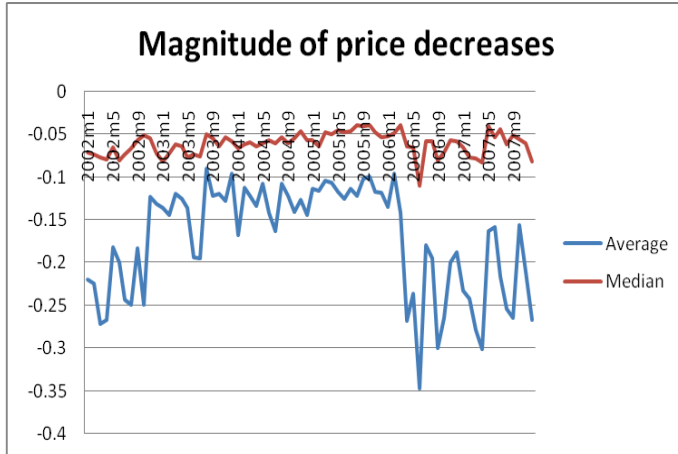


The month with the largest average price decrease was 2006m6 at -34,71% and the month with the smallest average price decrease was 2003m8 at -9,01%. Monthly median price decreases were considerably lower with the largest being in 2006m6 at -11,01%, and the



month with the smallest median price decreases being 2005m10 with median decreases of -3,94%, as per Fig. 20.<sup>19</sup>

**Fig. 20 Magnitude of price decreases (PPI)**



### 3.4.1 Alternative weighting procedures

The above findings for the magnitudes of price changes are not weighted, but offer a description of the magnitude of price changes for the data set as a whole and for the various product categories in the data set. Re-weighting of the data based on the various product category weights underlying the PPI during the period under review is again

<sup>19</sup> Upon enquiries to the South African statistical authorities regarding the large average magnitude of PPI price decreases (in absolute terms) in month 2006m6, it has been suggested that the unit level data contained some large outlier price decreases that had a significant effect on the average magnitude of price decreases. The fact that in absolute terms the median price decrease is also the largest of any month for 2006m6 may indicate that the data anomaly for the month may be more general than a handful of large outlier price level entries. This perception is also reinforced by the fact that the average and median magnitudes of PPI price increases and price changes are also comparatively large in the mid-2006 period. The South African statistical authorities maintain that any such anomalies at the unit level are dealt with in the process of composing the overall PPI measures, to the extent that the measure of PPI was reported as continuing on a smooth upward trend over the period in question, as outlined in Fig. 14. While this matter may require a more satisfactory explanation, it should be noted that the data anomaly does not impact significantly on the main findings of this research effort as the measured duration of PPI prices (in particular for the imported component of PPI), which is used as the basis for the discussion of the alternative parameterisations of the open economy DSGE model in Chapter 5, is not directly effected by such large magnitude price decreases. Nonetheless, the large magnitude price decreases will impact to some extent on various other aspects including the regression analysis in Chapter 4, concerning the seasonality and state-dependence of the magnitude of PPI price changes. To some extent the impact of large magnitude price decreases is indicated in the regression analysis (in *Appendix 10.14*) by the fact that price change magnitudes are larger after the break in the data in 2006m3.

undertaken to provide a perspective that more closely reflects the proportional significance of various product categories in the wider economy.

As Table 35 shows, using PPI weightings, the weighted-average absolute value magnitude of price increases is marginally lower at 15,39%, as compared to the unweighted absolute magnitude of price changes of 15,44%. The aggregated magnitude of price increase rises marginally from 14,57% for the unweighted data to 14,73% for the PPI weighted data. The aggregate magnitude for price decreases is -16,75% for the unweighted data and -16,40% for the PPI weighted data.

**Table 35 Magnitude of price changes with alternative weighting (PPI)**

|                                     | <i>Unweighted</i> | <i>PPI weighted</i> |
|-------------------------------------|-------------------|---------------------|
| <b>MAGNITUDE OF PRICE CHANGE</b>    | 15.44%            | 15.39%              |
| <b>MAGNITUDE OF PRICE INCREASES</b> | 14.57%            | 14.73%              |
| <b>MAGNITUDE OF PRICE DECREASES</b> | -16.75%           | -16.40%             |

### 3.4.2 Analysis of the magnitude of price changes by industry category

The findings on the size of price changes by industry category are outlined in Table 36 to show the overall average size of price changes where price change, the average size of price increases where prices rose and the average size of price decreases where prices declined.

**Table 36 Magnitude of price changes (PPI)**

| <i>Sector</i>                                 | <i>Magnitude of price changes</i> | <i>Magnitude of price increases</i> | <i>Magnitude of price decreases</i> |
|-----------------------------------------------|-----------------------------------|-------------------------------------|-------------------------------------|
| <b>AGRICULTURE</b>                            | 16.71%                            | 16.01%                              | -17.54%                             |
| <b>FORESTRY AND FISHING</b>                   | 12.87%                            | 13.21%                              | -8.76%                              |
| <b>MINING AND QUARRYING</b>                   | 25.67%                            | 24.22%                              | -27.33%                             |
| <b>FOOD AT MANUFACTURING</b>                  | 9.09%                             | 9.23%                               | -8.88%                              |
| <b>BEVERAGES</b>                              | 13.42%                            | 13.52%                              | -13.07%                             |
| <b>TOBACCO PRODUCTS</b>                       | 30.43%                            | 24.78%                              | -45.69%                             |
| <b>TEXTILES AND MADE-UP GOODS</b>             | 16.99%                            | 15.79%                              | -18.79%                             |
| <b>WOOD AND WOOD PRODUCTS</b>                 | 14.29%                            | 13.43%                              | -16.81%                             |
| <b>PAPER, PAPER PRODUCTS AND PRINTING</b>     | 15.56%                            | 15.47%                              | -15.66%                             |
| <b>PRODUCTS OF PETROLEUM AND COAL</b>         | 15.77%                            | 14.23%                              | -18.00%                             |
| <b>CHEMICALS AND CHEMICAL PRODUCTS</b>        | 12.80%                            | 12.28%                              | -13.66%                             |
| <b>RUBBER AND PLASTIC PRODUCTS</b>            | 18.80%                            | 15.58%                              | -25.78%                             |
| <b>NON-METALLIC MINERAL PRODUCTS</b>          | 11.93%                            | 11.15%                              | -13.39%                             |
| <b>BASIC METALS</b>                           | 10.46%                            | 10.93%                              | -9.77%                              |
| <b>METAL PRODUCTS</b>                         | 19.20%                            | 17.70%                              | -21.69%                             |
| <b>NON-ELECTRICAL MACHINERY AND EQUIPMENT</b> | 19.60%                            | 19.01%                              | -20.42%                             |
| <b>ELECTRICAL MACHINERY AND APPARATUS</b>     | 17.06%                            | 15.01%                              | -21.17%                             |

|                                                         |        |        |         |
|---------------------------------------------------------|--------|--------|---------|
| <b>RADIO, TV, COMMUNICATION EQUIPMENT AND APPARATUS</b> | 20.51% | 18.69% | -22.60% |
| <b>TRANSPORT EQUIPMENT</b>                              | 16.36% | 15.97% | -16.91% |
| <b>FURNITURE</b>                                        | 15.64% | 15.47% | -16.43% |
| <b>OTHER MANUFACTURES</b>                               | 20.31% | 18.66% | -23.03% |
| <b>ELECTRICITY</b>                                      | 5.95%  | 5.94%  | -5.96%  |
| <b>CONSTRUCTION</b>                                     | 29.28% | 27.59% | -31.39% |

### 3.4.3 Analysis of the magnitude of price increases by industry category

The largest average price increases have been in construction (27,59%), tobacco products (24,78%), mining and quarrying (24,22%) and non-electrical machinery and equipment (19,01%). The smallest average price increases have been in electricity (5,94%), food at manufacturing (9,23%) and basic metals (10,93%), as per Table 37.

**Table 37 Mean size of price increases (descending) (PPI)**

| <i>Sector</i>                                           | <i>Magnitude of price increases</i> |
|---------------------------------------------------------|-------------------------------------|
| <b>CONSTRUCTION</b>                                     | 27.59%                              |
| <b>TOBACCO PRODUCTS</b>                                 | 24.78%                              |
| <b>MINING AND QUARRYING</b>                             | 24.22%                              |
| <b>NON-ELECTRICAL MACHINERY AND EQUIPMENT</b>           | 19.01%                              |
| <b>RADIO, TV, COMMUNICATION EQUIPMENT AND APPARATUS</b> | 18.69%                              |
| <b>OTHER MANUFACTURES</b>                               | 18.66%                              |
| <b>METAL PRODUCTS</b>                                   | 17.70%                              |
| <b>AGRICULTURE</b>                                      | 16.01%                              |
| <b>TRANSPORT EQUIPMENT</b>                              | 15.97%                              |
| <b>TEXTILES AND MADE-UP GOODS</b>                       | 15.79%                              |
| <b>RUBBER AND PLASTIC PRODUCTS</b>                      | 15.58%                              |
| <b>PAPER, PAPER PRODUCTS AND PRINTING</b>               | 15.47%                              |
| <b>FURNITURE</b>                                        | 15.47%                              |
| <b>ELECTRICAL MACHINERY AND APPARATUS</b>               | 15.01%                              |
| <b>PRODUCTS OF PETROLEUM AND COAL</b>                   | 14.23%                              |
| <b>BEVERAGES</b>                                        | 13.52%                              |
| <b>WOOD AND WOOD PRODUCTS</b>                           | 13.43%                              |
| <b>FORESTRY AND FISHING</b>                             | 13.21%                              |
| <b>CHEMICALS AND CHEMICAL PRODUCTS</b>                  | 12.28%                              |
| <b>NON-METALLIC MINERAL PRODUCTS</b>                    | 11.15%                              |
| <b>BASIC METALS</b>                                     | 10.93%                              |
| <b>FOOD AT MANUFACTURING</b>                            | 9.23%                               |
| <b>ELECTRICITY</b>                                      | 5.94%                               |

### 3.4.4 Analysis of the magnitude of price decreases by industry category

The largest average price decreases have been in tobacco products (-45,69%), construction (-31,39%), mining and quarrying (-27,33%) and rubber and plastic products

(-25,78%). The smallest average price decreases have been in electricity (-5,96%), forestry and fishing (-8,76%) and food at manufacturing (-8,88%), as per Table 38.

**Table 38 Mean size of price decreases (ascending) (PPI)**

| <i>Sector</i>                                    | <i>Magnitude of price decreases</i> |
|--------------------------------------------------|-------------------------------------|
| TOBACCO PRODUCTS                                 | -45.69%                             |
| CONSTRUCTION                                     | -31.39%                             |
| MINING AND QUARRYING                             | -27.33%                             |
| RUBBER AND PLASTIC PRODUCTS                      | -25.78%                             |
| OTHER MANUFACTURES                               | -23.03%                             |
| RADIO, TV, COMMUNICATION EQUIPMENT AND APPARATUS | -22.60%                             |
| METAL PRODUCTS                                   | -21.69%                             |
| ELECTRICAL MACHINERY AND APPARATUS               | -21.17%                             |
| NON-ELECTRICAL MACHINERY AND EQUIPMENT           | -20.42%                             |
| TEXTILES AND MADE-UP GOODS                       | -18.79%                             |
| PRODUCTS OF PETROLEUM AND COAL                   | -18.00%                             |
| AGRICULTURE                                      | -17.54%                             |
| TRANSPORT EQUIPMENT                              | -16.91%                             |
| WOOD AND WOOD PRODUCTS                           | -16.81%                             |
| FURNITURE                                        | -16.43%                             |
| PAPER, PAPER PRODUCTS AND PRINTING               | -15.66%                             |
| CHEMICALS AND CHEMICAL PRODUCTS                  | -13.66%                             |
| NON-METALLIC MINERAL PRODUCTS                    | -13.39%                             |
| BEVERAGES                                        | -13.07%                             |
| BASIC METALS                                     | -9.77%                              |
| FOOD AT MANUFACTURING                            | -8.88%                              |
| FORESTRY AND FISHING                             | -8.76%                              |
| ELECTRICITY                                      | -5.96%                              |

### 3.4.5 Magnitude of price changes for local products, imported products and exported products

The average magnitude of price increases is similar for local products (14,27%), imported products (14%) and exported products (14,68%), as reported in Table 39. On the other hand, the average magnitude of price decreases is largest in absolute terms for local products (-18,80%) as compared to exported products (-16,00%) and imported products (-13,85%).

**Table 39 Comparing price change magnitudes for local, imported and exported products**

|                              | <i>Aggregate</i> | <i>Local products</i> | <i>Imported Products</i> | <i>Exported Products</i> |
|------------------------------|------------------|-----------------------|--------------------------|--------------------------|
| MAGNITUDE OF PRICE CHANGES   | 15.44%           | 15.82%                | 13.93%                   | 15.21%                   |
| MAGNITUDE OF PRICE INCREASES | 14.57%           | 14.27%                | 14.00%                   | 14.68%                   |
| MAGNITUDE OF PRICE DECREASES | -16.75%          | -18.80%               | -13.85%                  | -16.00%                  |

### 3.5 Duration of prices

As reported in Table 40, the overall measured duration of prices in the PPI data set is 3,4 months, with local products having an average price duration of 3,7 months, imported products having an average price duration of 3,0 months, and exported products having an average price duration of 3,5 months. Due to the problem of the break in the data, where prices cannot be traced to comparable stores before and after 2006m3, this measurement of price duration is lower than what it would be without the break in the data. The weighted average price duration for the period prior to the break in the data, that is, from 2001m12 to 2006m2, is 3,7 months. Re-weighting of the findings for price durations by the weightings given to industry categories in the PPI, increases the average duration to 3,5 months from 3,4 months.

**Table 40 Comparing average price durations for local, imported and exported PPI products**

|                           | <i>Aggregate</i> | <i>Local products</i> | <i>Imported Products</i> | <i>Exported Products</i> |
|---------------------------|------------------|-----------------------|--------------------------|--------------------------|
| <b>DURATION OF PRICES</b> | 3.4              | 3.7                   | 3.0                      | 3.5                      |

Forestry and fishing prices (8,2 months) are computed to have the longest duration, followed by furniture (8,0 months) and beverages (7,5 months). Prices for products of petroleum and coal (1,4 months), mining and quarrying (1,6 months) and agriculture (1,7 months) have the shortest durations, as outlined in Table 41.

**Table 41 Average duration of prices in months ranked in descending order (PPI)**

| <i>Sector</i>                                           | <i>Months</i> |
|---------------------------------------------------------|---------------|
| <b>FORESTRY AND FISHING</b>                             | 8.2           |
| <b>FURNITURE</b>                                        | 8.0           |
| <b>BEVERAGES</b>                                        | 7.5           |
| <b>OTHER MANUFACTURES</b>                               | 5.7           |
| <b>WOOD AND WOOD PRODUCTS</b>                           | 5.5           |
| <b>RUBBER AND PLASTIC PRODUCTS</b>                      | 4.9           |
| <b>NON-ELECTRICAL MACHINERY AND EQUIPMENT</b>           | 4.9           |
| <b>RADIO, TV, COMMUNICATION EQUIPMENT AND APPARATUS</b> | 4.7           |
| <b>TEXTILES AND MADE-UP GOODS</b>                       | 4.7           |
| <b>ELECTRICAL MACHINERY AND APPARATUS</b>               | 4.6           |
| <b>TOBACCO PRODUCTS</b>                                 | 4.5           |
| <b>METAL PRODUCTS</b>                                   | 4.2           |
| <b>TRANSPORT EQUIPMENT</b>                              | 4.0           |
| <b>CHEMICALS AND CHEMICAL PRODUCTS</b>                  | 3.9           |

|                                           |     |
|-------------------------------------------|-----|
| <b>NON-METALLIC MINERAL PRODUCTS</b>      | 3.9 |
| <b>PAPER, PAPER PRODUCTS AND PRINTING</b> | 3.4 |
| <b>FOOD AT MANUFACTURING</b>              | 2.8 |
| <b>CONSTRUCTION</b>                       | 2.5 |
| <b>BASIC METALS</b>                       | 2.4 |
| <b>ELECTRICITY</b>                        | 2.1 |
| <b>AGRICULTURE</b>                        | 1.7 |
| <b>MINING AND QUARRYING</b>               | 1.6 |
| <b>PRODUCTS OF PETROLEUM AND COAL</b>     | 1.4 |

### 3.6 Comparative Analysis

A brief summary of similar studies of PPI microdata data in other countries allows a comparison to be made with the findings for South Africa reported in this Chapter.

**Table 42 Comparison of findings on monthly price change frequencies using PPI microdata**

|                                  | <i>Frequency of price changes</i> |
|----------------------------------|-----------------------------------|
| <b>SOUTH AFRICA (2001–2007)</b>  | 27,8%                             |
| <b>EURO AREA (VARIOUS)</b>       | 21%                               |
| <b>UNITED STATES (1988–2005)</b> | 24,8%                             |
| <b>SPAIN (1991–1999)</b>         | 21%                               |
| <b>FRANCE (1994–2005)</b>        | 25%                               |
| <b>COLOMBIA (1999–2006)</b>      | 20,2%                             |

With regard to the monthly frequency of price changes at the aggregate level, the finding for South Africa of 27,8% using PPI weighted data would place South Africa as a country which experiences a comparatively high frequency of PPI price changes, as reported in Table 42<sup>20</sup>. Although South Africa appears to have a comparatively high PPI price change frequency, it should be recalled that the unweighted PPI price change frequency for South Africa was found to be 20,2%, this figure would be more in line with other countries and it remains relevant as there are methodological variations in the composition and weighting of price change frequency data across various country-studies. Unlike with Sierra Leone in the CPI cross-country comparisons, no high-inflation country is included in the comparative analysis of PPI pricing conduct.

<sup>20</sup> The comparative PPI price data are drawn from the summary presented in Klenow and Malin (2010b), which limits the comparison to the frequency of price changes and does not include the frequency of price increases and decreases or comparisons of price change magnitudes. Klenow and Malin (2010b) make use of the following data sources on PPI pricing conduct. For the Euro Area they use Vermuelen et al's (2007). For the United States they use Nakamura and Steinsson (2008), but they also cite a recent paper by Goldberg and Hellerstein (2009) which calculates the frequency of producer price changes in the United States to be 33,3% over the period 1987 to 2008. For Spain they use Alvarez et al (2008), for France, Gautier (2008) and for Colombia, Julio and Zarate (2008).

### 3.7 Conclusion: Summary of findings

Based on a study of the large PPI microdata set over the period December 2001 to December 2007, there is evidence at the aggregate level of:

- a varying frequency of price changes, and related price durations, over time, with an unweighted average monthly price change frequency of 20,2% over the period, a largest monthly price change frequency of 34,9% in 2007m10, and a smallest monthly price change frequency of 10,8% in 2004m12;
- asymmetry in pricing as price increases (12,2%) occur more frequently than price decreases (8,1%);
- heterogeneity in pricing across various product categories, with the frequency of price changes for imported products over the period (23,2%) being higher than the frequency of price changes for local products (18,8%) and for exported products (18,7%);
- sizeable magnitudes in price changes, which are larger than the prevailing inflation rate, as for prices that rose, the average magnitude of price increases was 14,6% and for prices that declined, the average magnitude of price decreases was -16,8%;

The heterogeneity in pricing conduct that exists amongst various industry subcategories is evidenced from the summary of findings on pricing conduct that is provided in Table 43.

**Table 43 Summary of pricing conduct at PPI industry category level**

| <i>Pricing metric</i>                                             | <i>Result</i>                                                                                                                               |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Aggregate frequency of price changes</b>                       | 20,23% of prices change each month (unweighted), price increases (12,18%) occur more frequently than price decreases (8,05%)                |
| <b>Industry categories with highest price change frequency</b>    | Products of petroleum and coal (67,82%), agriculture prices (50,76%), mining and quarrying prices (50,55%), and electricity prices (46,90%) |
| <b>Industry categories with lowest price change frequency</b>     | Furniture (8,32%), beverages (10,36%) and other manufactures (11,14%)                                                                       |
| <b>Industry categories with shortest measured price durations</b> | Products of petroleum and coal (1,4 months), mining and quarrying (1,6 months) and agriculture (1,7 months)                                 |
| <b>Industry categories with longest</b>                           | Forestry and fishing prices (8,2 months), furniture                                                                                         |

|                                                                                        |                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>measured price durations</b>                                                        | (8,0 months) and beverages (7,5 months)                                                                                                                                                                       |
| <b>Aggregate magnitude of price changes</b>                                            | 15,44% is the unweighted average absolute value magnitude of price changes, for price increases the average magnitude of price increases was 14,57%, and for price decreases the average magnitude was -16,75 |
| <b>Industry categories with largest magnitude of price increases</b>                   | Construction (27,59%), tobacco products (24,78%), mining and quarrying (24,22%) and non-electrical machinery and equipment (19,01%)                                                                           |
| <b>Industry categories with smallest magnitude of price increases</b>                  | Electricity (5,94%), food at manufacturing (9,23%) and basic metals (10,93%)                                                                                                                                  |
| <b>Industry categories with largest magnitude of price decreases (absolute value)</b>  | Tobacco products (-45,69%), construction (-31,39%), mining and quarrying (-27,33%) and rubber and plastic products (-25,78%)                                                                                  |
| <b>Industry categories with smallest magnitude of price decreases (absolute value)</b> | Electricity (-5,96%), forestry and fishing (-8,76%) and food at manufacturing (-8,88%)                                                                                                                        |

Overall, PPI prices appear on average to have notably higher price change frequencies than CPI prices. Furthermore, heterogeneity in pricing seems to be more pronounced for PPI prices than for CPI prices, as there is a larger variation in price change frequencies across the various PPI sectors than is found to be the case with the various product sub-categories of the CPI. On average PPI prices have somewhat shorter durations than PPI prices. On the other hand, both PPI prices and CPI prices display an asymmetrical bias toward price increases over price decreases and, for both PPI prices and CPI prices, the average magnitude of price changes are larger than the prevailing inflation rate.



## **CHAPTER 4: REGRESSION ANALYSIS OF SEASONALITY AND STATE-DEPENDENCE IN PRICING**

### **4.1 Introduction**

Based on the fundamental research on pricing conduct presented in the previous two Chapters, the purposed of the current Chapter is to analyse whether there is any evidence of seasonality or state-dependence, or both, in pricing conduct.

Seasonality refers to the identification of monthly seasonal patterns in pricing conduct, such as, a tendency for prices to be regularly raised or reduced at specific times in the year. State-dependence refers to a relationship between pricing conduct and current, or lagged, changes in key macroeconomic variables, such as, the policy interest rate (known as the ‘Repo rate’ in South Africa), exchange rates and the rate of inflation, or a relationship between pricing conduct and expected rates of inflation as estimated using bond yield differentials and survey data.

In this Chapter, tests are undertaken for evidence of seasonality in the frequency and magnitude of price changes, price increases and price decreases. Test are also undertaken to assess whether the frequency and magnitude of price changes, price increases and price decreases are associated with recent, current or expected rates of inflation and changes in inflation, or current or recent policy interest rates and changes in such rates, and current or recent exchange rate developments.

The theoretical basis for such analysis is to be found in theories of the transmission mechanism of monetary policy. Detailed theoretical discussion on the impact of the interest rate, the exchange rate and the inflation rate on aggregate demand and hence on prices is offered *inter alia* by Mahadeva and Sinclair (2005). From such an analysis of the monetary policy transmission mechanism certain propositions regarding pricing conduct can be inferred. Empirical testing, such as that undertaken in this Chapter, is required in order to ascertain whether such propositions are in fact supported by the pricing conduct of price-setters as revealed through the microdata.

The basic propositions regarding pricing conduct suggested by the theory of monetary policy transmission include the following with regard to price change frequencies: a positive association between the frequency of price increases and the rate of inflation, and the expected rate of inflation, in real time or after a lag; a negative association between the frequency of price increases and exchange rate appreciations in real time or after a lag; and a negative association between the frequency of price increases and the policy interest rate in real time or after a lag. The basic propositions regarding the magnitude of price changes include the following: a positive association between the magnitude of price increases and the rate of inflation, and the expected rate of inflation, in real time or after a lag; a negative association between the magnitude of price increases and the exchange rate appreciations in real time or after a lag, and a negative association between the magnitude of price increases and the policy interest rate in real time or after a lag.

The structure of the Chapter is as follows. In section 4.2 a descriptive summary of the data to be analysed is presented. In section 4.3 there is discussion on the regression model to be utilised in the study. In sections 4.4 and 4.5 the findings of the regression model for the frequency and the magnitude of CPI price changes are outlined. Similarly, in sections 4.6 and 4.7 the findings of the regression model for the frequency and the magnitude of PPI price changes are outlined. Finally, section 4.8 concludes with a summary of the key findings from the regression analysis.

## **4.2 Data sets utilised in the study**

Together with the previous Chapters' findings on the frequency and magnitude of price changes for the CPI and PPI data sets, the following times series data were used in the study:

- Consumer Prices for metropolitan and other urban areas (South African Reserve Bank time series 7112A);
- Total Producer Prices (South African Reserve Bank time series 7140A)

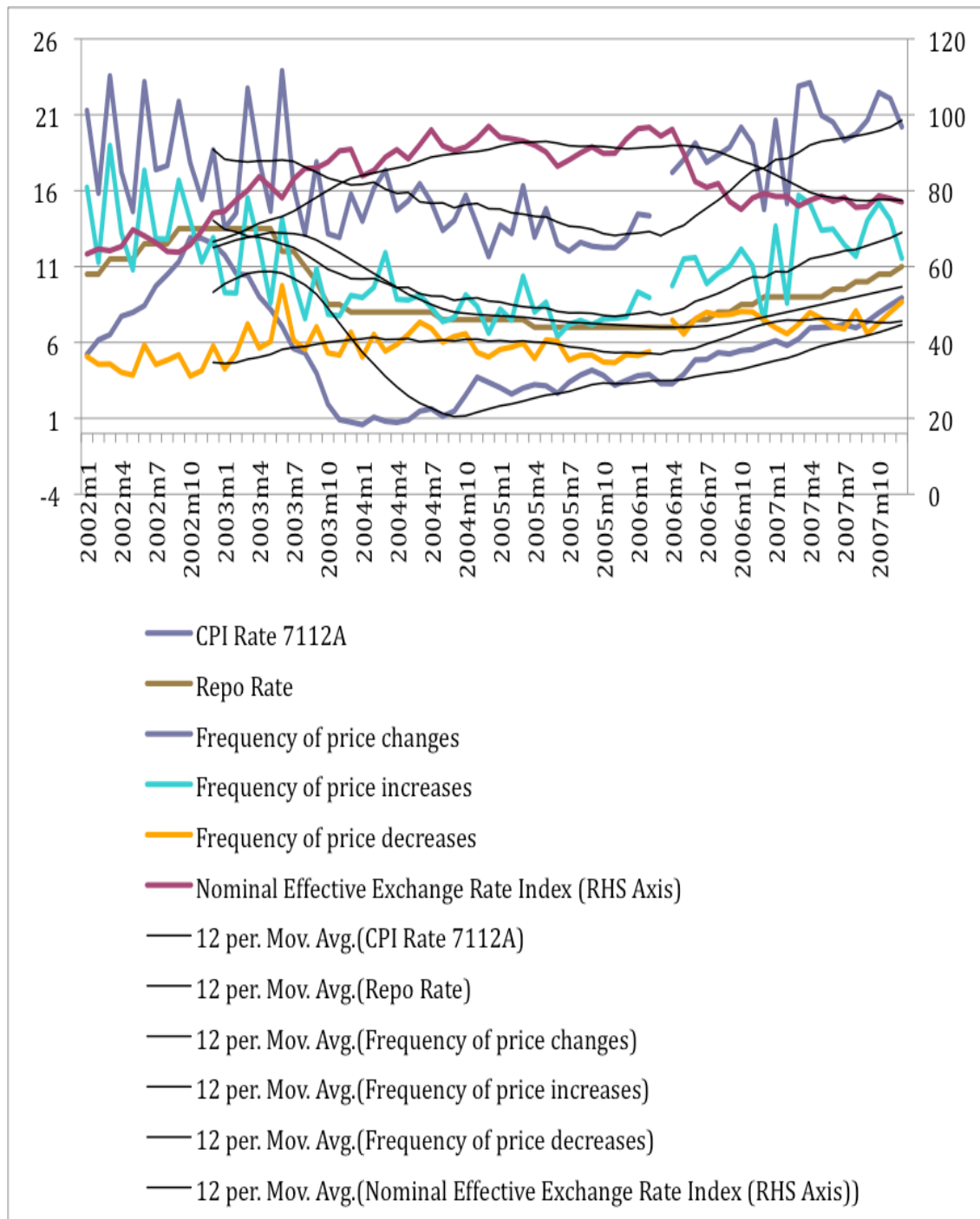
- Nominal Effective Exchange Rate of the Rand (South African Reserve Bank time series 5376M)
- Repurchase rate or Repo rate, the key policy interest rate used by the South African authorities

In Fig. 21, the relevant descriptive statistics for the CPI-related data are presented, providing an overview of the movements in the frequency of price changes, price increases and price decreases revealed in the CPI microdata study along with changes in the level of the CPI, the nominal effective exchange rate and the Repo rate. The use of 12 month moving averages for the various series assists in smoothing the data and makes it easier to compare overall trends in the data.

In Fig. 21, the descriptive data reveal a number of empirical propositions, which are later in this Chapter broadly confirmed through regression analysis:

- there is a positive association between the frequency of price changes and price increases and the rate of inflation, that is, a rise (fall) in the rate of inflation is associated with a rise (fall) in the frequency of price changes and price increases;
- there is a positive association between the frequency of price changes and price increases and the Repo rate, that is, a rise (fall) in the Repo rate is associated with a rise (fall) in the frequency of price changes and price increases
- there is a negative association between the frequency of price changes and price increases and the nominal effective exchange rate, that is, an appreciation (fall) in the exchange rate is associated with a fall (rise) in the frequency of price changes and price increases; and
- no clear associations are evident for the frequency of price decreases.

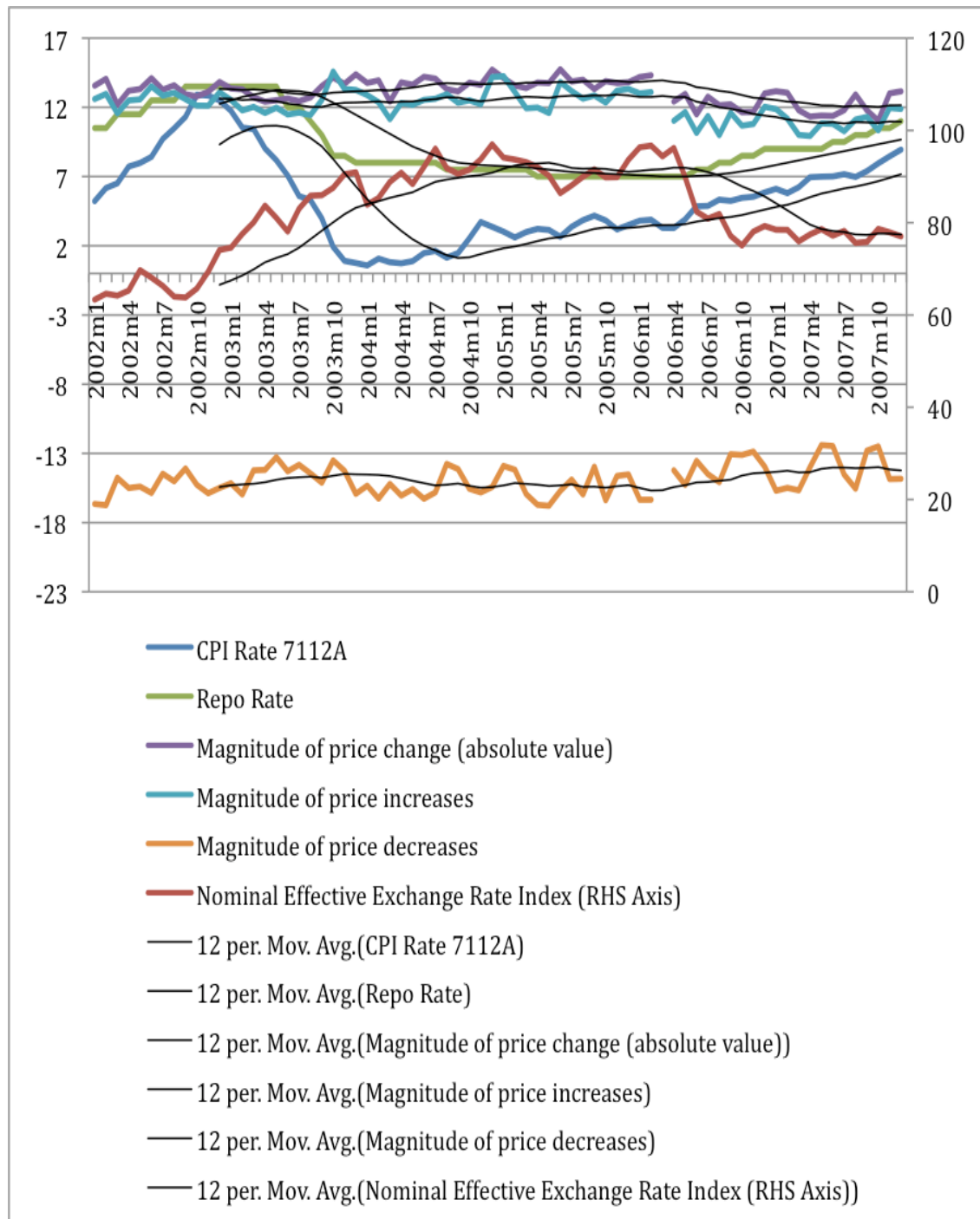
**Fig.21 Frequency of price changes, the inflation rate, the exchange rate and the Repo rate (with 12 month moving average)**



Source: SARB CPI data series 7112A, Nominal Effective Exchange rate 5376M, Repo Rate

Fig. 22 shows the time series relationship between the magnitudes of price changes, price increases and price decreases revealed in the CPI microdata study, along with changes in the level of CPI, the nominal effective exchange rate and the Repo rate.

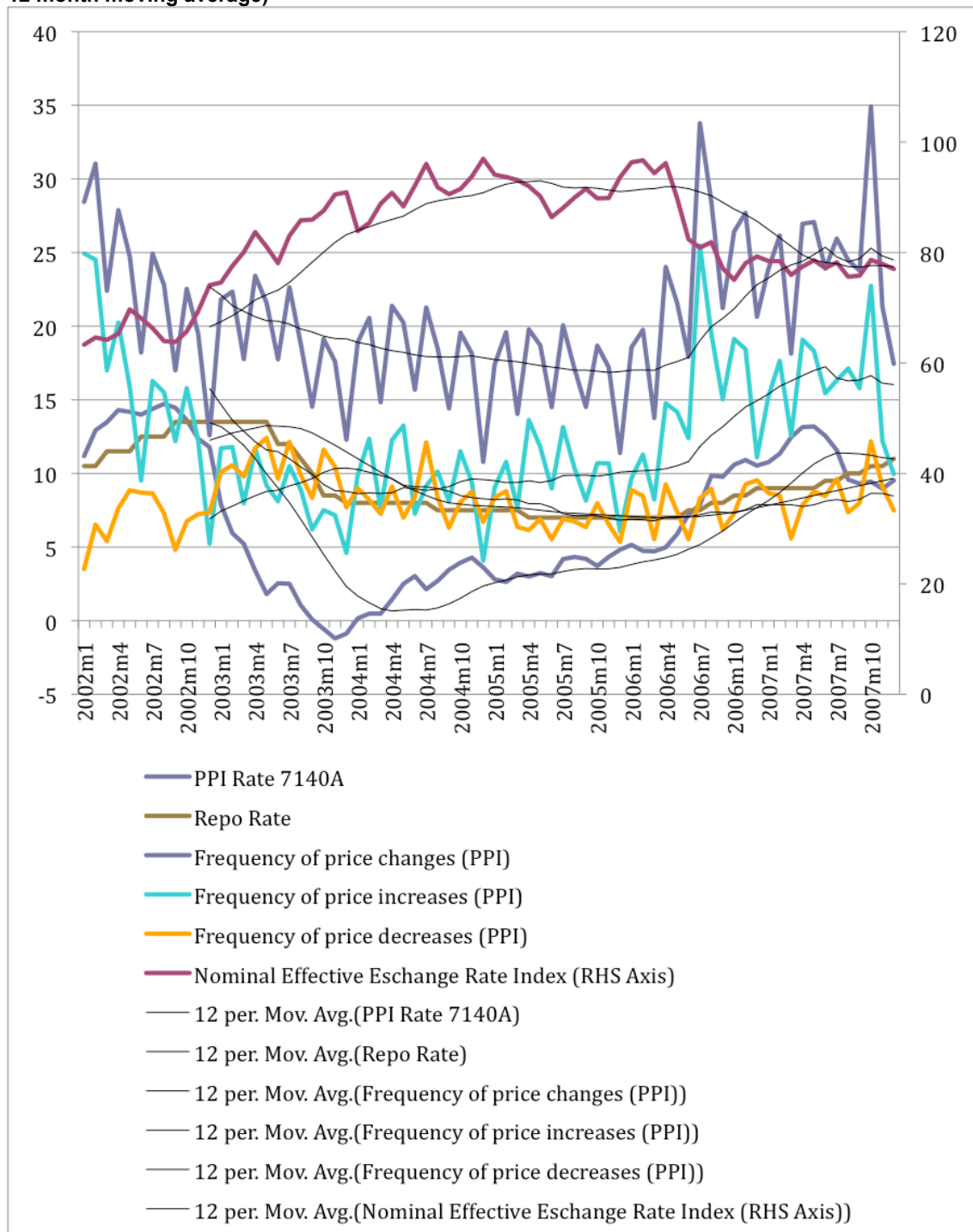
**Fig. 22 Magnitude of price changes, the inflation rate, the exchange rate and the Repo rate (with 12 month moving average)**



Source: SARB CPI data series 7112A, Nominal Effective Exchange rate 5376M, Repo Rate

Again, the use of 12 month moving averages for the various series assists in smoothing the data and makes it easier to compare overall trends in the data. In this case, the descriptive data is not as clear in revealing associations between the magnitudes of price

**Fig. 23 Frequency of PPI price changes, the inflation rate, the exchange rate and the Repo rate (with 12 month moving average)**



Source: SARB PPI data series 7140A, Nominal Effective Exchange rate 5376M, Repo Rate

changes, price increases and price decreases and the macroeconomic variables included in the study, although certain statistically significant relationships between the magnitude

of price changes and the macroeconomic variables are shown in the regression analysis later in the Chapter.

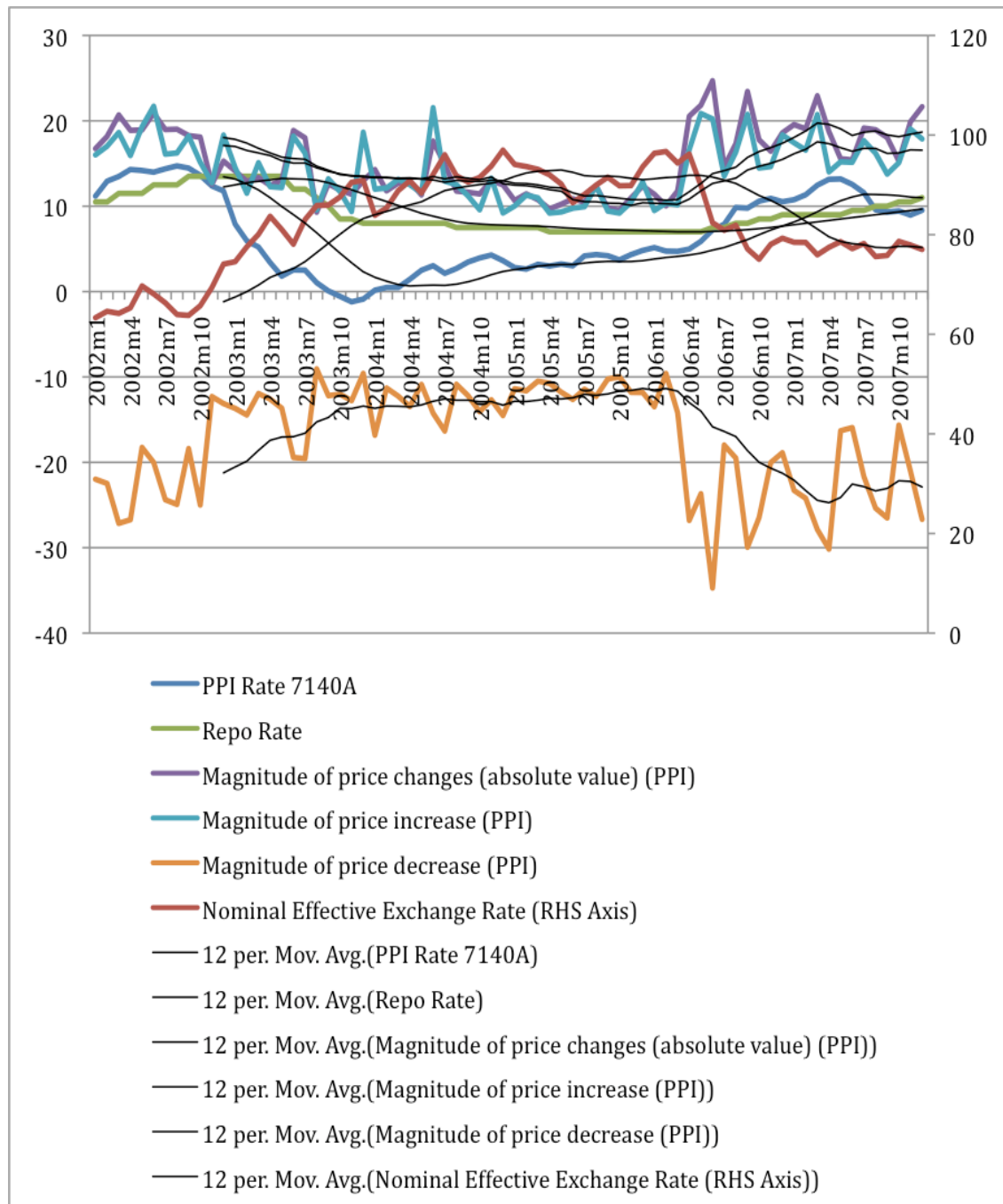
In Fig. 23, descriptive statistics are presented for the PPI data set, including the frequency and magnitude of price changes revealed in the PPI microdata study, as well as changes in the level of PPI, the nominal effective exchange rate and the Repo rate.

The findings are similar to those for the CPI-related data, most of which are borne out by the regression analysis that follows:

- there is a positive association between the frequency of price changes and price increases and the rate of inflation;
- there is a positive association between the frequency of price changes and price increases and the Repo rate;
- there is a negative association between the frequency of price changes and price increases and the nominal effective exchange rate; and
- no clear associations are evident for the frequency of price decreases.

Fig. 24 outlines the magnitude of PPI price changes and the various macroeconomic variables. Again the data does not reveal clear associations between the price change magnitudes and the macroeconomic variables included in the study, although certain statistically significant relationships between the magnitude of price changes and the macroeconomic variables are shown in the regression analysis later in the Chapter.

**Fig. 24 Magnitude of PPI price changes, the inflation rate, the exchange rate and the Repo rate (with 12 month moving average)**



Source: SARB PPI data series 7140A, Nominal Effective Exchange rate 5376M, Repo Rate

In the following section, a regression model is outlined which will be used to analyse whether any statistically significant relationships might exist between the various time series data. In particular, the question is asked as to whether there is any evidence of



seasonality in the frequency and magnitude of price changes in the CPI and PPI microdata, and whether any statistically significant associations can be found between pricing conduct and aggregate macroeconomic variables, such as, the inflation rate, the nominal effective exchange rate and the Repo rate, in real time and after a three-month lag.

### 4.3 Regression Model

In order to advance this study, time series regressions are conducted, estimating determinants of a regression model specified alternatively with the frequency of price changes (F), the frequency of price increases (F+) and the frequency of price decreases (F-), the magnitude of price changes (M), the magnitude of price increases (M+) and the magnitude of price decreases (M-) as related to the reported inflation rates, the nominal effective exchange rate, and the policy interest rate (the Repo rate). In addition to real time effects, the analysis will include analyses of 3-month lag effects. (The Stata code used to run the various regressions is outlined in *Appendix 9*.)

The regression model utilised in this Chapter is adapted from the model used by Alvarez et al (2004), which were used to analyse the time determinants of the time-series variation in pricing conduct in Spain from 1993 to 2001. In their work, Alvarez et al (2004) estimated the following regression model:

$$F_t = \alpha + \sum_{i=1}^3 \beta_i Q_i + \gamma DT95Q1 + \delta INF_t + \varphi ATR_t + \varepsilon_t$$

Where the frequency of price changes  $F_t$  is regressed against the year on year inflation rate ( $INF_t$ ), where  $Q$  are seasonal dummies, where  $DT95Q1$  is a dummy variable for the change in the VAT rate in Spain in 1995Q1, where  $ATR_t$  is the average incidence of attractive prices and  $\varepsilon_t$  is a residual error term. The study found that seasonal dummies are significant, that the change in Spain's VAT rate in January 1995 was associated with an increased frequency of price changes, particularly price increases, that inflation has a

positive and significant impact on the frequency of price increases and that attractive prices have a lower price change frequency.

Due to a number of factors, Alvarez et al's (2004) model is modified for the study of price setting conduct in South Africa.

Firstly, the data set used in the South African study contained in this Chapter is monthly, rather than quarterly, with obvious implications for the testing for seasonality in pricing. One benefit of working with higher frequency (monthly) data is that it makes it possible to identify shorter-run episodes in pricing behaviour.

Secondly, in the context of higher frequency (monthly) data, it is necessary to adjust the model in order to test for lagged effects. As a result, in testing for state-dependence in pricing conduct, the model is run using both real-time data and three-month lagged data. This modification also provides certain insights into causative factors.

Thirdly, there was no equivalent change in the VAT rate in South Africa during the period under review, although there was a change in the data collection methodology requiring the introduction of a dummy-term to assess the impact of the change in the data collection methodology on measured pricing conduct.

Fourthly, in addition to assessing the impact of inflation on pricing conduct, it is useful to assess whether other macroeconomic variables, such as the exchange rate and the Repo rate, can be shown to impact on pricing conduct. Over the period, South Africa's exchange rate was particularly volatile and it would provide important insights to test the impact of such volatility on pricing conduct. Furthermore, it would add to the understanding of the monetary policy transmission mechanism in South Africa to analyse how the level of the Repo rate and Repo rate changes can be shown to impact on pricing

conduct.<sup>21</sup> Therefore, in a number of instances, such as for the Repo rate, both the levels and the one period change of the explanatory variables are included in the regressions.

Fifthly, in order to check for robustness, the model is run with various specifications, both where the explanatory variables are regressed separately and in the form of a combined regression.

On the basis of such modifications, the following regression model is estimated for South Africa over the period 2001m12 to 2007m12, for F and then for F+, F-, M, M+ and M-:

$$F_t = a + \sum_{i=1}^{12} B_i + \kappa CPI_t + \lambda REPO_t + \sigma NER_t + \nu BREAKDUM_t + \varepsilon_t$$

Where:

$F_t$  = frequency of price changes in a particular month t (where F+ is for the frequency of price increase, F- for the frequency of price decreases, M is for the magnitude of price changes, M+ is for the magnitude of price increases and M- is for the magnitude of price decreases)

$a$  = constant term

$\sum_{i=1}^{12} B_i$  = seasonal dummies

$CPI_t$  = consumer price in month t

$REPO_t$  = policy rate (Repo rate) in month t

$NER_t$  = nominal exchange rate index in month t

$BREAKDUM_t$  = dummy term representing the break in the CPI and PPI data sets in 2006m3

$\varepsilon_t$  = residual error term

---

<sup>21</sup> It is possible that through the inclusion in the model of additional factors, such as changes in the oil price, the model could assist in identifying ‘second round’ effects in the form of lagged changes to price change frequencies and price change magnitudes both at an aggregate and disaggregate level. Such an investigation has not been undertaken in the current study, but would be an interesting subject of future research.

For the PPI microdata study, the Producer Price Index replaces the Consumer Price Index in the regression model. The regressions are run using Ordinary Least Squares (OLS).

Overall the model will assist in identifying whether there is any evidence of seasonality in pricing conduct, and whether any significant associations exist between pricing conduct and key macroeconomic variables. A limitation of the model's specification is that it cannot be relied upon for identifying clear structural relationships due to problems of endogeneity between pricing behaviour and both inflation and the Repo rate and due to a lack of any dynamic specification. In order to deal with these problems it would be possible to identify the seasonal structure of the data and deseasonalise the series using a VAR model, or alternatively, the introduction of an instrumental variable specification would assist in increasing the robustness of the results. Nonetheless, the model, even without such modifications, is sufficient for offering important insights into pricing conduct, and the association between pricing conduct and wider macroeconomic developments, in a manner consistent with that adopted in comparative international studies, such as, that undertaken by Alvarez et al (2004).

#### **4.4 Analysis of frequency of price changes using CPI micro-data**

In order to analyse the potential determinants of the time series variation of the frequency of price adjustments using the CPI microdata three regressions are run analysing (1) the frequency of price changes (F), (2) the frequency of price increases (F+) and (3) the frequency of price decreases (F-). First real-time explanatory variables are used and thereafter price changes are regressed against explanatory variables after a three-month lag.

##### **4.4.1 Seasonality**

As reported in Table 44, the results indicate that there is a degree of seasonality in the frequency of price changes, evidenced by the fact that the frequency of price changes is higher during the months of March and June as compared to the December base period.

The finding for March is statistically significant at the 1% level and that for June is significant at the 5% level. With one minor exception<sup>22</sup>, this result is robust across the various specifications reported in Table 41, both where the independent variables are included individually and where they are combined on the right hand side of the regression.

**Table 44 Frequency of changes in CPI prices regressed against real-time factors**

|                                                      | (1)                | (2)                 | (3)                | (4)                 | (5)                 | (6)                 | (7)                 | (8)                |
|------------------------------------------------------|--------------------|---------------------|--------------------|---------------------|---------------------|---------------------|---------------------|--------------------|
|                                                      | CPI                | CPI                 | CPI                | CPI                 | CPI                 | CPI                 | CPI                 | CPI                |
| January                                              | 0.010<br>(0.60)    | 0.007<br>(0.36)     | 0.007<br>(0.38)    | 0.004<br>(0.22)     | -0.001<br>(0.07)    | 0.003<br>(0.14)     | 0.013<br>(0.80)     | 0.011<br>(0.94)    |
| February                                             | -0.004<br>(0.23)   | -0.007<br>(0.35)    | -0.007<br>(0.43)   | -0.006<br>(0.32)    | -0.013<br>(0.88)    | -0.009<br>(0.47)    | -0.001<br>(0.09)    | -0.003<br>(0.22)   |
| March                                                | 0.051<br>(2.96)*** | 0.048<br>(2.40)**   | 0.046<br>(2.49)**  | 0.046<br>(2.39)**   | 0.039<br>(2.45)**   | 0.048<br>(2.30)**   | 0.054<br>(3.25)***  | 0.044<br>(3.55)*** |
| April                                                | 0.019<br>(1.14)    | 0.015<br>(0.77)     | 0.015<br>(0.89)    | 0.019<br>(1.05)     | 0.013<br>(0.87)     | 0.015<br>(0.76)     | 0.015<br>(0.97)     | 0.012<br>(1.01)    |
| May                                                  | 0.011<br>(0.65)    | 0.008<br>(0.40)     | 0.007<br>(0.43)    | 0.009<br>(0.51)     | 0.003<br>(0.17)     | 0.004<br>(0.20)     | 0.007<br>(0.47)     | 0.005<br>(0.38)    |
| June                                                 | 0.039<br>(2.37)**  | 0.036<br>(1.89)*    | 0.036<br>(2.05)**  | 0.036<br>(1.96)*    | 0.027<br>(1.76)*    | 0.032<br>(1.52)     | 0.036<br>(2.27)**   | 0.031<br>(2.51)**  |
| July                                                 | 0.009<br>(0.55)    | 0.006<br>(0.30)     | 0.006<br>(0.36)    | 0.009<br>(0.48)     | 0.000<br>(0.02)     | 0.006<br>(0.31)     | 0.007<br>(0.43)     | 0.002<br>(0.15)    |
| August                                               | 0.003<br>(0.18)    | 0.001<br>(0.03)     | 0.001<br>(0.08)    | 0.005<br>(0.30)     | -0.006<br>(0.42)    | -0.001<br>(0.06)    | 0.001<br>(0.09)     | -0.002<br>(0.16)   |
| September                                            | 0.021<br>(1.25)    | 0.019<br>(1.01)     | 0.020<br>(1.12)    | 0.022<br>(1.16)     | 0.010<br>(0.67)     | 0.017<br>(0.83)     | 0.020<br>(1.23)     | 0.016<br>(1.37)    |
| October                                              | 0.013<br>(0.78)    | 0.011<br>(0.59)     | 0.013<br>(0.76)    | 0.017<br>(0.90)     | 0.005<br>(0.30)     | 0.011<br>(0.57)     | 0.013<br>(0.80)     | 0.010<br>(0.88)    |
| November                                             | 0.003<br>(0.16)    | 0.003<br>(0.15)     | 0.003<br>(0.17)    | 0.004<br>(0.24)     | -0.002<br>(0.12)    | 0.002<br>(0.12)     | 0.002<br>(0.16)     | 0.002<br>(0.21)    |
| CPI - metropolitan<br>and other urban<br>areas 7112A | 0.005<br>(4.83)*** |                     |                    |                     |                     |                     |                     | 0.004<br>(2.03)**  |
| CPiChange                                            |                    | 0.011<br>(1.91)*    |                    |                     |                     |                     |                     | 0.009<br>(1.90)*   |
| Repo Rate                                            |                    |                     | 0.006<br>(3.89)*** |                     |                     |                     |                     | 0.011<br>(3.23)*** |
| Breakdummy                                           |                    |                     |                    |                     |                     |                     | 0.040<br>(5.46)***  | 0.046<br>(6.64)*** |
| Exchangeratechange                                   |                    |                     |                    |                     |                     | -0.001<br>(0.61)    |                     | 0.000<br>(0.22)    |
| Nominal Effective<br>Exchange Rate -<br>5376M        |                    |                     |                    |                     | -0.002              |                     |                     | -0.001             |
| Repochange                                           |                    |                     |                    | 0.024<br>(2.69)***  | (6.23)***           |                     |                     | (1.06)<br>-0.000   |
| Constant                                             | 0.127<br>(9.60)*** | 0.156<br>(11.63)*** | 0.098<br>(5.04)*** | 0.155<br>(11.83)*** | 0.332<br>(11.02)*** | 0.159<br>(11.15)*** | 0.143<br>(12.47)*** | 0.109<br>(1.68)*   |

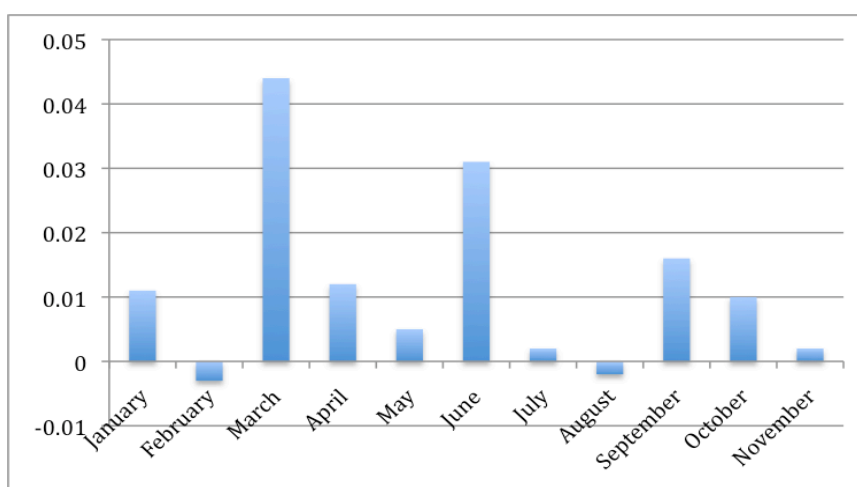
<sup>22</sup> Reported in column 6 of Table 43 where the frequency of price changes in June is not found to be significant where the change in the exchange rate is included individually.

|              |      |      |      |      |      |      |      |      |
|--------------|------|------|------|------|------|------|------|------|
| Observations | 71   | 71   | 71   | 71   | 71   | 71   | 71   | 71   |
| R-squared    | 0.42 | 0.24 | 0.36 | 0.28 | 0.52 | 0.20 | 0.47 | 0.75 |

Absolute value of t statistics in parentheses  
\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

The statistically significant elevated frequency of price changes in March and June is also indicated in Fig. 25, which graphically shows the higher frequency of price changes relative to the December base period. Such seasonality in the frequency of price changes is due to seasonality in price increases, rather than in price decreases. This is outlined in *Appendix 10.1* and *10.2*, where an equivalent result is reported of an elevated frequency of price increases in March and June, robust across the various specifications.

**Fig. 25 Seasonality in the frequency of price changes (CPI), relative to December**



Further research would be required to discern the causes of such seasonality in pricing. A possible fertile avenue for such research would be to analyse the effects on pricing conduct of annual taxation changes, particularly in the form of fuel levy increase and in increases of so-called ‘sin taxes’ on tobacco and alcoholic beverages, which take effect in March after the announcement of South Africa’s budget in February each year.

#### 4.4.2 Real-time explanatory variables

There is some clear evidence of real-time state-dependence in pricing. Firstly, there is evidence reported in Table 44 that the frequency of price changes is positively and significantly associated with the level of the CPI rate of inflation. This finding is robust across the various specifications and holds for both the level of the CPI and for changes in the level of inflation. From *Appendix 10.1* it is clear that this is due to the fact that the frequency of price increases is significantly and positively associated with a change in the CPI rate. There is also evidence, presented in *Appendix 10.2*, of a statistically significant negative real-time relationship between the frequency of price decreases and the level of inflation. This means that as the level of inflation rises, the frequency of price decreases falls. Interestingly, the finding of a positive relationship between inflation and price change frequencies is held up in the literature (such as in Klenow et al (2008) and in Gagnon (2009)), as providing evidence of synchronisation in pricing conduct, where rising inflation is associated with an increase in the frequency of price increases.

Secondly, there is evidence of a statistically significant negative real-time association between the frequency of price increases and an appreciation of the nominal effective exchange rate. As outlined in *Appendix 10.1* this finding is robust across the various specifications of the model, and as such an appreciation of the currency is associated with a small decrease in the frequency of price increases. On the other hand, the frequency of price decreases is positively and significantly associated with an appreciation of the nominal effective exchange rate. Thus, there is evidence of a pass-through effect in that pricing conduct is influenced by exchange rate developments in the expected manner, although, as outlined in *Appendix 10.2*, this finding is not robust across the various specifications of the model. It is possible that the two effects – a decrease in the frequency of price increases and an increase in the frequency of price decreases - cancel each other out as, at the aggregate level, there is no statistically significant relationship between a currency appreciation and the overall frequency of price changes in the full specification of the model. This result is not robust across all specifications, as per Table 44, where the nominal effective exchange rate variable is entered individually, there is a

statistically significant decrease in the frequency of price changes associated with a currency appreciation.

Thirdly, the frequency of price changes is significantly and positively associated with the Repo rate level and with changes in the Repo rate, if these independent variables are included individually. This result is significant at the 1% level as reported in Table 44. However, where the Repo rate levels and the change in the Repo rate are included with the other independent variables in the combined specification of the model, then only the level of the Repo rate remains statistically significant. This suggests that it may be the level of the Repo rate, rather than changes to the Repo rate, that is associated positively in real-time with the frequency of price changes. From *Appendix 10.1* and *10.2* respectively, it can be seen that it is both the frequency of price increases and the frequency of price decreases that are positively associated with the level of the Repo rate. The case of price increases being robust across all specifications of the model, and the case of price decreases only holding with the combined specification of the model. It is difficult to interpret the implications of this finding, as *a priori* an increase in the Repo rate should, due to the retardation of aggregate demand, be associated with an increase in the frequency of price decreases, and a *decrease* in the frequency of price increases. Perhaps, the rise in real-time in the frequency of price increases is indicative of some cost channel effects, whereby interest rate increases translate into higher prices.<sup>23</sup> Alternatively, the real time positive association between the frequency of price increases and the level of the Repo rate, may be indicative of a causal direction where the Repo rate is increasing in response to the (relatively high) frequency of price increases, and thereafter it would be expected that the decrease in the frequency of price increases would only become apparent after some time had passed, due to lag effects. The statistically significant (at the 1% confidence interval) positive association between the frequency of price decreases and the level of the Repo rate (reported in *Appendix 10.2*) may be indicative of the expected monetary policy transmission mechanism effect that would associate a higher Repo rate (particularly after a lag) with reduced aggregate

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<sup>23</sup> See Barth and Ramey (2001) and Ravenna and Walsh (2006) for full discussion on cost channel effects and the impact of such effects on monetary policy transmission.



demand and a higher frequency of price decreases.<sup>24</sup> The finding is not robust across all specifications as it only occurs in the combined version of the model.

Fourthly, the positive coefficients, in Table 44 and in *Appendix 10.1* and *10.2*, on the dummy for the break in the data set at 2006m3, offer a strong indication, significant at the 1% level, that the frequencies of price changes, price increases and price decreases all increase in the second part of the CPI data set. As explained, this is the likely effect of the inclusion of sales prices, which would tend to display such higher price change frequencies. This finding is robust for all specifications of the model.

#### 4.4.3 Three-month lagged explanatory variables

Table 45 reports the results of whether there is any significant relationship between the frequency of price changes and the explanatory variables after a three-month lag.<sup>25</sup>

**Table 45 Frequency of changes in CPI prices (3 month lagged)**

|           | (1)                | (2)               | (3)               | (4)               | (5)                | (6)               | (7)                | (8)                |
|-----------|--------------------|-------------------|-------------------|-------------------|--------------------|-------------------|--------------------|--------------------|
|           | CPI                | CPI               | CPI               | CPI               | CPI                | CPI               | CPI                | CPI                |
| January   | 0.008<br>(0.45)    | 0.006<br>(0.33)   | 0.007<br>(0.38)   | 0.011<br>(0.58)   | 0.007<br>(0.40)    | 0.006<br>(0.31)   | 0.013<br>(0.82)    | 0.016<br>(1.19)    |
| February  | -0.006<br>(0.34)   | -0.008<br>(0.39)  | -0.007<br>(0.37)  | -0.008<br>(0.44)  | -0.005<br>(0.30)   | -0.004<br>(0.22)  | -0.001<br>(0.07)   | 0.003<br>(0.19)    |
| March     | 0.050<br>(2.67)*** | 0.050<br>(2.44)** | 0.048<br>(2.46)** | 0.049<br>(2.56)** | 0.049<br>(2.77)*** | 0.050<br>(2.45)** | 0.055<br>(3.28)*** | 0.054<br>(3.83)*** |
| April     | 0.018<br>(0.99)    | 0.016<br>(0.82)   | 0.016<br>(0.84)   | 0.011<br>(0.60)   | 0.017<br>(1.00)    | 0.015<br>(0.76)   | 0.022<br>(1.40)    | 0.020<br>(1.51)    |
| May       | 0.010<br>(0.55)    | 0.008<br>(0.42)   | 0.008<br>(0.41)   | 0.007<br>(0.41)   | 0.010<br>(0.62)    | 0.010<br>(0.53)   | 0.014<br>(0.90)    | 0.016<br>(1.22)    |
| June      | 0.038<br>(2.16)**  | 0.036<br>(1.87)*  | 0.036<br>(1.91)*  | 0.032<br>(1.73)*  | 0.039<br>(2.31)**  | 0.037<br>(1.93)*  | 0.036<br>(2.28)**  | 0.035<br>(2.58)**  |
| July      | 0.009<br>(0.49)    | 0.007<br>(0.35)   | 0.007<br>(0.37)   | 0.009<br>(0.50)   | 0.012<br>(0.72)    | 0.011<br>(0.54)   | 0.007<br>(0.43)    | 0.012<br>(0.85)    |
| August    | 0.003<br>(0.18)    | 0.002<br>(0.09)   | 0.001<br>(0.08)   | 0.001<br>(0.08)   | 0.005<br>(0.28)    | 0.000<br>(0.02)   | 0.001<br>(0.09)    | 0.002<br>(0.14)    |
| September | 0.021<br>(1.18)    | 0.020<br>(1.01)   | 0.019<br>(1.02)   | 0.017<br>(0.95)   | 0.019<br>(1.14)    | 0.017<br>(0.87)   | 0.020<br>(1.23)    | 0.016<br>(1.22)    |
| October   | 0.014<br>(0.76)    | 0.012<br>(0.64)   | 0.012<br>(0.66)   | 0.013<br>(0.70)   | 0.015<br>(0.87)    | 0.016<br>(0.83)   | 0.013<br>(0.80)    | 0.015<br>(1.10)    |
| November  | 0.003<br>(0.16)    | 0.002<br>(0.12)   | 0.002<br>(0.13)   | 0.005<br>(0.26)   | 0.004<br>(0.21)    | 0.003<br>(0.14)   | 0.002<br>(0.16)    | 0.004<br>(0.31)    |

<sup>24</sup> Mahadeva and Sinclair (2005) offer a clear analysis of the workings of the monetary policy transmission mechanism and, although the authors do not deal explicitly with the effects of monetary policy on pricing conduct, their work provides an important backdrop against which to analyse how pricing conduct is effected by changes in the policy interest rate.

<sup>25</sup> A justification for the choice of the 3 month lag is the finding of Blinder's study (1994) of pricing conduct in the US economy where the mean lag in price adjustments in response to demand and cost shocks is found to be between 2,76 months for a positive cost shock and 3,27 months for a negative cost shock. The study also finds price adjustment lags in response to demand shocks of 2,88 months in response to an increase in demand and 2,90 month in response to a decrease in demand.

|                                                    |           |            |           |            |           |            |            |           |
|----------------------------------------------------|-----------|------------|-----------|------------|-----------|------------|------------|-----------|
| L3. CPI – metropolitan and other urban areas 7112A | 0.004     |            |           |            |           |            |            | -0.001    |
|                                                    | (3.52)*** |            |           |            |           |            |            | (0.43)    |
| L3.CPIchange                                       |           | 0.005      |           |            |           |            |            | -0.003    |
|                                                    |           | (0.80)     |           |            |           |            |            | (0.62)    |
| L3.Repochange                                      |           |            | 0.026     |            |           |            |            | 0.012     |
|                                                    |           |            | (2.91)*** |            |           |            |            | (1.56)    |
| L3.Exchangerate change                             |           |            |           |            | -0.002    |            |            | -0.001    |
|                                                    |           |            |           |            | (1.22)    |            |            | (0.69)    |
| L3.Breakdummy                                      |           |            |           |            |           | 0.041      |            | 0.043     |
|                                                    |           |            |           |            |           | (5.51)***  |            | (5.00)*** |
| L3. Repo Rate                                      |           | 0.004      |           |            |           |            |            | 0.005     |
|                                                    |           | (2.27)**   |           |            |           |            |            | (1.17)    |
| L3. Nominal Effective Exchange Rate – 5376M        |           |            |           |            | -0.002    |            |            | -0.001    |
|                                                    |           |            |           |            | (4.39)*** |            |            | (1.14)    |
| Constant                                           | 0.134     | 0.156      | 0.120     | 0.157      | 0.283     | 0.155      | 0.143      | 0.158     |
|                                                    | (9.47)*** | (11.35)*** | (5.69)*** | (12.12)*** | (9.08)*** | (11.34)*** | (12.44)*** | (2.08)**  |
| Observations                                       | 71        | 71         | 71        | 71         | 71        | 71         | 71         | 71        |
| R-squared                                          | 0.33      | 0.20       | 0.26      | 0.29       | 0.39      | 0.21       | 0.47       | 0.66      |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

With regard to state-dependent pricing, firstly, there is evidence, that the frequency of price increases is positively and significantly associated with the rate of inflation after a three-month lag, at the 1% level. This is due to a significant relationship between the frequency of price increases and the three-month lagged level of inflation, as there no such significant relationship between the frequency of price decreases and lagged inflation (see the results outlined in *Appendix 10.3* and *10.4*). This finding, that the frequency of price changes and price increases is positively associated with changes in the level of inflation, is not robust for all specifications of the model as it only pertains where the inflation level is included individually and not for the combined specification of the model. For all specifications of the model, there is no statistically significant relationship between changes in the CPI inflation rate and price change frequencies.

Secondly, pricing conduct is influenced by the exchange rate after a three-month lag, in that a statistically significant negative relationship is reported between the level of the nominal effective exchange rate and the frequency of price changes. In other words, after a three-month lag, an appreciation of the currency will be associated with a decrease in the frequency of price changes (Table 45), driven primarily by a decrease in the

frequency of price increases (*Appendix 10.3*), both significant at the 1% level. As per *Appendix 10.4*, the frequency of price decreases is positively and significantly associated with the nominal effective exchange rate, as a currency appreciation will lead to an increase in the frequency of price decreases after a three-month lag. The finding for the frequency of price decreases is robust across all specifications of the model, whereas for the frequency of price changes, the finding only holds where the lagged nominal exchange rate is entered individually in the model. Thus, there is evidence of the expected pass-through effects, in that, pricing conduct is influenced by exchange rate developments after a three-month lag.

Thirdly, with regard to the level of the Repo rate and changes in the Repo rate, the key finding is that the frequency of price changes (Table 45) and the frequency of price increases (*Appendix 10.3*) are both positively associated with the level of the Repo rate and changes in the Repo rate after a three-month lag. For the change in the Repo rate, the positive association with the frequency of price increases is robust across the various specifications of the model, although at different levels of significance (at 1% significance for the separate specification and at 10% significance for the combined specification). This offers evidence of cost channel effects, whereby interest rate increases result in an increase in price increase frequencies after a three-month lag. There is also some evidence, in *Appendix 10.4*, significant at the 5% level, that the frequency of price decreases is positively associated with increases in the level of the Repo rate after a three-month lag. This would offer evidence of the expected monetary policy transmission mechanism effect, whereby an increased policy interest rate would result in reduced aggregate demand and related price decreases. This finding is not robust across all specifications of the model, as it only holds for the combined specification.

#### **4.5 Analysis of magnitude of price changes using CPI micro-data**

In order to analyse the potential determinants of the time series variation of the magnitude of price adjustments three regressions are run analyzing (1) the average magnitude of price changes of price that change (M), (2) the average magnitude of price

increases where prices increase (M+) and (3) the average magnitude of price decreases where prices decrease (M-).

#### 4.5.1 Seasonality

There is evidence of seasonality in the magnitude of price changes. As reported in Table 46, the magnitude of price increases is relatively large, and statistically significant, in March, June, April, January and September (as outlined in Fig. 26). This finding is robust for the various specifications of the model.

**Table 46 Magnitude of increases in CPI prices regressed against real-time factors**

|                                                      | (1)                | (2)                | (3)                | (4)                | (5)                 | (6)                | (7)                | (8)                |
|------------------------------------------------------|--------------------|--------------------|--------------------|--------------------|---------------------|--------------------|--------------------|--------------------|
|                                                      | CPI                | CPI                | CPI                | CPI                | CPI                 | CPI                | CPI                | CPI                |
| January                                              | 0.022<br>(1.76)*   | 0.018<br>(1.17)    | 0.018<br>(1.39)    | 0.015<br>(1.02)    | 0.010<br>(0.97)     | 0.018<br>(1.04)    | 0.021<br>(1.35)    | 0.018<br>(1.86)*   |
| February                                             | 0.004<br>(0.36)    | 0.001<br>(0.09)    | 0.001<br>(0.05)    | 0.002<br>(0.14)    | -0.006<br>(0.55)    | 0.000<br>(0.01)    | 0.003<br>(0.22)    | 0.002<br>(0.16)    |
| March                                                | 0.055<br>(4.32)*** | 0.052<br>(3.14)*** | 0.049<br>(3.58)*** | 0.050<br>(3.16)*** | 0.042<br>(3.98)***  | 0.053<br>(3.04)*** | 0.056<br>(3.43)*** | 0.046<br>(4.59)*** |
| April                                                | 0.024<br>(1.95)*   | 0.019<br>(1.24)    | 0.020<br>(1.56)    | 0.025<br>(1.62)    | 0.018<br>(1.77)*    | 0.020<br>(1.23)    | 0.020<br>(1.31)    | 0.019<br>(1.99)*   |
| May                                                  | 0.014<br>(1.18)    | 0.011<br>(0.71)    | 0.011<br>(0.84)    | 0.013<br>(0.87)    | 0.006<br>(0.57)     | 0.011<br>(0.66)    | 0.011<br>(0.71)    | 0.010<br>(0.99)    |
| June                                                 | 0.031<br>(2.56)**  | 0.028<br>(1.78)*   | 0.028<br>(2.12)**  | 0.028<br>(1.87)*   | 0.018<br>(1.79)*    | 0.029<br>(1.63)    | 0.028<br>(1.82)*   | 0.024<br>(2.39)**  |
| July                                                 | 0.012<br>(0.95)    | 0.008<br>(0.51)    | 0.009<br>(0.67)    | 0.011<br>(0.76)    | 0.002<br>(0.23)     | 0.009<br>(0.57)    | 0.009<br>(0.60)    | 0.005<br>(0.49)    |
| August                                               | 0.005<br>(0.45)    | 0.003<br>(0.18)    | 0.004<br>(0.29)    | 0.008<br>(0.53)    | -0.004<br>(0.44)    | 0.004<br>(0.25)    | 0.004<br>(0.25)    | 0.001<br>(0.06)    |
| September                                            | 0.022<br>(1.78)*   | 0.020<br>(1.28)    | 0.021<br>(1.57)    | 0.023<br>(1.50)    | 0.011<br>(1.05)     | 0.021<br>(1.23)    | 0.021<br>(1.32)    | 0.017<br>(1.74)*   |
| October                                              | 0.018<br>(1.49)    | 0.016<br>(1.04)    | 0.019<br>(1.42)    | 0.022<br>(1.46)    | 0.009<br>(0.92)     | 0.018<br>(1.09)    | 0.018<br>(1.16)    | 0.014<br>(1.53)    |
| November                                             | 0.009<br>(0.70)    | 0.009<br>(0.56)    | 0.009<br>(0.69)    | 0.010<br>(0.69)    | 0.004<br>(0.38)     | 0.008<br>(0.51)    | 0.008<br>(0.54)    | 0.007<br>(0.78)    |
| CPI - metropolitan<br>and other urban<br>areas 7112A | 0.005<br>(6.97)*** |                    |                    |                    |                     |                    |                    | -0.001<br>(0.97)   |
| CPIchange                                            |                    | 0.012<br>(2.62)**  |                    |                    |                     |                    |                    | 0.008<br>(2.00)*   |
| Repo Rate                                            |                    |                    | 0.007<br>(5.98)*** |                    |                     |                    |                    | 0.006<br>(2.27)**  |
| Breakdummy                                           |                    |                    |                    |                    |                     |                    | 0.021<br>(2.91)*** | 0.019<br>(3.45)*** |
| Exchangeratechange                                   |                    |                    |                    |                    |                     | 0.000<br>(0.10)    |                    | 0.001<br>(0.59)    |
| Nominal Effective<br>Exchange Rate -<br>5376M        |                    |                    |                    |                    | -0.002<br>(9.89)*** |                    |                    | -0.001<br>(2.65)** |
| Repochange                                           |                    |                    |                    | 0.025              |                     |                    |                    | 0.004              |

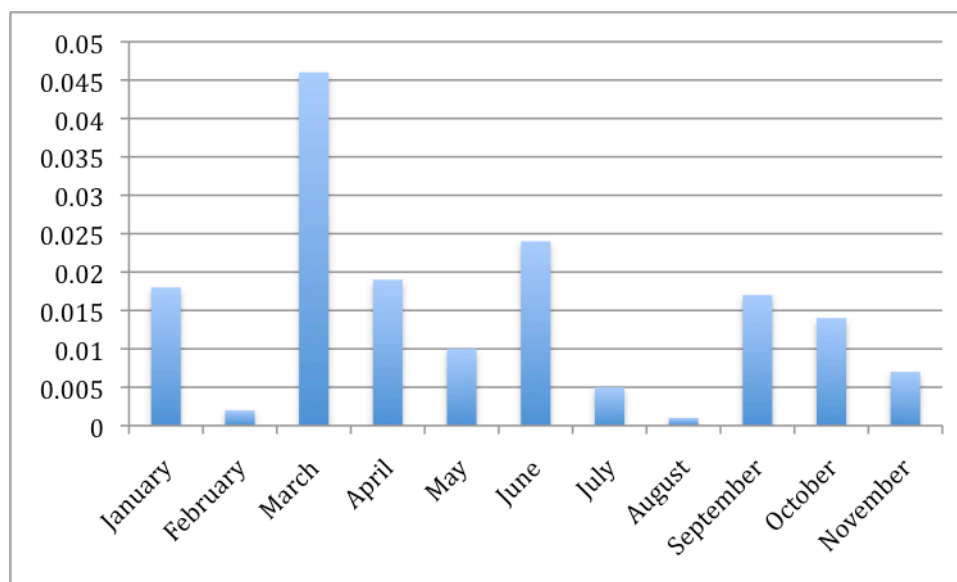
|              |                    |                    |                  |                                 |                     |                    |                    |                             |
|--------------|--------------------|--------------------|------------------|---------------------------------|---------------------|--------------------|--------------------|-----------------------------|
| Constant     | 0.060<br>(6.13)*** | 0.091<br>(8.23)*** | 0.024<br>(1.68)* | (3.45)***<br>0.090<br>(8.38)*** | 0.278<br>(13.81)*** | 0.092<br>(7.56)*** | 0.085<br>(7.58)*** | (0.66)<br>0.130<br>(2.50)** |
| Observations | 71                 | 71                 | 71               | 71                              | 71                  | 71                 | 71                 | 71                          |
| R-squared    | 0.57               | 0.29               | 0.51             | 0.34                            | 0.71                | 0.21               | 0.31               | 0.78                        |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

As with the seasonal pattern in price change frequencies, the larger magnitude of price increases in March is likely the effect of annual taxation changes, particularly in the form of fuel levy increases and in increases of so-called ‘sin taxes’ on tobacco and alcoholic beverages, which take effect in March after the announcement of South Africa’s budget in February each year. Further research is required regarding the reasons for the seasonal increase in the magnitude of price increases in the months of June, April, January and September.

**Fig. 26 Seasonality in the magnitude of price increases (CPI), relative to December**



There is no evidence of seasonality in the magnitude of price decreases, as reported in *Appendix 10.6*. The seasonality in the magnitude of overall price changes reported in *Appendix 10.5* indicates that relative to December, there is a smaller magnitude of overall price changes in all other months, indicative of the fact that the combined effect of price

increases and price decreases results in larger overall magnitude of price changes during December.

#### **4.5.2 Real-time explanatory variables**

There is some evidence of real-time state-dependence in the average magnitude of price changes. Firstly, the real-time magnitude of price increases is positively and significantly associated with the level of inflation, at a 1% confidence level, and with changes in the rate of inflation, at a 5% confidence level. As reported in Table 46, this latter result is robust across the various specifications of the model, whereas the positive association with the level of inflation only pertains where this variable is entered individually and not in the combined version of the model. The real-time magnitude of price decreases is negatively, and significantly (at the 1% level), associated with the level of inflation, as the level of inflation rises, the magnitude of price decreases falls (in absolute terms). As reported in *Appendix 10.6*, this result is not robust across all specifications of the model.

Secondly, the magnitude of price increases is negatively associated with real-time developments in the exchange rate. As outlined in Table 46, an appreciation of the nominal effective exchange rate will be associated with a real-time decrease in the magnitude of price increases. This result is robust across all specifications of the model. The magnitude of price decreases is positively associated with the exchange rate, in that, if there is an appreciation of the currency then the magnitude of price decreases is larger (in absolute terms). As reported in *Appendix 10.6*, this result is not robust across all specifications of the model.

Thirdly, the magnitude of price increases is positively associated with changes in the Repo rate in real-time. Robust across the various specifications of the model, it is found that an increase in the Repo rate is associated with a rise in the magnitude of price increases (as reported in Table 46). As with the analysis of the frequency of price changes, such an association may be as a result of a causation where the Repo rate is responding *inter alia* to the relatively high magnitude of price increases, or a causation which indicates that via a credit channel, the higher Repo rate results in a larger

magnitude of price increases. An analysis of the lagged effects of the change in the level of the Repo rate will offer further insight into this matter. In the combined specification of the model only, the magnitude of price decreases is positively associated with the change in the Repo rate (see *Appendix 10.6*). If there is an increase in the Repo rate, then the magnitude of price decreases is larger (in absolute terms), affording some evidence of the expected monetary policy transmission mechanism effect.

Fourthly, the break in the data in 2006m3 is associated with an increase in the magnitude of price increases and price decreases.

### 4.5.3 Three-month lagged explanatory variables

Table 47 reports the results of whether there is any significant relationship between the magnitude of price increases and the explanatory variables after a three-month lag.

**Table 47 Magnitude of increases in CPI prices (3 month lagged)**

|                                                             | (1)                | (2)                | (3)                | (4)                | (5)                | (6)                | (7)                | (8)                |
|-------------------------------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|                                                             | CPI                | CPI                | CPI                | CPI                | CPI                | CPI                | CPI                | CPI                |
| January                                                     | 0.020<br>(1.35)    | 0.018<br>(1.11)    | 0.019<br>(1.24)    | 0.022<br>(1.45)    | 0.018<br>(1.53)    | 0.017<br>(1.08)    | 0.021<br>(1.38)    | 0.023<br>(2.06)**  |
| February                                                    | 0.002<br>(0.14)    | 0.001<br>(0.05)    | 0.001<br>(0.08)    | 0.000<br>(0.00)    | 0.004<br>(0.30)    | 0.005<br>(0.28)    | 0.004<br>(0.24)    | 0.008<br>(0.69)    |
| March                                                       | 0.054<br>(3.56)*** | 0.054<br>(3.17)*** | 0.052<br>(3.30)*** | 0.053<br>(3.36)*** | 0.053<br>(4.24)*** | 0.054<br>(3.16)*** | 0.056<br>(3.47)*** | 0.055<br>(4.77)*** |
| April                                                       | 0.022<br>(1.55)    | 0.021<br>(1.30)    | 0.021<br>(1.37)    | 0.016<br>(1.05)    | 0.022<br>(1.85)*   | 0.019<br>(1.19)    | 0.024<br>(1.56)    | 0.022<br>(1.96)*   |
| May                                                         | 0.013<br>(0.93)    | 0.012<br>(0.74)    | 0.011<br>(0.75)    | 0.011<br>(0.73)    | 0.015<br>(1.21)    | 0.014<br>(0.88)    | 0.015<br>(0.95)    | 0.018<br>(1.60)    |
| June                                                        | 0.030<br>(2.11)**  | 0.029<br>(1.76)*   | 0.028<br>(1.84)*   | 0.024<br>(1.58)    | 0.032<br>(2.66)**  | 0.030<br>(1.84)*   | 0.028<br>(1.83)*   | 0.030<br>(2.65)**  |
| July                                                        | 0.011<br>(0.77)    | 0.009<br>(0.56)    | 0.009<br>(0.62)    | 0.012<br>(0.76)    | 0.016<br>(1.31)    | 0.014<br>(0.84)    | 0.009<br>(0.61)    | 0.018<br>(1.58)    |
| August                                                      | 0.005<br>(0.38)    | 0.004<br>(0.26)    | 0.004<br>(0.25)    | 0.004<br>(0.25)    | 0.008<br>(0.65)    | 0.003<br>(0.16)    | 0.004<br>(0.25)    | 0.006<br>(0.56)    |
| September                                                   | 0.022<br>(1.52)    | 0.021<br>(1.27)    | 0.020<br>(1.33)    | 0.018<br>(1.22)    | 0.020<br>(1.70)*   | 0.017<br>(1.07)    | 0.021<br>(1.33)    | 0.018<br>(1.59)    |
| October                                                     | 0.019<br>(1.30)    | 0.017<br>(1.07)    | 0.018<br>(1.16)    | 0.018<br>(1.19)    | 0.020<br>(1.70)*   | 0.022<br>(1.36)    | 0.018<br>(1.17)    | 0.022<br>(1.98)*   |
| November                                                    | 0.009<br>(0.60)    | 0.008<br>(0.50)    | 0.008<br>(0.55)    | 0.011<br>(0.70)    | 0.010<br>(0.81)    | 0.009<br>(0.53)    | 0.008<br>(0.54)    | 0.011<br>(0.97)    |
| L3. CPI -<br>metropolitan<br>and other urban<br>areas 7112A | 0.004<br>(4.34)*** |                    |                    |                    |                    |                    |                    | -0.000<br>(0.12)   |

|                                                      |                    |                    |                    |                     |                     |                    |                    |                     |
|------------------------------------------------------|--------------------|--------------------|--------------------|---------------------|---------------------|--------------------|--------------------|---------------------|
| L3.CPIchange                                         |                    | 0.007<br>(1.51)    |                    |                     |                     |                    |                    | -0.004<br>(0.81)    |
| L3.Repochange                                        |                    |                    |                    | 0.026<br>(3.49)***  |                     |                    |                    | 0.012<br>(1.80)*    |
| L3.Exchangerate<br>change                            |                    |                    |                    |                     | -0.002<br>(1.74)*   |                    |                    | -0.001<br>(1.05)    |
| L3.Breakdummy                                        |                    |                    |                    |                     |                     | 0.022<br>(3.06)*** |                    | 0.017<br>(2.46)**   |
| L3. Repo Rate                                        |                    |                    | 0.005<br>(3.47)*** |                     |                     |                    |                    | 0.001<br>(0.32)     |
| L3. Nominal<br>Effective<br>Exchange Rate -<br>5376M |                    |                    |                    | -0.002<br>(7.31)*** |                     |                    |                    | -0.001<br>(3.05)*** |
| Constant                                             | 0.069<br>(6.02)*** | 0.091<br>(7.92)*** | 0.046<br>(2.74)*** | 0.092<br>(8.61)***  | 0.240<br>(10.92)*** | 0.090<br>(7.88)*** | 0.084<br>(7.57)*** | 0.198<br>(3.17)***  |
| Observations                                         | 71                 | 71                 | 71                 | 71                  | 71                  | 71                 | 71                 | 71                  |
| R-squared                                            | 0.40               | 0.24               | 0.35               | 0.35                | 0.59                | 0.25               | 0.32               | 0.69                |

Absolute value of t statistics in parentheses  
\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Firstly, there is a positive and statistically significant (at the 1% confidence level) association between magnitude of price increases and the rate of inflation after a three-month lag. This is the finding when the rate of inflation is entered on its own into the model, but does not hold for the combined version of the model. There is a similar positive and significant association between the overall magnitude of price changes and inflation after a three-month lag (as reported in *Appendix 10.8*), but there is no statistically significant relationship between lagged inflation and the magnitude of price decreases.

Secondly, the magnitude of price increases is found to be negatively associated with the nominal effective exchange rate after a three-month lag, significant at the 1% level. This implies that an appreciation of the currency will be associated with a decrease in the mean value of the magnitude of price increases after a three-month lag. As per Table 47, this finding is robust for all specifications of the model. As reported in *Appendix 10.8*, the magnitude of price decreases (in absolute terms) are positively associated with the nominal effective exchange rate after a three-month lag, providing evidence of a pass-through effect where, after a three-month lag, an exchange rate appreciation results in a larger average magnitude of price decreases (in absolute terms). This result is robust across the various specifications of the model and is significant at the 1% level for the combined version of the model.



Thirdly, after a three-month lag an increase in the Repo rate is found to be positively and significantly associated with an increase in the mean magnitude of price increases, as outlined in Table 47. This result is true both for the level of the Repo rate and for changes in the Repo rate, but is only robust across the various specifications of the model for the change in the Repo rate. As discussed previously, this result offers a further indication of a cost channel effect, as in addition to the finding of a positive real time association between the Repo rate and the magnitude of price increases, there is also evidence that after a three-month lag the positive effect of the Repo rate on the mean magnitude of price increases persists. As a result, the alternative explanation, that the positive real time association may be as a result of a causation running from the higher mean magnitude of price increases to the Repo rate, is diminished. As per *Appendix 10.8*, the mean magnitude of price decreases is positively and significantly (at the 5% level) associated with the level of the Repo rate, in that an increase in the Repo rate will be associated with an increase (in absolute terms) with the magnitude of price decreases. This is the expected result in terms of the monetary policy transmission mechanism's prediction that the Repo rate increase would result in a suppression of aggregate demand and related changes in pricing conduct.

#### **4.5.4 Analysis including inflation expectations**

One method for estimating inflation expectations is to analyse the spreads between the yields on South African government inflation-linked bonds and conventional nominal bonds of similar maturity.<sup>26</sup> Another method utilised in South Africa is regularly to survey the inflation expectations of business executives, financial analysts and trade unions.<sup>27</sup>

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<sup>26</sup> The data series utilised are the spread between R189 and R153 bonds (maturing 2013) and the Spread between R197 and R186 bonds (maturing 2023). The process of using bond spreads to estimate inflation expectations is outlined in some detail in the South African Reserve Bank's Monetary Policy Review (November 2006)(p.27-28).

<sup>27</sup> The data series utilised in this section are as follows:

- Surveyed inflation expectations (current year) (South African Reserve Bank time series 7123K)
- Surveyed inflation expectations (one year ahead) (South African Reserve Bank time series 7124K)
- Surveyed inflation expectations (two years ahead) (South African Reserve Bank time series 7125K)

When the spreads between South Africa's R189 and R153 bonds which mature in 2013 and between the R197 and R186 bonds maturing in 2023 are included in the regression model as proxies for inflation expectations, there is clear evidence that inflation expectations impact on pricing conduct.

As reported in Table 48, the frequency of price increases is positively and significantly (at the 1% confidence level) associated with the spread between the R189 and R153 bonds and this finding is robust for both the specification which includes the R189 and R153 bond spread alone, and where this combined with the spread between the R197 and R186 bonds. Furthermore, the frequency of price increases is found to be positively and significantly (at the 10% confidence level) associated with the spread between the R197 and R186 bonds, but this finding not robust across all specifications. The finding is not as strong for the frequency of price decreases, which is found to be negatively associated only with the spread between the R189 and R153 bonds and only at the 10% confidence level.

**Table 48 Frequency of changes in CPI prices regressed against expected inflation (based on bond yield spreads)**

|           | (1)<br>CPI<br>Frequency<br>of<br>price<br>change | (2)<br>CPI<br>Frequency<br>of<br>price<br>change | (3)<br>CPI<br>Frequency<br>of<br>price<br>change | (4)<br>CPI<br>Frequency<br>of<br>price<br>increase | (5)<br>CPI<br>Frequency<br>of<br>price<br>increase | (6)<br>CPI<br>Frequency<br>of<br>price<br>increase | (7)<br>CPI<br>Frequency<br>of<br>price<br>decrease<br>s | (8)<br>CPI<br>Frequency<br>of<br>price<br>decrease<br>s | (9)<br>CPI<br>Frequency<br>of<br>price<br>decrease<br>s |
|-----------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|----------------------------------------------------|----------------------------------------------------|----------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|
| January   | 0.008<br>(0.44)                                  | 0.008<br>(0.45)                                  | 0.007<br>(0.42)                                  | 0.019<br>(1.56)                                    | 0.020<br>(1.49)                                    | 0.019<br>(1.53)                                    | -0.012<br>(1.57)                                        | -0.012<br>(1.57)                                        | -0.012<br>(1.55)                                        |
| February  | -0.008<br>(0.45)                                 | -0.007<br>(0.39)                                 | -0.008<br>(0.46)                                 | 0.000<br>(0.04)                                    | 0.001<br>(0.10)                                    | 0.000<br>(0.01)                                    | -0.008<br>(1.08)                                        | -0.008<br>(1.10)                                        | -0.008<br>(1.07)                                        |
| March     | 0.047<br>(2.59)**                                | 0.047<br>(2.56)**                                | 0.047<br>(2.56)**                                | 0.050<br>(3.88)**                                  | 0.051<br>(3.68)**                                  | 0.050<br>(3.85)**                                  | -0.004<br>(0.45)                                        | -0.004<br>(0.47)                                        | -0.004<br>(0.45)                                        |
| April     | 0.010<br>(0.58)                                  | 0.008<br>(0.44)                                  | 0.011<br>(0.64)                                  | 0.014<br>(1.13)                                    | 0.011<br>(0.84)                                    | 0.015<br>(1.21)                                    | -0.004<br>(0.52)                                        | -0.003<br>(0.46)                                        | -0.004<br>(0.52)                                        |
| May       | 0.005<br>(0.30)                                  | 0.003<br>(0.15)                                  | 0.006<br>(0.35)                                  | 0.008<br>(0.67)                                    | 0.005<br>(0.40)                                    | 0.009<br>(0.75)                                    | -0.003<br>(0.42)                                        | -0.003<br>(0.35)                                        | -0.003<br>(0.42)                                        |
| June      | 0.033<br>(1.91)*                                 | 0.029<br>(1.64)                                  | 0.034<br>(1.95)*                                 | 0.024<br>(1.96)*                                   | 0.020<br>(1.50)                                    | 0.026<br>(2.05)**                                  | 0.009<br>(1.15)                                         | 0.009<br>(1.23)                                         | 0.008<br>(1.10)                                         |
| July      | 0.002<br>(0.12)                                  | -0.003<br>(0.16)                                 | 0.004<br>(0.23)                                  | 0.004<br>(0.30)                                    | -0.002<br>(0.16)                                   | 0.006<br>(0.46)                                    | -0.002<br>(0.21)                                        | -0.001<br>(0.09)                                        | -0.002<br>(0.23)                                        |
| August    | -0.002<br>(0.14)                                 | -0.005<br>(0.30)                                 | -0.001<br>(0.06)                                 | -0.001<br>(0.06)                                   | -0.004<br>(0.32)                                   | 0.001<br>(0.05)                                    | -0.002<br>(0.22)                                        | -0.001<br>(0.14)                                        | -0.002<br>(0.23)                                        |
| September | 0.015<br>(0.89)                                  | 0.012<br>(0.70)                                  | 0.017<br>(0.95)                                  | 0.016<br>(1.26)                                    | 0.012<br>(0.91)                                    | 0.017<br>(1.35)                                    | -0.000<br>(0.04)                                        | 0.000<br>(0.04)                                         | -0.000<br>(0.05)                                        |
| October   | 0.007<br>(0.43)                                  | 0.007<br>(0.41)                                  | 0.008<br>(0.45)                                  | 0.012<br>(0.95)                                    | 0.011<br>(0.86)                                    | 0.012<br>(0.97)                                    | -0.004<br>(0.57)                                        | -0.004<br>(0.56)                                        | -0.004<br>(0.57)                                        |
| November  | 0.001<br>(0.03)                                  | -0.001<br>(0.05)                                 | 0.001<br>(0.07)                                  | 0.006<br>(0.49)                                    | 0.004<br>(0.33)                                    | 0.007<br>(0.54)                                    | -0.006<br>(0.74)                                        | -0.005<br>(0.70)                                        | -0.006<br>(0.74)                                        |

|                                                             |          |          |          |          |          |          |          |          |          |
|-------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Spread between R189 and R153 bonds (maturing 2013)BEYJ053 D | 0.014    |          | 0.019    | 0.017    |          | 0.022    | -0.003   |          | -0.003   |
|                                                             | (4.15)** |          | (1.86)*  | (6.86)** |          | (3.03)** | (1.77)*  |          | (0.71)   |
|                                                             | *        |          |          | *        |          | *        |          |          |          |
| Spread between R197 and R186 bonds (maturing 2023)BEYJ057 D |          | 0.018    | -0.006   |          | 0.021    | -0.007   |          | -0.003   | 0.001    |
|                                                             |          | (3.63)** | (0.46)   |          | (5.77)** | (0.71)   |          | (1.62)   | (0.11)   |
|                                                             |          | *        |          |          | *        |          |          |          |          |
| Constant                                                    | 0.079    | 0.073    | 0.086    | -0.000   | -0.008   | 0.007    | 0.079    | 0.081    | 0.078    |
|                                                             | (3.55)** | (2.78)** | (3.22)** | (0.00)   | (0.39)   | (0.38)   | (8.18)** | (7.24)** | (6.78)** |
| Observations                                                | 71       | 71       | 71       | 71       | 71       | 71       | 71       | 71       | 71       |
| R-squared                                                   | 0.38     | 0.34     | 0.38     | 0.56     | 0.50     | 0.57     | 0.17     | 0.16     | 0.17     |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

The results of inflation expectations surveys are analysed as reported in Table 49. A strong result from this survey data is that the frequency of price increases is positively and significantly associated with surveyed inflation expectations. This result holds true for expectations surveyed in the current year, for one year ahead and for two years ahead. The result is also robust for all specifications and in all cases is significant at either the 1% or 5% confidence level.

**Table 49 Frequency of changes in CPI prices regressed against surveyed inflation expectations**

|           | (1)     | (2)     | (3)     | (4)     | (5)     | (6)     | (7)     | (8)     | (9)     | (10)    | (11)    | (12)    |
|-----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|           | CPI     | CPI     | CPI     | CPI     | CPI     | CPI     | CPI     | CPI     | CPI     | CPI     | CPI     | CPI     |
|           | Frequen | Frequen | Frequen | Frequen | Frequen | Frequen | Frequen | Frequen | Frequen | Frequen | Frequen | Frequen |
|           | ncy of  | ncy of  | ncy of  | ncy of  | ncy of  | ncy of  | ncy of  | ncy of  | ncy of  | ncy of  | ncy of  | ncy of  |
|           | price   | price   | price   | price   | price   | price   | price   | price   | price   | price   | price   | price   |
|           | change  | change  | change  | change  | change  | change  | change  | change  | change  | change  | change  | change  |
| January   | 0.007   | 0.007   | 0.006   | 0.016   | 0.019   | 0.019   | 0.017   | 0.027   | -0.012  | -0.012  | -0.011  | -0.011  |
|           | (0.37)  | (0.35)  | (0.31)  | (1.01)  | (1.26)  | (1.23)  | (1.09)  | (2.42)  | (1.63)  | (1.65)  | (1.59)  | (1.53)  |
| February  | -0.007  | -0.007  | -0.008  | 0.001   | 0.001   | 0.001   | -0.000  | 0.009   | -0.008  | -0.008  | -0.008  | -0.008  |
|           | (0.38)  | (0.39)  | (0.41)  | (0.10)  | (0.08)  | (0.07)  | (0.01)  | (0.83)  | (1.16)  | (1.17)  | (1.12)  | (1.06)  |
| March     | 0.048   | 0.048   | 0.048   | 0.059   | 0.052   | 0.051   | 0.051   | 0.061   | -0.004  | -0.003  | -0.003  | -0.002  |
|           | (2.43)  | (2.39)  | (2.36)  | (3.65)  | (3.33)  | (3.25)  | (3.05)  | (5.31)  | (0.47)  | (0.43)  | (0.37)  | (0.27)  |
| April     | **      | **      | **      | ***     | ***     | ***     | ***     | ***     | ***     | ***     | ***     | ***     |
|           | 0.016   | 0.016   | 0.016   | 0.014   | 0.021   | 0.021   | 0.021   | 0.020   | -0.005  | -0.005  | -0.005  | -0.006  |
|           | (0.83)  | (0.84)  | (0.81)  | (0.91)  | (1.39)  | (1.41)  | (1.32)  | (1.80)  | (0.69)  | (0.73)  | (0.74)  | (0.80)  |
| May       | 0.008   | 0.008   | 0.008   | 0.006   | 0.011   | 0.012   | 0.012   | 0.010   | -0.004  | -0.004  | -0.004  | -0.004  |
|           | (0.41)  | (0.42)  | (0.39)  | (0.39)  | (0.76)  | (0.79)  | (0.73)  | (0.95)  | (0.50)  | (0.55)  | (0.55)  | (0.61)  |
| June      | 0.036   | 0.037   | 0.036   | 0.035   | 0.029   | 0.029   | 0.029   | 0.028   | 0.008   | 0.008   | 0.008   | 0.007   |
|           | (1.93)  | (1.92)  | (1.87)  | (2.26)  | (1.93)  | (1.94)  | (1.81)  | (2.53)  | (1.08)  | (1.06)  | (1.06)  | (0.99)  |
| July      | *       | *       | *       | **      | *       | *       | *       | **      | **      | **      | **      | **      |
|           | 0.007   | 0.007   | 0.007   | 0.004   | 0.010   | 0.010   | 0.010   | 0.007   | -0.003  | -0.003  | -0.003  | -0.003  |
|           | (0.39)  | (0.38)  | (0.37)  | (0.23)  | (0.69)  | (0.67)  | (0.64)  | (0.60)  | (0.38)  | (0.39)  | (0.43)  | (0.43)  |
| August    | 0.002   | 0.002   | 0.002   | -0.002  | 0.005   | 0.005   | 0.005   | 0.001   | -0.003  | -0.003  | -0.003  | -0.003  |
|           | (0.11)  | (0.10)  | (0.09)  | (0.12)  | (0.31)  | (0.31)  | (0.29)  | (0.10)  | (0.36)  | (0.37)  | (0.40)  | (0.41)  |
| September | 0.020   | 0.020   | 0.020   | 0.016   | 0.021   | 0.021   | 0.021   | 0.018   | -0.001  | -0.001  | -0.002  | -0.002  |
|           | (1.06)  | (1.05)  | (1.02)  | (1.05)  | (1.44)  | (1.42)  | (1.35)  | (1.63)  | (0.18)  | (0.19)  | (0.22)  | (0.23)  |
| October   | 0.013   | 0.013   | 0.013   | 0.013   | 0.018   | 0.018   | 0.018   | 0.018   | -0.005  | -0.005  | -0.005  | -0.005  |
|           | (0.67)  | (0.67)  | (0.65)  | (0.83)  | (1.21)  | (1.19)  | (1.13)  | (1.64)  | (0.72)  | (0.73)  | (0.74)  | (0.74)  |
| November  | 0.002   | 0.002   | 0.002   | 0.002   | 0.008   | 0.008   | 0.008   | 0.008   | -0.006  | -0.006  | -0.006  | -0.006  |
|           | (0.13)  | (0.13)  | (0.13)  | (0.16)  | (0.56)  | (0.56)  | (0.52)  | (0.76)  | (0.81)  | (0.82)  | (0.83)  | (0.82)  |

|                                                           |                 |                 |                 |                 |                 |                 |                 |                 |                  |                 |                 |                 |
|-----------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|
| Surveyed inflation expectations (current year) - 7122K    | 0.005           |                 | 0.023           |                 | 0.007           |                 | 0.018           |                 | -0.002           |                 | 0.005           |                 |
|                                                           | (2.01)<br>**    |                 | (2.39)<br>**    |                 | (3.83)<br>***   |                 | (2.58)<br>**    |                 | (2.59)<br>**     |                 | (1.20)          |                 |
| Surveyed inflation expectations (one year ahead) - 7124K  | 0.006           |                 | 0.042           |                 | 0.010           |                 | 0.048           |                 | -0.004           |                 | -0.006          |                 |
|                                                           | (1.70)<br>*     |                 | (2.34)<br>**    |                 | (3.54)<br>***   |                 | (3.74)<br>***   |                 | (2.92)<br>***    |                 | (0.70)          |                 |
| Surveyed inflation expectations (two years ahead) - 7125K | 0.003           |                 | -0.082          |                 | 0.008           |                 | -0.076          |                 | -0.005           |                 | -0.006          |                 |
|                                                           | (0.73)          |                 | (5.44)<br>***   |                 | (2.25)<br>**    |                 | (7.04)<br>***   |                 | (3.05)<br>***    |                 | (0.93)          |                 |
| Constant                                                  | 0.126<br>(6.26) | 0.121<br>(4.79) | 0.138<br>(4.87) | 0.248<br>(7.38) | 0.047<br>(2.94) | 0.033<br>(1.64) | 0.046<br>(1.98) | 0.142<br>(5.93) | 0.080<br>(10.31) | 0.088<br>(9.32) | 0.092<br>(8.90) | 0.106<br>(6.78) |
| Observations                                              | 71              | 71              | 71              | 71              | 71              | 71              | 71              | 71              | 71               | 71              | 71              | 71              |
| R-squared                                                 | 0.24            | 0.23            | 0.20            | 0.52            | 0.37            | 0.35            | 0.27            | 0.67            | 0.22             | 0.24            | 0.25            | 0.27            |
| Absolute value of t statistics in parentheses             |                 |                 |                 |                 |                 |                 |                 |                 |                  |                 |                 |                 |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

The frequency of price decreases is negatively and significantly associated with survey inflation expectations for the current year, for one year ahead and for two years ahead. This finding is not robust to all specifications of the model, but only holds where the various surveys are entered individually.

## 4.6 Analysis of frequency of price changes using PPI micro-data

In order to analyse the potential determinants of the time series variation of the frequency of price adjustments using the PPI microdata, regressions are run analysing (1) the frequency of price changes (F), (2) the frequency of price increases (F+) and (3) the frequency of price decreases (F-). First real-time explanatory variables are used and thereafter price changes are regressed against explanatory variables after a three-month lag.

### 4.6.1 Seasonality

As reported in Table 50, the PPI microdata reveals there is seasonality in the frequency of price changes, evidenced by the fact that the frequency of price changes is higher during

all months of the year as compared to the December base period. Intuitively, this can be rationalised on the basis that producer prices tend not to rise in December, as factories are typically closed during that period, but are likely to rise during the other months of the year. The month with the highest frequency of PPI price increases is April, and this finding is robust across the various specifications of the model (as reported in *Appendix 10.9*). There is also evidence, robust across the various specifications of the model, that the frequency of PPI price decreases is highest in July (as reported in *Appendix 10.10*).

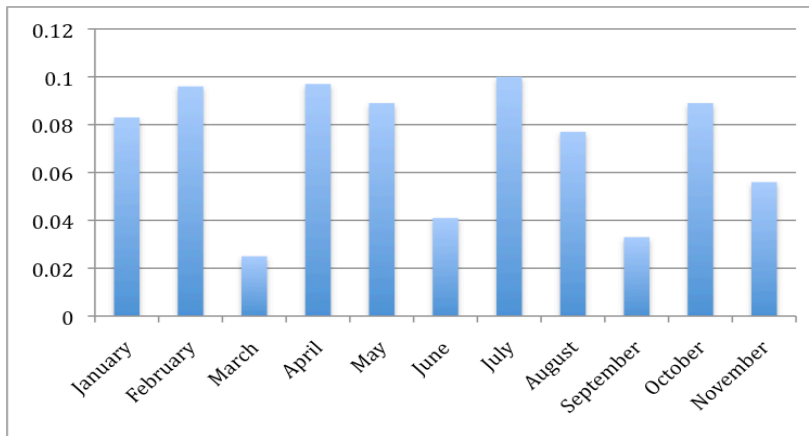
**Table 50 Frequency of changes in PPI prices regressed against real time factors**

|                    | (1)                                    | (2)                                    | (3)                                    | (4)                                    | (5)                                    | (6)                                    | (7)                                    | (8)                                    |
|--------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|
|                    | PPI<br>Frequency<br>of Price<br>change | PPI<br>Frequency<br>of Price<br>change | PPI<br>Frequency<br>of Price<br>change | PPI<br>Frequency<br>of Price<br>change | PPI<br>Frequency<br>of Price<br>change | PPI<br>Frequency<br>of Price<br>change | PPI<br>Frequency<br>of Price<br>change | PPI<br>Frequency<br>of Price<br>change |
| January            | 0.074<br>(4.17)***                     | 0.073<br>(3.09)***                     | 0.074<br>(3.17)***                     | 0.070<br>(3.19)***                     | 0.064<br>(3.43)***                     | 0.073<br>(2.89)***                     | 0.082<br>(4.33)***                     | 0.083<br>(6.34)***                     |
| February           | 0.092<br>(5.14)***                     | 0.090<br>(3.80)***                     | 0.091<br>(3.92)***                     | 0.094<br>(4.27)***                     | 0.084<br>(4.49)***                     | 0.090<br>(3.71)***                     | 0.099<br>(5.25)***                     | 0.096<br>(7.62)***                     |
| March              | 0.026<br>(1.47)                        | 0.024<br>(1.01)                        | 0.026<br>(1.12)                        | 0.023<br>(1.05)                        | 0.020<br>(1.06)                        | 0.026<br>(1.06)                        | 0.026<br>(1.40)                        | 0.025<br>(1.98)*                       |
| April              | 0.096<br>(5.40)***                     | 0.096<br>(4.04)***                     | 0.097<br>(4.19)***                     | 0.104<br>(4.71)***                     | 0.094<br>(5.07)***                     | 0.097<br>(4.00)***                     | 0.097<br>(5.15)***                     | 0.097<br>(7.88)***                     |
| May                | 0.080<br>(4.49)***                     | 0.080<br>(3.39)***                     | 0.081<br>(3.51)***                     | 0.085<br>(3.85)***                     | 0.075<br>(4.03)***                     | 0.081<br>(3.21)***                     | 0.081<br>(4.31)***                     | 0.089<br>(6.90)***                     |
| June               | 0.035<br>(1.98)*                       | 0.035<br>(1.50)                        | 0.038<br>(1.62)                        | 0.038<br>(1.74)*                       | 0.026<br>(1.40)                        | 0.038<br>(1.46)                        | 0.038<br>(2.02)**                      | 0.041<br>(3.12)***                     |
| July               | 0.103<br>(5.76)***                     | 0.105<br>(4.43)***                     | 0.105<br>(4.54)***                     | 0.109<br>(4.97)***                     | 0.097<br>(5.22)***                     | 0.106<br>(4.35)***                     | 0.106<br>(5.61)***                     | 0.100<br>(8.07)***                     |
| August             | 0.072<br>(4.06)***                     | 0.075<br>(3.18)***                     | 0.075<br>(3.23)***                     | 0.081<br>(3.70)***                     | 0.065<br>(3.49)***                     | 0.075<br>(3.01)***                     | 0.075<br>(3.98)***                     | 0.077<br>(5.99)***                     |
| September          | 0.032<br>(1.80)*                       | 0.035<br>(1.47)                        | 0.034<br>(1.46)                        | 0.037<br>(1.69)*                       | 0.022<br>(1.19)                        | 0.034<br>(1.35)                        | 0.034<br>(1.80)*                       | 0.033<br>(2.57)**                      |
| October            | 0.092<br>(5.17)***                     | 0.094<br>(3.97)***                     | 0.094<br>(4.05)***                     | 0.100<br>(4.55)***                     | 0.083<br>(4.46)***                     | 0.093<br>(3.82)***                     | 0.093<br>(4.96)***                     | 0.089<br>(7.02)***                     |
| November           | 0.060<br>(3.38)***                     | 0.062<br>(2.61)**                      | 0.061<br>(2.63)**                      | 0.064<br>(2.91)***                     | 0.055<br>(2.96)***                     | 0.061<br>(2.50)**                      | 0.061<br>(3.21)***                     | 0.056<br>(4.53)***                     |
| PPI Total - 7140A  | 0.006<br>(7.09)***                     |                                        |                                        |                                        |                                        |                                        |                                        | -0.002<br>(1.69)*                      |
| PPIchange          |                                        | 0.008<br>(1.72)*                       |                                        |                                        |                                        |                                        |                                        | 0.005<br>(1.52)                        |
| Repo Rate          |                                        |                                        | 0.005<br>(2.37)**                      |                                        |                                        |                                        |                                        | -0.002<br>(0.65)                       |
| Breakdummy         |                                        |                                        |                                        |                                        |                                        |                                        | 0.052<br>(6.22)***                     | 0.053<br>(7.40)***                     |
| Exchangeratechange |                                        |                                        |                                        |                                        |                                        | -0.000<br>(0.03)                       |                                        | 0.004<br>(3.46)***                     |
| Nominal Effective  |                                        |                                        |                                        |                                        | -0.003<br>(6.41)***                    |                                        |                                        | -0.003<br>(3.76)***                    |
| Repochange         |                                        |                                        |                                        | 0.039<br>(3.65)***                     |                                        |                                        |                                        | 0.009<br>(1.26)                        |
| Constant           | 0.106<br>(7.78)***                     | 0.142<br>(8.50)***                     | 0.095<br>(3.69)***                     | 0.139<br>(8.94)***                     | 0.361<br>(9.86)***                     | 0.142<br>(8.03)***                     | 0.124<br>(9.13)***                     | 0.419<br>(4.19)***                     |
| Observations       | 72                                     | 72                                     | 72                                     | 72                                     | 72                                     | 72                                     | 72                                     | 72                                     |
| R-squared          | 0.68                                   | 0.44                                   | 0.46                                   | 0.52                                   | 0.65                                   | 0.41                                   | 0.64                                   | 0.87                                   |

Absolute value of t statistics in parentheses  
significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

The monthly pattern that indicates the frequency of price changes in all other months tends to be above the December base period, is outlined in Fig. 27.

**Fig. 27 Seasonality in the frequency of price changes (PPI), relative to December**



#### **4.6.2 Real-time explanatory variables**

The PPI microdata offers some clear evidence of real-time state-dependence in pricing. Firstly, the frequency of price changes is found to be associated positively and significantly (at the 1% confidence level) with the real-time PPI rate of inflation and with real time changes in the PPI (at the 10% confidence level), although, as reported in Table 50, these findings are not robust for all specifications of the model. In real time there is evidence outlined in *Appendix 10.9* that the frequency of price increases is positively associated with the PPI rate of inflation and with changes in the PPI. In *Appendix 10.10*

the combined version of the model indicates that the frequency of price decreases is negatively associated with PPI inflation, robust across all specifications of the model, and, in certain specifications, with changes in PPI inflation.

Secondly, the frequency of price changes and price increases are negatively and significantly associated with the nominal effective exchange rate (all at the 1% confidence level). As per Table 50 and *Appendix 10.9* such a finding is robust across all specifications of the model. An appreciation of the exchange rate is associated in real-time with a decrease in the frequency of price changes and a decrease in the frequency of price increases. According to *Appendix 10.10* there is some evidence in real-time (not robust across all specifications of the model), of a positive relationship between the frequency of price decreases and the nominal effective exchange rate.

Thirdly, the frequency of price changes is revealed to be associated positively and significantly with the level of the Repo rate and to changes in the Repo rate. This is reported in Table 50, where it can be seen that these results are not robust for all specifications of the model. The frequency of price increases is also positively and significantly associated with changes in the Repo rate, but negatively associated with the level of the Repo rate, as per *Appendix 10.9*. The former may offer some evidence in the PPI microdata of a cost channel effect, and the latter that a higher level of the Repo rate may be associated with a transmission mechanism effect. Similarly, the frequency of price decreases is significantly and positively associated in real time with the level of the Repo rate (as per *Appendix 10.10* this finding is robust across all specifications of the model), and in some specifications of the model is negatively associated with changes in the Repo rate.

Fourthly, after the break in the data in 2006m3 there is a statistically significant increase in the frequency of PPI microdata price changes. This is as a result both of a statistically significant rise in the frequency of price increases and a rise in the frequency of price decreases, as reported in *Appendix 10.9* and *10.10* respectively.

### 4.6.3 Three-month lagged explanatory variables

There is evidence of state-dependence in the PPI microdata, as the data reveals that the frequency of price changes is associated with key macroeconomic developments after a three-month lag.

Firstly, the frequency of price changes is associated positively and significantly with the overall PPI rate after a three-month lag (at a 1% confidence level), but as reported in Table 51, this result is not robust for all specifications of the model, as it does not hold in the combined version of the model. The frequency of price increases is positively associated with the PPI rate after a three-month lag and the change in the PPI rate after a three-month lag, both at a 1% confidence level, with the former result being robust cross all specifications, but at a lower confidence level for the combined specification of the model, as reported in *Appendix 10.11*. For the combined specification of the model, the frequency of price decreases is negatively associated with the PPI after a three-month lag (significant at the 5% confidence level). The frequency of price decreases is also negatively associated with a change in the PPI after a three-month lag. This result is significant at the 1% confidence level when the change in the PPI is entered separately and is significant at the 10% level for the combined specification of the model, as reported in *Appendix 10.12*.

**Table 51 Frequency of changes in PPI prices (3 month lagged)**

|                 | (1)                       | (2)                       | (3)                       | (4)                       | (5)                       | (6)                       | (7)                       | (8)                       |
|-----------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
|                 | PPI                       | PPI                       | PPI                       | PPI                       | PPI                       | PPI                       | PPI                       | PPI                       |
|                 | Frequency of Price change | Frequency of Price change | Frequency of Price change | Frequency of Price change | Frequency of Price change | Frequency of Price change | Frequency of Price change | Frequency of Price change |
| January         | 0.075<br>(3.74)***        | 0.072<br>(3.00)***        | 0.073<br>(3.03)***        | 0.077<br>(3.30)***        | 0.074<br>(3.35)***        | 0.073<br>(3.16)***        | 0.083<br>(4.75)***        | 0.081<br>(5.21)***        |
| February        | 0.092<br>(4.61)***        | 0.089<br>(3.75)***        | 0.091<br>(3.75)***        | 0.090<br>(3.87)***        | 0.094<br>(4.25)***        | 0.100<br>(4.26)***        | 0.101<br>(5.75)***        | 0.105<br>(6.69)***        |
| March           | 0.029<br>(1.43)           | 0.026<br>(1.09)           | 0.027<br>(1.10)           | 0.026<br>(1.13)           | 0.030<br>(1.36)           | 0.030<br>(1.31)           | 0.036<br>(2.08)**         | 0.039<br>(2.51)**         |
| April           | 0.100<br>(4.99)***        | 0.096<br>(4.05)***        | 0.097<br>(4.02)***        | 0.093<br>(3.97)***        | 0.099<br>(4.49)***        | 0.095<br>(4.12)***        | 0.107<br>(6.13)***        | 0.106<br>(6.81)***        |
| May             | 0.084<br>(4.19)***        | 0.080<br>(3.36)***        | 0.081<br>(3.36)***        | 0.081<br>(3.48)***        | 0.084<br>(3.83)***        | 0.088<br>(3.79)***        | 0.091<br>(5.22)***        | 0.095<br>(6.06)***        |
| June            | 0.039<br>(1.97)*          | 0.035<br>(1.47)           | 0.038<br>(1.57)           | 0.034<br>(1.45)           | 0.041<br>(1.87)*          | 0.041<br>(1.78)*          | 0.038<br>(2.18)**         | 0.040<br>(2.52)**         |
| July            | 0.107<br>(5.33)***        | 0.104<br>(4.35)***        | 0.106<br>(4.37)***        | 0.108<br>(4.61)***        | 0.111<br>(5.05)***        | 0.115<br>(4.92)***        | 0.106<br>(6.06)***        | 0.111<br>(6.98)***        |
| August          | 0.075<br>(3.77)***        | 0.073<br>(3.07)***        | 0.075<br>(3.10)***        | 0.075<br>(3.21)***        | 0.078<br>(3.56)***        | 0.073<br>(3.14)***        | 0.075<br>(4.29)***        | 0.074<br>(4.69)***        |
| September       | 0.033<br>(1.65)           | 0.031<br>(1.29)           | 0.034<br>(1.40)           | 0.032<br>(1.36)           | 0.034<br>(1.53)           | 0.028<br>(1.19)           | 0.034<br>(1.94)*          | 0.029<br>(1.83)*          |
| October         | 0.092<br>(4.62)***        | 0.092<br>(3.86)***        | 0.093<br>(3.86)***        | 0.093<br>(4.00)***        | 0.096<br>(4.34)***        | 0.102<br>(4.38)***        | 0.093<br>(5.35)***        | 0.097<br>(6.20)***        |
| November        | 0.060<br>(2.99)***        | 0.060<br>(2.52)**         | 0.061<br>(2.50)**         | 0.063<br>(2.68)***        | 0.062<br>(2.81)***        | 0.061<br>(2.65)**         | 0.061<br>(3.47)***        | 0.060<br>(3.89)***        |
| L3. PPI Total - | 0.005<br>(5.28)***        |                           |                           |                           |                           |                           |                           | 0.002<br>(0.99)           |
| L3.PPIchange    |                           | 0.007<br>(1.50)           |                           |                           |                           |                           |                           | 0.004<br>(0.88)           |



|                 |                    |                    |                    |                    |                     |                    |                    |                    |
|-----------------|--------------------|--------------------|--------------------|--------------------|---------------------|--------------------|--------------------|--------------------|
| L3.Repochange   |                    |                    |                    |                    | 0.025<br>(2.16)**   |                    |                    | -0.004<br>(0.42)   |
| L3.Exchangerate |                    |                    |                    |                    |                     | -0.004<br>(2.50)** |                    | -0.002<br>(1.55)   |
| L3.Breakdummy   |                    |                    |                    |                    |                     |                    | 0.061<br>(7.41)*** | 0.052<br>(5.43)*** |
| L3. Repo Rate   |                    |                    | 0.001<br>(0.50)    |                    |                     |                    |                    | 0.002<br>(0.46)    |
| L3. Nominal     |                    |                    |                    |                    | -0.002<br>(3.57)*** |                    |                    | -0.000<br>(0.48)   |
| Constant        | 0.110<br>(7.16)*** | 0.143<br>(8.49)*** | 0.132<br>(4.87)*** | 0.142<br>(8.59)*** | 0.274<br>(6.83)***  | 0.139<br>(8.50)*** | 0.122<br>(9.61)*** | 0.136<br>(1.17)    |
| Observations    | 72                 | 72                 | 72                 | 72                 | 72                  | 72                 | 72                 | 72                 |
| R-squared       | 0.60               | 0.43               | 0.41               | 0.45               | 0.51                | 0.47               | 0.69               | 0.78               |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Secondly, the frequency of price changes is negatively associated with the nominal effective exchange rate (significant at the 1% confidence level) and changes in the exchange rate (significant at the 5% confidence level) after a three-month lag. As reported in Table 51 this result is not robust across all specifications of the model. This result is due to the fact that the frequency of price increases is negatively associated (at the 1% confidence level) with the nominal effective exchange rate, as reported in *Appendix 10.11*, although this finding is not robust across all specifications of the model. There is also evidence that the frequency of price changes and the frequency of price increases are negatively associated with changes in the exchange rate. As such, a currency appreciation is associated with a decline in the frequency of price changes and price increases after a three-month lag. There is no evidence of a significant association between the three-month lagged nominal effective exchange rate, or changes in the exchange rate, and the frequency of price decreases, as reported in *Appendix 10.12*.

Thirdly, there is evidence, significant at the 5% confidence level, that a change in the Repo rate is associated with an increase in the frequency of price changes after a three-month lag. As reported in Table 51, this result is not robust across all specifications of the model and there is no such positive relationship between the frequency of price changes and the level of the Repo rate. As reported in *Appendix 10.11*, there is a positive association between the frequency of price changes and changes in the Repo rate after a three-month lag (at the 5% confidence level) but this finding is not robust across all specifications of the model. There is a suggestion of a possible cost channel effect as the price increase frequency rises with positive changes in the Repo rate after a three-month lag. Interestingly, the level of the Repo rate is associated positively and significantly with the frequency of price decreases after a three-month lag, as reported in *Appendix*

10.12. This finding is robust across all specifications, but is at a higher level of confidence when the level of the Repo rate is entered separately (at 1% confidence) than for the combined specification of the model (at 5% confidence). This result, as is the case with the real-time data, offers some evidence of the expected monetary policy transmission mechanism, that associates a positive Repo rate change with a suppression of aggregate demand and, relatedly, with an increase in the frequency of price decreases.

#### 4.7 Analysis of magnitude of price changes using PPI micro-data

In order to analyse the potential determinants of the time series variation of the magnitude of price adjustments using the PPI micro-data three regressions are run analysing (1) the average magnitude of price changes of price that change (M), (2) the average magnitude of price increases where prices increase (M+) and (3) the average magnitude of price decreases where prices decrease (M-).

##### 4.7.1 Seasonality

There is some evidence of seasonality in the magnitude of price changes offered by the PPI microdata. As per Table 52, the magnitude of price increases is significantly larger than the December base period in June, May and March. The result for June is robust across all specifications of the model and is significant at the 5% confidence level. As discussed above, the higher magnitude of price increases in March, which like the May finding is not robust across all specifications and is significant at the 10% confidence level, is likely the effect of tax increases announced in the country's annual national budget, including fuel levy increases and in increases of so-called 'sin taxes' on tobacco and alcoholic beverages. As reported in *Appendix 10.13* and *10.14* the PPI microdata offers no evidence of seasonality in the magnitude of price changes or the magnitude of price decreases.

**Table 52 Magnitude of increases in PPI prices regressed against real time factors**

|         | (1)                              | (2)                              | (3)                              | (4)                              | (5)                              | (6)                              | (7)                              | (8)                              |
|---------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
|         | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase |
| January | 0.049                            | 0.048                            | 0.048                            | 0.047                            | 0.044                            | 0.063                            | 0.047                            | 0.056                            |

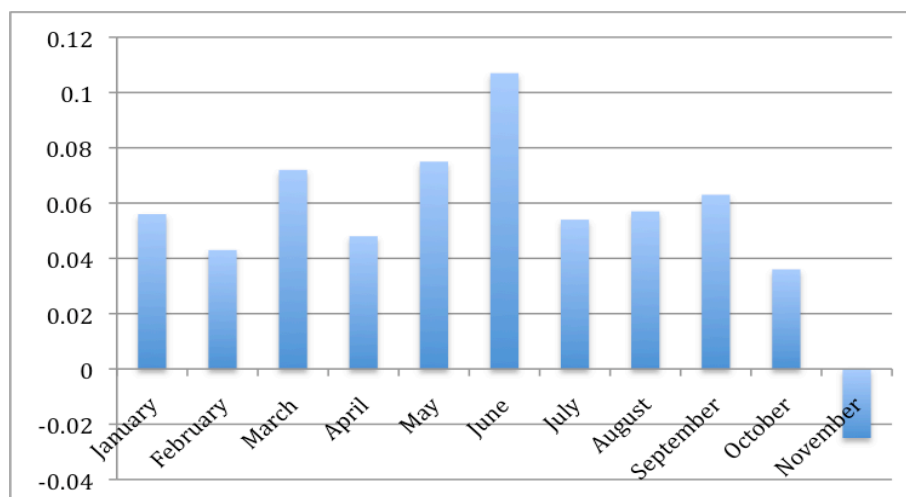
|                                               |                   |                   |                   |                   |                   |                   |                   |                   |
|-----------------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| February                                      | (1.18)<br>0.048   | (1.14)<br>0.047   | (1.15)<br>0.047   | (1.13)<br>0.048   | (1.05)<br>0.044   | (1.47)<br>0.052   | (1.12)<br>0.046   | (1.25)<br>0.043   |
| March                                         | (1.16)<br>0.063   | (1.12)<br>0.062   | (1.13)<br>0.063   | (1.14)<br>0.063   | (1.06)<br>0.060   | (1.26)<br>0.073   | (1.09)<br>0.063   | (1.00)<br>0.072   |
| April                                         | (1.54)<br>0.049   | (1.48)<br>0.049   | (1.51)<br>0.050   | (1.49)<br>0.051   | (1.45)<br>0.048   | (1.74)*<br>0.053  | (1.51)<br>0.050   | (1.68)*<br>0.048  |
| May                                           | (1.20)<br>0.062   | (1.17)<br>0.062   | (1.19)<br>0.063   | (1.21)<br>0.064   | (1.17)<br>0.060   | (1.27)<br>0.079   | (1.19)<br>0.063   | (1.14)<br>0.075   |
| June                                          | (1.51)<br>0.092   | (1.49)<br>0.092   | (1.50)<br>0.093   | (1.51)<br>0.093   | (1.45)<br>0.087   | (1.83)*<br>0.113  | (1.50)<br>0.093   | (1.71)*<br>0.107  |
| July                                          | (2.23)**<br>0.058 | (2.19)**<br>0.059 | (2.22)**<br>0.059 | (2.22)**<br>0.060 | (2.10)**<br>0.055 | (2.57)**<br>0.063 | (2.22)**<br>0.059 | (2.37)**<br>0.054 |
| August                                        | (1.41)<br>0.053   | (1.41)<br>0.054   | (1.41)<br>0.054   | (1.43)<br>0.056   | (1.34)<br>0.050   | (1.51)<br>0.067   | (1.42)<br>0.054   | (1.28)<br>0.057   |
| September                                     | (1.29)<br>0.059   | (1.30)<br>0.060   | (1.30)<br>0.060   | (1.32)<br>0.060   | (1.19)<br>0.054   | (1.57)<br>0.073   | (1.29)<br>0.060   | (1.29)<br>0.063   |
| October                                       | (1.43)<br>0.040   | (1.43)<br>0.041   | (1.43)<br>0.041   | (1.44)<br>0.042   | (1.30)<br>0.036   | (1.71)*<br>0.048  | (1.42)<br>0.041   | (1.42)<br>0.036   |
| November                                      | (0.98)<br>-0.019  | (0.98)<br>-0.018  | (0.98)<br>-0.019  | (1.00)<br>-0.018  | (0.87)<br>-0.021  | (1.15)<br>-0.018  | (0.97)<br>-0.019  | (0.83)<br>-0.025  |
| PPI Total - 7140A                             | (0.46)<br>0.003   | (0.43)<br>(1.62)  | (0.44)            | (0.43)            | (0.51)            | (0.43)            | (0.45)            | (0.58)<br>0.003   |
| PPIchange                                     |                   | 0.004<br>(0.43)   |                   |                   |                   |                   |                   | (0.71)<br>-0.003  |
| Repo Rate                                     |                   |                   | 0.002<br>(0.61)   |                   |                   |                   |                   | (0.21)<br>-0.010  |
| Breakdummy                                    |                   |                   |                   |                   |                   |                   | -0.006<br>(0.30)  | (1.06)<br>-0.021  |
| Exchangeratechange                            |                   |                   |                   |                   |                   | 0.005<br>(1.32)   |                   | (0.84)<br>0.006   |
| Nominal Effective<br>Exchange Rate -<br>5376M |                   |                   |                   |                   | -0.001<br>(1.41)  |                   |                   | (1.35)<br>-0.002  |
| Repochange                                    |                   |                   |                   | 0.008<br>(0.39)   |                   |                   |                   | (0.78)<br>-0.015  |
| Constant                                      | 0.065<br>(2.09)** | 0.085<br>(2.85)** | 0.063<br>(1.35)   | 0.084<br>(2.82)** | 0.191<br>(2.35)** | 0.075<br>(2.47)** | 0.086<br>(2.85)** | 0.351<br>(1.03)   |
| Observations                                  | 72                | 72                | 72                | 72                | 72                | 72                | 72                | 72                |
| R-squared                                     | 0.19              | 0.16              | 0.16              | 0.16              | 0.18              | 0.18              | 0.16              | 0.25              |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

For the months of June, May and March the magnitude of price increases is significantly larger than the December base period, as outlined in Fig. 28.

**Fig. 28 Seasonality in the magnitude of price increases (PPI), relative to December**



#### 4.7.2 Real-time explanatory variables

There is some evidence of real-time state-dependence in the magnitude of PPI price changes. Firstly, the magnitude of price changes is positively and significantly associated with the overall level of the PPI (at the 1% confidence level) and changes in the PPI (at the 10% confidence level). This latter finding reported in *Appendix 10.13* is robust across all specifications of the model.

As there is no significant real-time relationship between inflation and the magnitude of price increases, as reported in Table 52, the positive association between the magnitude of price change and the PPI level is due to the fact that the magnitude of price decreases (in absolute terms) is positively associated with inflation, as reported in *Appendix 10.14*. This result is opposite to the negative association found for the CPI data. The counter-intuitive result that there is a larger magnitude of price decreases (in absolute terms) in real-time during periods of PPI inflation might be driven to some extent by the PPI data anomalies discussed in Chapter 3 (at 3.4).

Another possible way to resolve this puzzle is to rationalise that when the positive relationship between the PPI level and the increased magnitude of price decreases (in absolute terms) is combined with the reported negative association between the frequency of price decreases and PPI inflation, the reduced frequency of price decreases is more impactful than the rise (in absolute terms) in the magnitude of price decreases.

Secondly, for certain specifications of the model, *Appendices 10.13* and *10.14* report a negative and statistically significant real-time association between the nominal effective exchange rate and the magnitude of price changes and the magnitude of price decreases (in absolute terms). As such a currency appreciation is associated with a smaller overall magnitude of price changes and smaller absolute price decreases. This is not equivalent to the finding of the CPI data set, where an appreciation was associated with larger price decreases in absolute terms.

Thirdly, as reported in *Appendix 10.13* there is a positive and significant real-time association between the magnitude of price changes and the Repo rate (at the 10% confidence level) and changes in the Repo rate (at the 1% confidence level). This is based on the fact of a positive and significant real-time association between the magnitude of price decreases (in absolute terms) and the Repo rate. As reported in *Appendix 10.14* this result is not robust across all specifications. A rise in the Repo rate is associated with a rise in the magnitude of price decreases (in absolute terms), which may be indicative of the working of the monetary transmission mechanism, although this effect would be expected to take place after a lag.

Fourthly, the break in the data in 2006m3 is associated with a large increase in the magnitude of price decreases, as reported in *Appendix 10.14*. This finding is robust across all specifications of the model. Relatedly, the break in the data is associated with a robust increase in the overall magnitude of price changes (as reported in *Appendix 10.13*). There is no statistically significant evidence that the magnitude of price increases is influenced by the break in the data (as reported in Table 52).

#### 4.7.3 Three-month lagged explanatory variables

Firstly, Table 53 reports that there is a positive association, significant at the 10% confidence level, between the change in the PPI rate and the magnitude of price increases after a three-month lag. This finding is robust across all specifications of the model. There is a positive association after a three-month lag between the magnitude of price changes and the magnitude of price decreases (in absolute terms) and the level of the PPI. This finding is not robust across all specifications of the model. As discussed above, this counter-intuitive finding is either due to data anomalies or is tempered by the fact that the frequency of price decreases is negatively associated with the PPI after a three-month lag – meaning that a rise in the PPI is associated with fewer, but larger price decreases.

**Table 53 Magnitude of increases in PPI prices (3 month lagged)**

|         | (1)                              | (2)                              | (3)                              | (4)                              | (5)                              | (6)                              | (7)                              | (8)                              |
|---------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
|         | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase | PPI Size<br>of Price<br>Increase |
| January | 0.049                            | 0.045                            | 0.048                            | 0.049                            | 0.048                            | 0.048                            | 0.046                            | 0.039                            |

|                                             |                           |                           |                           |                           |                             |                           |                           |                            |
|---------------------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|-----------------------------|---------------------------|---------------------------|----------------------------|
| February                                    | (1.18)<br>0.048<br>(1.16) | (1.09)<br>0.045<br>(1.10) | (1.15)<br>0.047<br>(1.13) | (1.17)<br>0.047<br>(1.12) | (1.16)<br>0.049<br>(1.18)   | (1.14)<br>0.050<br>(1.19) | (1.10)<br>0.045<br>(1.08) | (0.94)<br>0.045<br>(1.06)  |
| March                                       | 0.065<br>(1.56)           | 0.063<br>(1.53)           | 0.064<br>(1.52)           | 0.063<br>(1.51)           | 0.066<br>(1.58)             | 0.065<br>(1.54)           | 0.062<br>(1.47)           | 0.060<br>(1.44)            |
| April                                       | 0.051<br>(1.23)           | 0.048<br>(1.18)           | 0.050<br>(1.19)           | 0.049<br>(1.15)           | 0.051<br>(1.22)             | 0.049<br>(1.17)           | 0.048<br>(1.14)           | 0.046<br>(1.10)            |
| May                                         | 0.064<br>(1.55)           | 0.060<br>(1.47)           | 0.063<br>(1.50)           | 0.063<br>(1.50)           | 0.065<br>(1.56)             | 0.065<br>(1.55)           | 0.061<br>(1.46)           | 0.059<br>(1.39)            |
| June                                        | 0.094<br>(2.26)**         | 0.087<br>(2.12)**         | 0.093<br>(2.22)**         | 0.092<br>(2.18)**         | 0.095<br>(2.29)**           | 0.094<br>(2.24)**         | 0.093<br>(2.22)**         | 0.087<br>(2.03)**          |
| July                                        | 0.060<br>(1.44)           | 0.055<br>(1.35)           | 0.059<br>(1.42)           | 0.060<br>(1.43)           | 0.063<br>(1.51)             | 0.063<br>(1.48)           | 0.059<br>(1.42)           | 0.052<br>(1.21)            |
| August                                      | 0.054<br>(1.31)           | 0.050<br>(1.23)           | 0.054<br>(1.29)           | 0.054<br>(1.29)           | 0.056<br>(1.36)             | 0.053<br>(1.27)           | 0.054<br>(1.29)           | 0.044<br>(1.04)            |
| September                                   | 0.059<br>(1.43)           | 0.053<br>(1.30)           | 0.060<br>(1.42)           | 0.059<br>(1.41)           | 0.060<br>(1.44)             | 0.057<br>(1.36)           | 0.060<br>(1.43)           | 0.048<br>(1.12)            |
| October                                     | 0.040<br>(0.97)           | 0.038<br>(0.92)           | 0.041<br>(0.97)           | 0.041<br>(0.97)           | 0.042<br>(1.01)             | 0.044<br>(1.04)           | 0.041<br>(0.97)           | 0.037<br>(0.88)            |
| November                                    | -0.019<br>(0.46)          | -0.020<br>(0.49)          | -0.019<br>(0.45)          | -0.018<br>(0.43)          | -0.018<br>(0.43)            | -0.018<br>(0.44)          | -0.019<br>(0.45)          | -0.024<br>(0.56)           |
| L3. PPI Total - 7140A                       | 0.002                     |                           |                           |                           |                             |                           |                           | 0.005                      |
| L3.PPIchange                                | (1.31)                    |                           |                           |                           |                             |                           |                           | (1.27)                     |
| L3.Repochange                               |                           | 0.016<br>(1.85)*          |                           | 0.007<br>(0.34)           |                             |                           |                           | 0.020<br>(1.69)*           |
| L3.Exchange rate                            |                           |                           |                           |                           |                             | -0.002<br>(0.52)          |                           | -0.002<br>(0.64)           |
| L3.Breakdummy                               |                           |                           |                           |                           |                             |                           | -0.010<br>(0.49)          | -0.027<br>(1.03)           |
| L3. Repo Rate                               |                           |                           | 0.002<br>(0.44)           |                           |                             |                           |                           | 0.006<br>(0.66)            |
| L3. Nominal Effective Exchange Rate - 5376M |                           |                           |                           |                           | -0.001                      |                           |                           | 0.002                      |
| Constant                                    | 0.068<br>(2.14)**         | 0.087<br>(3.01)***        | 0.069<br>(1.46)           | 0.084<br>(2.85)***        | (1.19)<br>0.168<br>(2.22)** | 0.083<br>(2.81)***        | 0.088<br>(2.89)***        | (0.72)<br>-0.159<br>(0.51) |
| Observations                                | 72                        | 72                        | 72                        | 72                        | 72                          | 72                        | 72                        | 72                         |
| R-squared                                   | 0.18                      | 0.20                      | 0.16                      | 0.16                      | 0.18                        | 0.16                      | 0.16                      | 0.25                       |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Secondly, after a three-month lag the nominal effective exchange rate is negatively associated with the magnitude of price changes (as reported in *Appendix 10.15*) and absolute price decreases (as reported in *Appendix 10.16*). Therefore, as with the real-time data, an appreciation of the currency will be associated after a three-month lag with a decrease in the overall magnitude of price changes and a decrease in magnitude of price decreases (in absolute terms). This result is not robust across all specifications of the model.

Thirdly, as reported in *Appendix 10.16*, after a three-month lag there is a positive and significant (at the 5% confidence level) association between the Repo rate and the magnitude of price decreases (in absolute terms). Relatedly, the overall magnitude of price changes is positively and significantly (at the 1% confidence level) associated with

changes in the Repo rate (as reported in *Appendix 10.15*). Neither of these results is robust across all specifications of the model. The fact that the average magnitude of price decreases (in absolute terms) are positively associated with the Repo rate after a three-month lag, reinforces the equivalent finding for the real-time data and offers further evidence of the expected relationships underlying the monetary policy transmission mechanism.

#### **4.8 Conclusion: Summary of findings**

The key finding of this study is that an analysis of pricing conduct in South Africa between 2001m12 and 2007m12, using the large CPI and PPI microdata sets, reveals some evidence of seasonality and state-dependence in pricing conduct, as outlined in Table 54 and Table 55 and summarised below.

With regard to *seasonality*, the CPI microdata reveals evidence that the frequency of price changes rises during the month of March, which is most likely linked to changes in certain indirect taxes, such as, fuel taxes and excise duties on tobacco and alcohol products, announced in South Africa's national budget each year. During June there is also some evidence of a higher frequency of price changes, although this is at lower statistical confidence than the finding for March. In both March and June the elevated frequency of price change is driven by a rise in the frequency of price increases, rather than any seasonality in the frequency of price decreases. With regard to the magnitude of price changes, there is evidence in the CPI microdata that the magnitude of price increases is relatively large, and statistically significant, in March, June, April, January and September. The magnitude of price increases is largest in March, again indicating a likely relationship between price increases and taxation changes. There is no evidence of any statistically significant seasonality of price decreases, although there is some evidence of a seasonal rise in overall magnitude of price changes (including both price increases and price decreases) in December.

The PPI microdata reveals that producer prices tend not to rise in December, likely due to factory closures over that period, but that they are more likely to rise during the other months of the year. April is the month with the highest frequency of PPI price increases and the frequency of PPI price decreases is highest in July. The magnitude of PPI price increases is significantly larger in June, May and March, but that there is no seasonality in the magnitude of price decreases, or of overall price changes including both price increases and price decreases.

**Table 54 Summary of findings on seasonality in pricing conduct**

|                    | <i>CPI Data</i>                                                                                                                                                                                                                                                                                                                                           | <i>PPI Data</i>                                                                                                                                                                                                                                                                                                    |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Seasonality</b> | <p>The <b>frequency</b> of CPI price changes, driven by price increases, rises during March and to a lesser extent in June.</p> <p>The <b>magnitude</b> of price increases is relatively large in March, June, April, January and September. There is a rise in overall magnitude of price changes (price increases and price decreases) in December.</p> | <p>Producer prices tend not to rise in December, but are more likely to rise during other months. April has the highest <b>frequency</b> of PPI price increases and July has the highest frequency of PPI price decreases.</p> <p>The <b>magnitude</b> of PPI price increases is larger in June, May and March</p> |

With regard to *state-dependence* in pricing, certain themes emerge:

Firstly, with regard to *inflation and pricing conduct*, there is evidence from the CPI and PPI microdata of synchronisation in pricing, in that, pricing conduct is influenced by the prevailing level of inflation. The frequency of price changes and price increases both rise with rising inflation levels and the frequency of price decreases falls. After a three-month lag, there is evidence that the level of inflation is positively associated the frequency of price increases for the CPI and PPI microdata, but only the PPI microdata reveals a negative association between the frequency of price decreases and the level of inflation after a three-month lag. For the CPI microdata rising inflation expectations (as measured by bond-yield spreads and surveys) are strongly associated with a rising frequency of



price increases, with weaker evidence that rising inflation expectations are associated with a falling frequency of price decreases.

Furthermore, the magnitude of price changes is influenced by the prevailing level of inflation, with the CPI microdata revealing that larger price increases and smaller price decreases (in absolute) terms are associated with higher prevailing levels of inflation. This does not hold for the PPI microdata, as the magnitude of price decreases (in absolute terms) is positively associated with the prevailing level of inflation, possibly indicating data anomalies or that the fall in the frequency of price decreases in the face of inflation is more consequential than the absolute rise in the magnitude of price decreases. For the CPI microdata, after a three-month lag, inflation is positively associated with the magnitude of price increases, but has no statistically significant relationship with the magnitude of price decreases. This is not the case for the PPI microdata where after a three-month lag a rise in inflation is associated with fewer, but larger magnitude price decreases (in absolute terms). The comment on this counter-intuitive result is the same as for the real-time PPI analysis.

Secondly, with regard to the *exchange rate and pricing conduct*, there is evidence of a pass-through effect as the CPI microdata reveals that in real-time, and after a three-month lag, a currency appreciation is negatively associated with the frequency of price increases and positively associated with the frequency of price decreases. For the PPI microdata, there is evidence in real-time and after three-month lag of a negative association between a currency appreciation and the frequency of price increases, but the positive association between the frequency of price decreases and a currency appreciation is evident only in the real-time data and not after a three-month lag, when intuitively such an association would be expected to be more likely after a lag.

For the CPI microdata, both in real-time and after a three-month lag, the average magnitude of price increases is negatively associated with a currency appreciation and the average magnitude of price decreases rises (in absolute terms) when the currency appreciates. For the PPI microdata, both in real-time and after a three-month lag, a

currency appreciation is associated with a smaller average magnitude of price increases, but counter-intuitively, and distinctly from the findings for the CPI microdata, also with a smaller (absolute value) magnitude of price decreases.

Thirdly, with regard to the *policy rate and pricing conduct*, there is evidence from the CPI microdata that an increase in the Repo rate is positively associated, in real-time and after a three-month lag, with the frequencies of price changes, price increases and price decreases. *A priori* an increase in the Repo rate would be expected, particularly after a lag, to result in a suppression of aggregate demand as per the expected operation of the monetary policy transmission mechanism. Such a process would likely be associated with a decreased frequency of price increases and an increased frequency of price decreases in real-time and after a three-month lag. On the other hand, the fact that the rise in the Repo rate is associated with a rise in real-time and three-month lagged frequency of price increases can be interpreted as being indicative of a cost channel effect. A further possibility is that any negative association between the frequency of price increases and the Repo rate would be expected to reveal itself after a longer period than a three-month lag.

For the PPI microdata the finding is that, in real-time, there is evidence of a cost channel effect in that the frequency of price increases is positively associated with changes in the Repo rate and the frequency of price decreases is negatively associated with changes in the Repo rate. There is also evidence of a transmission mechanism effect as the frequency of price decreases is positively associated with the level of the Repo rate and the frequency of price increases is negatively associated with the level of the Repo rate. After a three-month lag there is also evidence of these effects, but not in all specifications of the model.

The magnitude of CPI price increases, both in real-time and after a three-month lag, is positively associated with the level of the Repo rate, evidencing a possible cost channel effect. On the other hand, in absolute terms the magnitude of price decreases is positively associated with the level of the Repo rate, evidencing the expected monetary policy

transmission mechanism effect. For the PPI microdata, a positive real-time association is in evidence between the Repo rate and the magnitude of price increases and price decreases (in absolute terms). After a three-month lag, there is evidence of a statistically significant positive relationship between the magnitude of price decreases (in absolute terms) and the Repo rate, but no such relationship between the magnitude of price increases and the Repo rate. Again, some evidence for of both cost channel and transmission mechanism effects can be gleaned from this analysis of PPI price change magnitudes.

**Table 55 Summary of findings on state-dependence in pricing conduct**

|                                             | <i>CPI Data</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <i>PPI Data</i>                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>State-dependence:<br/>Inflation rate</b> | <p>In real-time, the <b>frequency</b> of CPI price changes and price increases rises with rising inflation levels and the frequency of price decreases falls. After a three-month lag, price increases are positively associated with inflation. Rising inflation expectations are strongly associated with a rising frequency of price increases.</p> <p>In real-time a larger <b>magnitude</b> of CPI price increases and smaller price decreases (in absolute) terms are associated with higher prevailing levels of inflation. After a three-month lag, higher inflation leads to a larger magnitude of price increases, but there is no link with the magnitude of price decreases.</p> | <p>In real-time and after three month lag, the <b>frequency</b> of PPI price changes and price increases rises with rising inflation levels and the frequency of price decreases falls.</p> <p>In real-time and after a three-month lag, a rise in inflation is associated with fewer, but larger <b>magnitude</b> PPI price decreases (in absolute terms).</p> |
| <b>State-dependence:<br/>Exchange rate</b>  | <p>There is a pass-through effect as in real-time, and after a three-month lag, a currency appreciation is negatively associated with the <b>frequency</b> of CPI price increases and</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>In real-time and after three-month lag there is a negative association between a currency appreciation and the <b>frequency</b> of PPI price increases. The positive association between the</p>                                                                                                                                                             |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>State-dependence:</b></p> <p><b>Repo rate</b></p> | <p>positively associated with the frequency of price decreases.</p> <p>In real-time and after a three-month lag, the <b>magnitude</b> of CPI price increases is negatively associated with a currency appreciation and the magnitude of price decreases rises (in absolute terms) when the currency appreciates.</p> <p>An increase in the level of the Repo rate is positively associated, in real-time and after a three-month lag, with an increased <b>frequency</b> of CPI price changes, price increases and price decreases, offering evidence of 'cost channel' and 'transmission mechanism' effects.</p> <p>In real-time and after a three-month lag, the <b>magnitude</b> of CPI price increases is positively associated with the level of the Repo rate, evidencing a possible 'cost channel' effect. In absolute terms the magnitude of price decreases is positively associated with the level of the Repo rate, evidencing a 'transmission mechanism' effect.</p> | <p>frequency of price decreases and a currency appreciation is evident only in the real-time data and not after a three-month lag.</p> <p>In real-time and after a three-month lag, a currency appreciation is associated with a smaller average <b>magnitude</b> of PPI price increases, but also with a smaller (absolute value) magnitude of price decreases.</p> <p>In real-time, the <b>frequency</b> of price increases is positively associated with changes in the Repo rate and the frequency of PPI price decreases is negatively associated with changes in the Repo rate, 'cost channel' evidence. There is also evidence of a 'transmission mechanism' effect as the frequency of price decreases is positively associated, and the frequency of price increases is negatively associated, with the level of the Repo rate.</p> <p>A positive real-time association between the Repo rate and the <b>magnitude</b> of PPI price increases and price decreases (in absolute terms). After a three-month lag, there is evidence of a positive relationship between the magnitude of price decreases (in absolute terms) and the Repo rate, but no such relationship between the magnitude of price increases and the Repo rate.</p> |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## **CHAPTER 5: MODELLING THE IMPLICATIONS OF PRICING CONDUCT**

### **5.1 Introduction**

Robert King recently noted that “the new data on micro prices provides discipline on quantitative macroeconomic model building” (p.347, in King (2009)). Similarly, Angeloni et al (2006) have argued that the ultimate objective of the type of price microdata research undertaken in this paper is “to use the knowledge about price-setting behaviour at the micro level to improve currently used structural models of inflation, which can then in turn be used to derive policy implications and policy advice... Several of the most commonly used assumptions in micro-founded macro models are seriously challenged by the new findings” (p.563).

In line with such insights, this Chapter aims to enhance understanding of the implications for economic modeling and monetary policy of the pricing conduct revealed in the previous Chapters’ analysis of South Africa’s CPI and PPI microdata.

Initially, this Chapter, in section 5.2, recapitulates the role that nominal rigidities, or sticky prices, play in the context of imperfectly competitive markets where the theoretical possibility is allowed that nominal shocks will lead to real output effects. In section 5.3 a basic closed economy theoretical model is utilised to show how different assumptions on pricing conduct result in different outcomes for inflation, output and nominal and real interest rates in the face of shocks.

In section 5.4 an open economy New Keynesian Dynamic Stochastic General Equilibrium (DSGE) model developed by Steinbach et al (2009) at the South African Reserve Bank is used to analyse the impact of pricing conduct and to highlight the possible policy implications of pricing conduct revealed by the study of South Africa’s pricing microdata in the preceding Chapters. Initially, a comparative analysis is undertaken as pricing setting parameters are re-calibrated to assist in the comparison of

sticky price and flexible price scenarios. Thereafter, aspects of the CPI and PPI microdata findings from previous Chapters are incorporated in the pricing parameters of the open economy DSGE model and the impact thereof is discussed. A further refinement is then undertaken as the pricing parameters of the model are modified based on a proposed method for decomposing price changes into price re-optimisations, on the one hand, and price changes indexed to the prevailing rate of inflation, on the other. The section concludes with a discussion on the implications of the microdata for DSGE modelling, and for the form of the Phillips curve to be utilised in such models. Finally, section 5.5 concludes with a summary of the key findings.

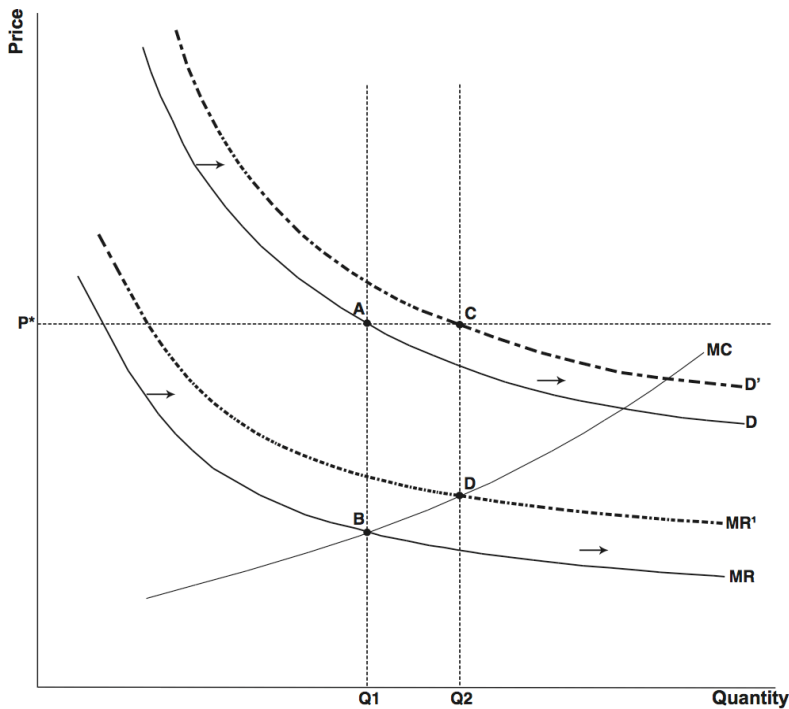
## 5.2 Imperfect competition and sticky price models

Typically, New Keynesian models assume some form of inflexibility in pricing conduct, or some form of nominal rigidity, in order for monetary disturbances to have real effects. It is worth recalling that in Keynes's original *General Theory of Employment Interest and Money* (1936) emphasis was placed on wage rigidity, whereby an increase in the money stock is associated with falling real wages as prices rise and nominal wages are sticky ( $\frac{\bar{W}}{P}$ ). This approach implied countercyclical real wages, as real wages would fall during an increase in aggregate demand allowing for increased demand for labour and increased output. The empirical basis of the countercyclical wage implication has been challenged for some time, as real wages tend to be pro-cyclical, rising as aggregate demand rises (Dunlop 1938).

According to Romer (2001), "Rather than abandoning his theory, Keynes (1939) merely argued that its description of price-setting behavior should be changed" (p322). Ever since, New Keynesian research has placed remarkable emphasis on the treatment of pricing conduct and on understanding the implications of nominal rigidities of price setting in the goods market, whereby pricing is assumed to be rigid ( $P = \bar{P}$ ) at least in the short-run.

The assumption that prices are not completely flexible is generally based, in turn, on the assumption of imperfect competition in the goods market. Firms are price-makers, rather than price-takers, they exhibit some market power in relatively inaccessible markets, which are associated with supra-normal profitability. A key factor is that such firms will respond to a positive aggregate demand shock, such as an increase in money supply, by increasing output rather than increasing prices. This is due to the fact that for such firms an effect of the positive demand shock is that marginal revenue exceeds marginal cost at the initial level of output, and, as indicated in Fig. 29, profit maximisation is facilitated by meeting additional demand with the production of more output (from  $Q_1$  to  $Q_2$ ) at the prevailing price ( $P^*$ ).

**Fig. 29 A representative firm's incentive to increase output in response to an increase in aggregate demand, under imperfect competition**



An important nuance is that imperfect competition does not in itself imply money non-neutrality. Where a change in the money stock leads to equi-proportional changes in money wages and prices output levels and real wages remain unchanged, yet output will be at less than the socially optimal level. What is implied by imperfect competition is

that in the presence of relatively inflexible prices – due to factors such as time-dependent pricing, state-dependent pricing, or menu costs – money will be non-neutral. Changes in the money stock will result in changes (in the same direction) in output and real wages, as profit maximising firms, with  $MR > MC$ , will respond to increased demand by raising output levels, potentially up until the point where  $MR = MC$ .

An implication of pricing rigidity in the context of imperfect competition is that the economy will exhibit a tendency towards countercyclical markups. As there is an increase in demand (from  $D$  to  $D'$ ) the markup, given as the ratio of price to marginal cost, declines from  $\frac{A}{B}$  to  $\frac{C}{D}$  (where  $\frac{A}{B} > \frac{C}{D}$ ). This is because the increase in demand and related increase in output leads to an increase in marginal costs and a declining marginal product of labour.

Empirically, the countercyclical markup result is well recognised in the international literature, such as, in Bils (1987), Warner and Barsky (1995), Chevalier and Scharfstein (1996) and Sbordone (2002). *A fortiori* for the South African economy, Fedderke et al (2006) find evidence of markups over marginal cost, which exceed the magnitude of United States estimates, and which are positively influenced *inter alia* by the degree of industry concentration and negatively influenced by the degree of import and export penetration.

In the context of imperfect competition, producers will set their price at a markup over marginal cost, with the size of the markup being determined by the elasticity of demand, that is,  $\frac{P_i}{P} = \frac{\eta}{\eta - 1} \frac{W}{P}$ , where  $\frac{P_i}{P}$  is the relative price of good  $i$ ,  $\eta$  is the elasticity of demand and marginal cost is represented by the real wage  $(\frac{W}{P})$ .<sup>28</sup> Such a ‘markup over marginal cost’ assumption of pricing conduct forms an important building block in the

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<sup>28</sup> Romer (2001) provides a textbook treatment of how, in the context of imperfect competition, a pricing strategy is followed based on a markup over marginal cost.



development of general equilibrium New Keynesian DSGE models, such as those discussed in the remaining parts of this Chapter.

Furthermore, such models typically include two explicit behavioral assumptions regarding pricing conduct, which facilitate the inclusion of nominal pricing rigidity into the models.

Firstly, as discussed previously in Chapter 1, it may be assumed that only a proportion of firms  $(1 - \theta)$ , reset prices in each period (Calvo (1983)). A consequence of this is that in response to a shock, all other firms  $(\theta)$  accept a sub-optimal price for their output for at least one period. Similarly, the overall price, which is an aggregation of all firms' prices is also sub-optimal, with both distributional and output consequences. As  $\theta$  rises the degree of price stickiness rises, with  $0 \leq \theta \leq 1$ .

Secondly, those prices that do not change are partially indexed, where  $\delta$  is the degree of partial indexation, to the previous period's rate of inflation. As  $\delta$  rises the degree of indexation to the previous period's inflation rises, with  $0 \leq \delta \leq 1$ , as per Smets and Wouters (2002).

Based on such a framework of pricing conduct, it is instructive to make use of formal models for comparing the impact of variations in price stickiness  $(\theta)$  and indexation  $(\delta)$ .

Initially, a basic closed economy theoretical model ('basic theoretical model') is developed which assists in isolating and comparing the impact of various degrees of price stickiness and various degrees of backward-looking indexation of prices. This model is based on an adaptation of the model used by Altissimo et al (2006) in their study of the manner in which pricing conduct impacts on inflation persistence in the European Union. In this model, the Calvo parameter  $(\theta)$  is not included explicitly, but is implicitly included as a deep parameter underlying the Phillips Curve's  $\kappa$  term, which governs the degree of responsiveness of inflation to the output gap. In this framework

$\kappa = \frac{(1-\theta)(1-\theta\beta)}{\theta}$ , where  $\beta$  is the subjective discount factor. Smaller values of  $\kappa$  indicate a higher degree of price stickiness and larger values of  $\theta$  denote a higher degree of price stickiness (Yun (1996)). In this model,  $\delta$  is used to indicate the degree of backward indexation of prices to the prevailing inflation rate, which is rising in  $\delta$ .

Thereafter, the open economy New Keynesian DSGE model developed by Steinbach et al (2009) is utilised to facilitate comparisons of the impact of different pricing conduct in the context of various shocks. In this model,  $\theta_h$  represents the degree of price stickiness amongst firms producing for the domestic market,  $\theta_f$  represents the degree of price stickiness for firms that are importing foreign goods into the domestic economy, and  $\delta$  represents the degree of backward indexation of prices to the prevailing inflation rate.

### 5.3 Basic Closed Economy Theoretical Model

The basic closed economy theoretical model used below is adapted from the work of Altissimo et al (2006) and broadly follows what Benes et al (2008) describe as the “canonical New Keynesian model of monetary transmission” (p.168). The model provides a theoretical framework for understanding the implications of particular forms of pricing behaviour for the conduct of monetary policy, or more specifically for interest rate setting.

The model defines prices as being sticky where such prices respond in a comparatively muted manner to changes in the output gap, defined as the difference between actual and potential output. In general the positive relationship between inflation and the output gap is maintained, but a high degree of price stickiness means a lower degree of inflation responsiveness to the changes in the output gap. Furthermore, the model defines the degree of backward-looking indexation as being positively associated with the degree to which price-setters base the current period’s prices on the previous period’s level of inflation.

The three-equation model includes a New Keynesian Phillips curve (NKPC), an Investment-Savings (IS) curve and a Taylor rule. The NKPC relates current inflation to its own lag, the previous period's output gap and a cost push shock. The IS curve links the current output gap to its own lagged value, the real interest rate and a demand shock. The behaviour of the policy-maker is reflected in terms of a Taylor rule, by which the nominal policy interest rate is set, based on the interest rate in the previous period, if there is a degree of interest rate smoothing, and where the interest rate depends positively on deviations from steady state inflation and the output gap. The model is outlined as follows:

$$\pi_t = \delta\pi_{t-1} + \kappa y_{t-1} + \kappa\mu_t \quad (\text{NKPC})$$

$$y_t = \beta y_{t-1} - \sigma(r_{t-1} - \pi_{t-1}) + \varepsilon_t \quad (\text{IS curve})$$

$$r_t = \phi_r r_{t-1} + \phi_\pi(\pi_t - \pi^*) + \phi_y y_t \quad (\text{Taylor rule})$$

Where:

$\pi$  = inflation,

$y$  = output gap,

$r$  = the policy interest rate,

$\mu$  = cost push shock,

$\varepsilon$  = demand shock,

$\delta$  = degree of backward indexation in pricing,

$\kappa$  = degree of price stickiness indicating inflation responsiveness to output gap and to cost shock,

$\beta$  = output persistence ,

$\sigma$  = degree of output responsiveness to real interest rate changes,

$\phi_r$  = extent of interest rate smoothing by authorities,

$\phi_\pi$  = degree of responsiveness of policy interest rate setting to the deviation of current inflation from steady state inflation ( $\pi^*$ ), and

$\phi_y$  = degree of responsiveness of policy interest rate setting to the output gap

Although for the sake of simplicity, the model omits the forward-looking aspects included by Altissimo et al (2006), it offers the proper intuition for understanding the comparative effects of cost shocks on inflation, output and interest rates of varying degrees of price stickiness and price indexation. Furthermore there are circumstances, such as a situation of relatively low stable inflation, where inflation tends to follow a random walk, where writers such as Ball and Mankiw (2002) have offered a theoretical justification for making use of backward looking inflation in this manner, as “forecasting future inflation with past inflation, as is assumed by adaptive expectations, is not far from rational” (p.8). Overall, the results suggested by the basic theoretical model, regarding the impact of cost shocks and the related policy implications, are similar to those of Altissimo et al (2006) which includes both backward and forward looking aspects.<sup>29</sup>

With the objective of advancing the heuristic value of the basic theoretical model and not endeavouring to correctly calibrate the model any actual economy, the model’s parameters are set as follows<sup>30</sup>:

$\kappa$  = variously calibrated at 0,3, 0,5 and 0,7 to compare degrees of price stickiness with stickier prices being indicated with a smaller  $\kappa$  values

$\delta$  = variously calibrated at 0,9, 0,6 and 0,3 to compare degrees of backward indexation in pricing with higher degrees of indexation being indicated by larger  $\delta$  values

$\beta$  = 0,9 indicating a high degree of output persistence

$\sigma$  = 0,06 indicating output responsiveness to real interest rate changes

$\phi_r$  = 0,2 indicating a limited degree of interest rate smoothing

$\phi_\pi$  = 1,5 as per Taylor (1993)

$\phi_y$  = 0,5 as per Taylor (1993)

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<sup>29</sup> One difference is that the model of Altissimo et al (2006) shows less inflation persistence for various degrees of price stickiness than is evident in the basic theoretical model used in this Chapter. On the other hand, both models show persistent output effects, positively associated with price stickiness.

<sup>30</sup> Altissimo et al (2006) based calibrations on Smets (2004) where  $\kappa = 0,18$ ,  $\delta = 0,48$ ,  $\beta = 0,44$ ,  $\sigma = 0,06$ ,  $\phi_r = 0,0$ ,  $\phi_\pi = 1,5$  and  $\phi_y = 0,5$

For purposes of comparing the effects of cost shocks given various degrees of price stickiness, then it is assumed that the degree of backward indexation is fixed at  $\delta = 0,9$ . In isolating the comparison of various degrees of backward indexation price stickiness is fixed at  $\kappa=0,5$ .

### 5.3.1 Comparing degrees of price stickiness

The model responds to a positive single unit cost-push shock  $\mu$  as follows: an increase in prices due to  $\mu$  leads to an increase in inflation  $\pi$  (NKPC); the increase in  $\pi$  leads to an increase in the policy interest rate  $r$  (Taylor rule); this leads to a restraining of output growth  $y$  (IS curve); which ultimately leads to the containment of inflation (NKPC).

Stickier prices, that is, prices of lower change frequency, or longer durations, are associated with smaller  $\kappa$  values. As outlined in Fig. 30, the model has different outcomes depending on whether the degree of price stickiness in the economy is *high* (long price duration and smaller  $\kappa$  values), *medium* (medium price duration and medium  $\kappa$  values), or *low* (short price duration and larger  $\kappa$  values). The more rigid prices are, the less responsive is inflation to changes in the proximate determinants such as the output gap, hence the smaller  $\kappa$  values. For the diagrams of the basic theoretical model, the x axis indicates the passing of time, notionally months or quarters, and the y axis indicates the degree of positive or negative deviation of particular variable from its steady state value (at  $y = 0$ ).

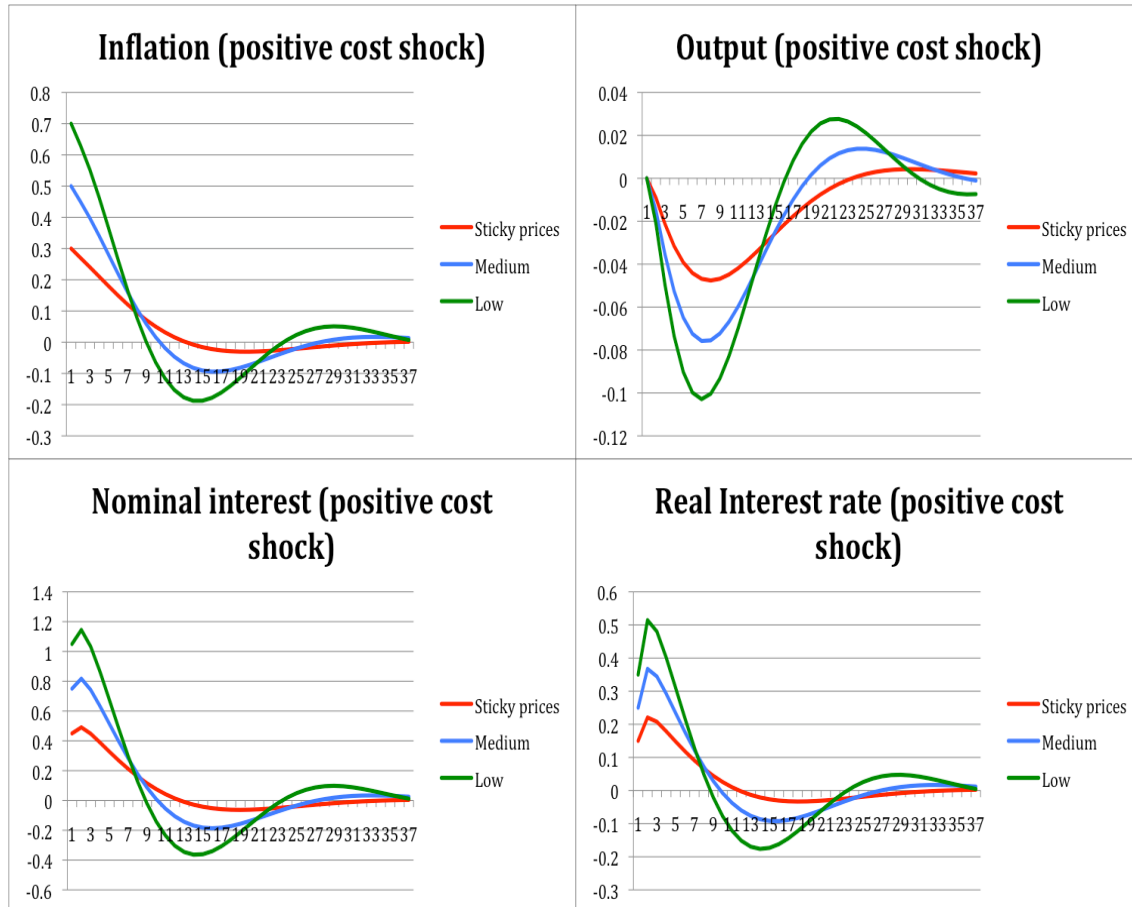
In summary, for a positive cost shock, if prices are relatively sticky (lower  $\kappa$ ) then the following time paths are observed for the various key macroeconomic variables:

*Inflation* – For relatively sticky prices, inflation increases, but by less than if prices are more flexible, and above trend inflation persists for a longer period than for more flexible prices.

*Output* – For relatively sticky prices, the negative deviation from trend output is lower than for more flexible prices, and this negative deviation from trend output persists for a longer period than for more flexible prices.

*Nominal and real interest rates* – For relatively sticky prices, there is a lower positive interest rate response than if prices are more flexible, but the above trend interest rate continues for a longer period than for more flexible prices.

**Fig. 30 Comparing the effect of varying degrees of price stickiness and responses to a positive cost shock**



From the impulse responses of the nominal and real interest rates, a higher degree of price stickiness implies a less aggressive, but more persistent, monetary policy reaction. By less aggressive it is understood that the size of interest rate changes will need to be relatively smaller (measured along the y axis) if prices are sticky. By more persistent, it is understood that interest rate increase and decreases (above or below  $y = 0$ ) take place over a longer period (measured along the x axis).

In Fig. 30 the required increase in the policy interest rate is less aggressive (smaller), but is more persistent (over a longer period), if prices are relatively sticky. This is because if prices are of a relatively long duration then, in response to a positive cost shock  $\mu$ , the increase in nominal and real interest rates required to keep inflation in check is less than would be required if price durations were relatively short and price increases were larger. The smaller size of the interest rate response is due to the fact that with small  $\kappa$  values the impact of the positive cost shock  $\mu$  will result in lower levels of inflation. The longer period over which the interest rate response must operate is due to the higher inflation persistence associated with relatively sticky prices.<sup>31</sup>

### 5.3.2 Comparing degrees of backward-looking price indexation

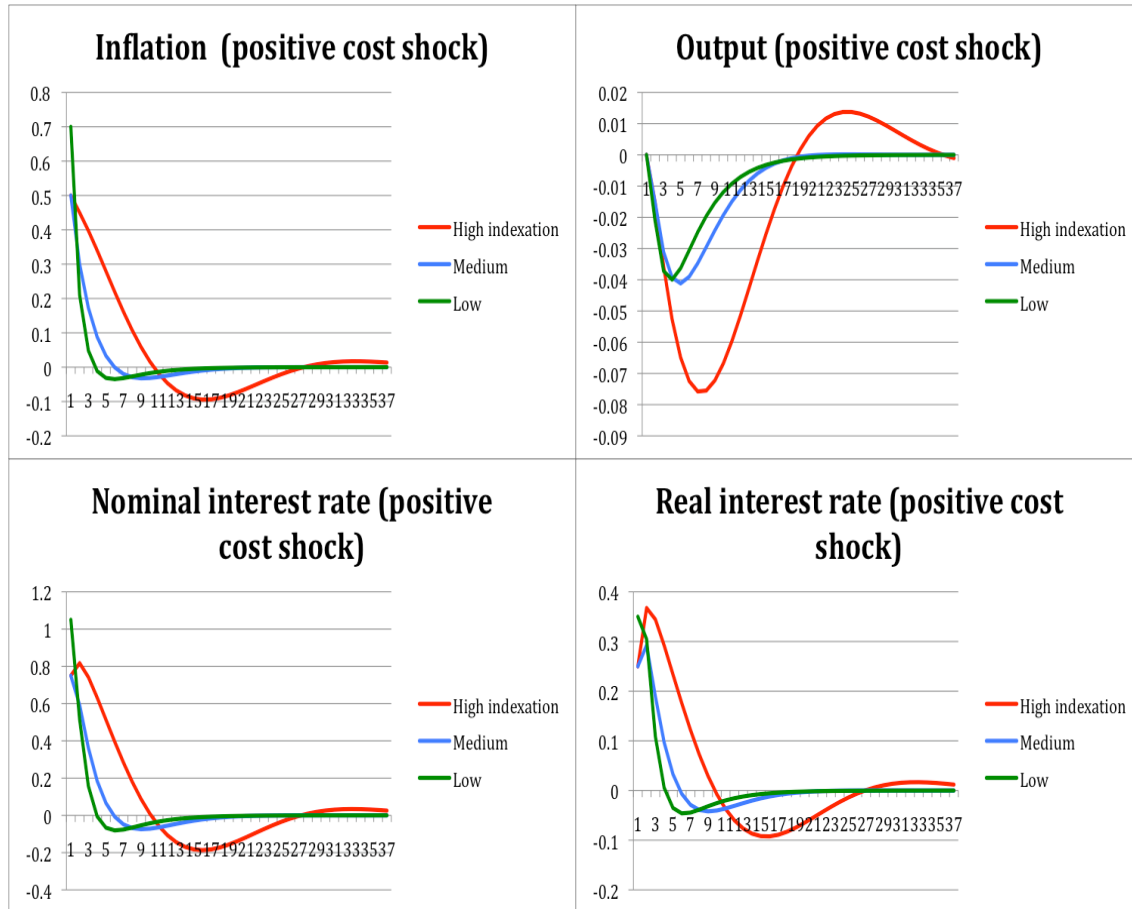
The model defines the degree of backward-looking indexation as the extent to which price-setters base the current period's prices on the previous period's level of inflation. Higher values of  $\delta$  indicate that price-setters set the current period's prices at a relatively high proportion of the inflation rate prevailing in the previous period.

As outlined in Fig. 31, the model has different responses to a positive cost shock depending on whether the degree of backward-looking price indexation in the economy is *high* (high  $\delta$  values), *medium* (medium  $\delta$  values), or *low* (low  $\delta$  values).

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<sup>31</sup> It is instructive to compare the situation of relative price stickiness ( $\kappa=0,3, 0,5$ , and  $0,7$ ) and backward indexation ( $\delta=0,9$ ) to the 'no price rigidity case' where prices adjust immediately ( $\kappa=1$ ) and where there is no backward indexation ( $\delta=0$ ). As indicated in *Appendix 11*, in the 'no price rigidity case' a positive cost shock results in a perfect inflationary response in the first period and then inflation returns rapidly and sharply to its long run trend level. Flexible prices result in a minimal deviation from trend inflation and output levels. This is due to the fact that the strong inflation response (not mediated by any price stickiness or backward indexation) results in strong response in the policy interest rate (via the Taylor rule). This leads to a rapid decline in inflation which means in turn that the policy interest rate and real interest rates decrease more rapidly than in the 'sticky price case'. As a result of this lack of persistence in inflation and elevated interest rates the negative deviation in output is also minimised. In sum, the 'sticky price case' is shown to include greater levels of inflation persistence, more prolonged nominal and real interest rates responses, and larger deviations in output than the 'no price rigidity case'. In the 'no price rigidity case' there is assumed to be no interest rate smoothing ( $\phi_r=0$ ).

**Fig. 31 Comparing the effect of varying degrees of backward looking price indexation and responses to a positive cost shock**



In summary, for a positive cost shock, if backward indexation in the economy is relatively *high* (high  $\delta$  values) then the following time paths are observed for the various key macroeconomic variables:

*Inflation* – For relatively high backward indexation, inflation increases less sharply, but more persistently, than for lower degrees of backward indexation. For high levels of backward indexation, above trend inflation persists for a longer period.

*Output* – For relatively high backward indexation, the negative deviation from trend output is larger than if backward indexation is less prevalent. Furthermore, this negative deviation from trend output persists for a longer period.

*Nominal and real interest rates* – The level of nominal and real interest rate responses is more or less the same for various degrees of backward indexation. However, both



nominal and real interest rates increases persist for a longer period where there is relatively high degree of backward indexation.

For high degrees of backward indexation the monetary policy response to a positive cost shock is *more persistent*, but *no less aggressive* than for low degrees of backward indexation. The reason is that with a higher degree of backward indexation, inflation is more persistent in response to a positive cost push shock and therefore the positive interest rate policy response is required for a longer period. For low degrees of backward indexation, the impact of a positive cost shock will be dampened and inflation will be less persistent. As a result the policy nominal interest rate and the real interest rate responses will be less persistent.<sup>32</sup>

### 5.3.3 Summary

A key implication of the model is that interest rate responses to cost shocks will have to be more persistent, but less aggressive, if prices are relatively sticky. Furthermore, if there is a relatively high degree of backward indexation of prices, then the interest rate response will have to be more persistent, but equally aggressive as compared to a relatively low degree of backward indexation.

Variations in pricing behaviour have implications for the conduct of monetary policy, as a relatively high degree of price stickiness has shown, with the aid of this basic model, to entail *less aggressive, but more persistent*, interest rates responses to cost shocks in the context of a medium term monetary policy framework. Similarly, a relatively high degree of backward indexation of prices, has been shown to require a *more persistent, but no less aggressive*, interest rate response as compared to situations of a relatively lesser degree backward indexation.

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<sup>32</sup> Altissimo et al (2006) come to the similar finding that: “The benefit of a low degree of inflation persistence is an improved inflation-output variability trade-off and a much reduced need to respond to cost-push shocks.” (p.34)

Where prices are relatively more flexible, or less sticky, then the basic theoretical model would imply that a *more aggressive, but less persistent* interest rate response would be required. This is in line with the result for the open economy DSGE model reported in the next section, where a simulation is run in the context of a price shock (equivalent to cost shock in the basic theoretical model) using the relatively flexible price scenario for domestic price setters, as suggested by the pricing microdata, and it is found that the required interest rate response should be *more aggressive, but less persistent* than the interest rate response implied by the estimated open economy DSGE model. On the other hand, the open economy DSGE model does not allow one to come to equivalent clear-cut conclusions regarding comparisons of various degrees of backward indexation in pricing conduct.

#### **5.4 Open Economy DSGE Model**

Unlike the closed economy theoretical model outlined above, open economy New Keynesian Dynamic Stochastic General Equilibrium (DSGE) model employed by Steinbach et al (2009) is estimated using Bayesian techniques on South African domestic and trade-partner data for the period 1990Q1 to 2007Q4. Price-setting is assumed to be continuous as the model makes use of a Calvo pricing assumption, whereby a specified number of firms re-optimize prices in each period, as well as allowing for a degree of backward-looking indexation of prices to past inflation. It is assumed that those prices which are not re-optimized, based on a markup over marginal cost, are partially indexed to the previous period's inflation rate. As such, all prices change each period, with a proportion of price changes, represented by  $(1 - \theta)$  being optimal, or profit maximising, and the remaining price changes, represented by  $\theta$ , being non-optimal indexations, resulting in price changes which are a proportion  $(0 < \delta < 1)$  of the previous period's inflation rate.

In order to compare the implications of different assumptions regarding pricing conduct, it is possible to make adjustments to a number of the model's key parameters, such as, the degree of price stickiness and the degree of indexation. Through such a procedure, it is possible to isolate the effect of pricing conduct variations on a number of macroeconomic

variables in the model - including output, interest rates and inflation - in the face of shocks. Shocks considered include demand shocks, policy shocks, price shocks and wage shocks.

#### 5.4.1 Workings of the model

The full details of the open economy DSGE model developed for the South African economy are outlined in Steinbach et al (2009). A log-linear approximation of the model is outlined below, where the left hand side variables indicate log deviations from the deterministic steady state. Particular attention will be paid to the price setting assumptions utilised in the model.

The consumption equation is expressed as:

$$c_t = \frac{1}{1+\nu} E_t \{c_{t+1}\} + \frac{\nu}{1+\nu} c_{t-1} - \frac{1-\nu}{\sigma(1+\nu)} [r_t - E\{\pi_{t+1}\} + \hat{\mu}_t^d]$$

where  $c$  is consumption,  $r_t$  is the nominal interest rate,  $\pi_{t+1}$  is consumer price inflation from period  $t$  to  $t+1$ , and  $\hat{\mu}_t^d$  is the risk premium on asset holdings which follows an AR(1) process, as follows  $\hat{\mu}_t^d = \rho_d \hat{\mu}_{t-1}^d + \varepsilon_t^d, \varepsilon_{t=1}^d \approx iid N(0, \sigma_d^2)$ .

The Phillips-curve type relation for nominal wage inflation ( $\pi_{w,t}$ ), which is partially indexed to consumer price inflation ( $\pi_{t-1}$ ), is expressed as follows:

$$\pi_{w,t} - \alpha \pi_{t-1} = \beta \pi_{w,t+1} - \alpha \beta \pi_t + \frac{(1-\theta_w)(1-\theta_w\beta)}{\theta_w(1+\varphi\xi_w)} \hat{\mu}_t^w$$

where the mark-up  $\hat{\mu}_t^w$  serves as a wedge between the real wage rate and the marginal rate of substitution between labour and consumption that arises due to wage stickiness ( $\theta_w$ ). Following Erceg et al (2000) it is assumed that households set wages in Calvo-style staggered contracts, that is, in every period each household may reset its existing wage contract with probability  $1 - \theta_w$ . As  $\theta_w$  rises wage setting becomes more sticky as the probability that wages will be reset declines.

The mark-up  $\hat{\mu}_t^w$  is expressed as:

$$\hat{\mu}_t^w = \frac{\sigma}{(1-\vartheta)}(c_t - \vartheta c_{t-1}) + \varphi(y_t - a_t) - \varpi + \eta_t^w$$

where  $\varpi = p_t - w_t$  is the level of the real wage and where the wage markup shock,  $\eta_t^w$  follows an AR(1) process as follows:  $\eta_t^w = \rho_w \eta_{t-1}^w + \varepsilon_t^w, \varepsilon_t^w \approx iid N(0, \sigma_w^2)$ .

The terms of trade, indicating the price of imports ( $p_{f,t}$ ) relative to the price domestically produced goods ( $p_{h,t}$ ), is expressed as follows:  $s_t = p_{f,t} - p_{h,t}$ . The overall price level is  $p_t = p_{h,t} + \gamma s_t$ . Real marginal cost is expressed in terms of the real wage, the terms of trade and productivity:  $mc_t = \varpi_t - a_t + \gamma s_t + \eta_t^p$ , where  $\eta_t^p$  serves as a stochastic cost-push shock and follows an AR(1) process:  $\eta_t^p = \rho_p \eta_{t-1}^p + \varepsilon_t^p, \varepsilon_t^p \approx iid N(0, \sigma_p^2)$ .

The New Keynesian Phillips curve for domestic inflation ( $\pi_h$ ) is derived through a combination of an optimal price-setting rule and the price level:

$$\pi_{h,t} = \frac{\delta}{1+\delta\beta} \pi_{h,t-1} + \frac{\beta}{1+\delta\beta} \pi_{h,t+1} + \frac{(1-\theta_h)(1-\theta_h\beta)}{\theta_h(1+\delta\beta)} mc_t$$

Nominal rigidity enters into the system, as it is assumed that intermediate goods firms set prices in a staggered manner as per Calvo (1983), whereby in each period  $t$ , each firm is allowed to reset its price with a probability of  $(1 - \theta_h)$ . Therefore, in a given period  $t$ , not all firms are able to react to shocks immediately. The higher is  $\theta_h$ , the stickier are prices, as a smaller number of firms, given by  $(1 - \theta_h)$ , are able to re-optimize their prices in each period. The result of  $\frac{(1-\theta_h)(1-\theta_h\beta)}{\theta_h(1+\delta\beta)}$  is that for higher values of  $\theta_h$ , shocks in marginal cost ( $mc_t$ ) will result in smaller changes to domestic inflation ( $\pi_h$ ) as prices are relatively sticky.<sup>33</sup> For lower levels of  $\theta_h$ , prices are less sticky and increases in marginal cost will result in larger inflationary effects. In the special case where prices are flexible,

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<sup>33</sup> The open economy DSGE model's positive relationship between inflation and marginal cost, mediated by the degree of price stickiness, is equivalent to the manner in which a cost shock ( $\mu$ ) in the basic model results in an increased level of inflation.

that is,  $\theta_h = 0$ , then all firms would be able to change their prices.<sup>34</sup> In the following section, it is by setting  $\theta_h$  at different levels that it is possible to use the model to assess the impact of varying degrees of price stickiness.

Following Smets and Wouters (2002), pricing inertia is also provided for in that it is assumed that domestic prices are partially indexed, indicated by the level of  $\delta$ , to the last period's domestic inflation rate ( $\pi_{h,t-1}$ ). For higher levels of  $\delta$ , there is a higher degree of indexation of prices to inflation in the previous period. In the following section, it is by setting  $\delta$  at different levels that it is possible to use the model to assess the impact of varying degrees of indexation.

Overall CPI inflation is based on a combination of domestic inflation ( $\pi_h$ ) and imported inflation ( $\pi_f$ ), which is log-linearised as follows:  $\pi_t = (1 - \gamma)\pi_{h,t} + \gamma\pi_{f,t}$ . Imported inflation ( $\pi_f$ ) can be expressed as a Phillips-curve type relationship including the import price index and optimal price setting by importing retailers, where higher price stickiness among importing retailers is indicated by higher values for  $\theta_f$ :

$$\pi_{f,t} = \beta\pi_{f,t+1} + \frac{(1 - \theta_f)(1 - \theta_f\beta)}{\theta_f}\psi_{f,t}. \quad \text{The law of one price is expressed as:}$$

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<sup>34</sup> In terms of the open economy DSGE model, firms that have the ability to change their prices in period  $t$ , will choose the optimal reset price  $\hat{P}_{h,t}$  such that they maximize the following objective:

$$E \sum_{k=0}^{\infty} \theta_h^k Q_{t,t+k} Y_{t+k}(j) [\hat{P}_{h,t} \Pi_{h,t+k-1}^{\delta} - MC_{t+k} P_{h,t+k}], \text{ subject to the demand for intermediate goods by final}$$

goods producers:  $Y_t(j) = \left[ \frac{P_{h,t}(j) \Pi_{h,t-1}^{\delta}}{P_{h,t}} \right]^{-\xi_h} Y_t$ . The optimal solution to this objective is therefore:

$$E \sum_{k=0}^{\infty} \theta_h^k Q_{t,t+k} Y_{t+k}(j) [\hat{P}_{h,t} \Pi_{h,t+k-1}^{\delta} - (1 + \mu^P) MC_{t+k} P_{h,t+k}] = 0, \text{ which states that the firm maximizes its}$$

expected future profits by setting the optimal reset price equal to the markup ( $\mu^P$ ) over a discounted stream of expected future nominal marginal cost. In the special case where prices are flexible, that is  $\theta_h = 0$ , all firms would be able to change their price in every period, and therefore the optimal pricing equation then reduces to  $\hat{P}_t = (1 + \mu^P) MC_t^n$  which implies that firms would choose a reset price that includes a constant markup ( $\mu^P$ ) over marginal cost.

$\psi_{f,t} = (e_t + p_t^*) - p_{f,t}$ , where  $\psi_{f,t}$  is the law of one price gap,  $e_t + p_t^*$  is the world price in domestic currency terms and  $p_{f,t}$  the domestic currency price of imports.

The international risk sharing condition, which indicates that, in equilibrium, the differences in marginal utilities of consumption are captured by movements in the real exchange rate, is given by:  $\frac{\sigma}{1-\vartheta}(c_t - \vartheta c_{t-1}) = \frac{\sigma}{1-\vartheta}(c_t^* - \vartheta c_{t-1}^*) + q_t$ , where  $q_t$  is the real exchange rate and the uncovered interest parity condition for the exchange rate is:

$E_t\{\Delta q_{t+1}\} = (r_t - \pi_{t+1}) - (r_t^* - \pi_{t+1}^*) + \phi_t$ , where  $\phi_t = \hat{\mu}_t^d - \hat{\mu}_t^{d*}$  is the exchange rate risk premium and where  $\hat{\mu}_t^d$  is assumed to follow an AR(1) process:  $\hat{\mu}_t^d = \rho_d \hat{\mu}_t^d + \varepsilon_t^d, \varepsilon_t^d \approx iidN(0, \sigma_d^2)$ , and where  $\hat{\mu}_t^{d*}$  is assumed to follow an analogous AR(1) process.

Aggregate demand in the domestic economy is made up of domestic demand as well as foreign demand for exports and is given as:  $y_t = (1-\gamma)c_t + \eta\gamma(2-\gamma)s_t + \gamma y_t^* + \eta\gamma\psi_{f,t}$ , where the rest of world, or foreign economy ( $y_t^*$ ), is modeled as a closed economy version of the domestic economy.

To close the model the behaviour of the domestic and foreign monetary authorities is specified using a Taylor rule. In term of this rule, the aim of the central bank is to stabilise both output and inflation, as follows:  $r_t = \rho_r r_{t-1} + (1-\rho_r)[\phi_\pi \pi_t + \phi_y(\Delta y_t)] + \varepsilon_t^r$ , where  $\rho_r$  is the degree of policy smoothing, where  $\phi_\pi$  is the relative weight on inflation, where  $\phi_y$  is the relative weight on output growth, and where  $\varepsilon_t^r \approx iidN(0, \sigma_r^2)$  represents the shocks to the policy rule. For the foreign economy an analogous Taylor rule is followed.

The parameters of the open economy DSGE model of Steinbach et al (2009) are calibrated as follows:

$\beta$  = the discount factor, set at 0,99

$\vartheta$  = the degree of habit formation, set at 0,7 (guided by Smets and Wouters (2007))

$\gamma$  = the import share in the domestic economy, set at 0,2 (guided by the actual import penetration in total South African GDP)

$\xi_w$  = the labour demand elasticity, set at 1,0

$\delta$  = the degree of backward price indexation in the domestic economy, set at 0,25 (guided by Justiniano and Preston (2004) and Adolfson et al (2005))

$\theta_w$  = the Calvo parameter for wage setting, set at 0,5 (which implies that wage contracts are reset every two quarters)

$\rho_r$  = the monetary policy smoothing parameter for the domestic economy, set at 0,73 (guided by Ortiz and Sturzenegger (2007))

$\rho_w$  = the persistence parameter for a wage shock in the domestic economy, set at 0,8

$\sigma^*$  = the intratemporal elasticity of substitution for the foreign economy, set at 1,0

$\delta^*$  = the degree of backward price indexation in the foreign economy, set at 0,5 (guided by Smets and Wouters (2002))

$\rho_w^*$  = the persistence parameter for a wage shock in the foreign economy, set at 0,8

$\rho_r^*$  = the monetary policy smoothing parameter for the foreign economy, set at 0,8

The other parameters of the model are estimated using Bayesian techniques, with the prior and posterior means listed as follows:

Structural parameters:

$\sigma$  = inverse of substitution elasticity (prior mean = 1) (posterior mean = 1,026)

$\eta$  = home/foreign substitution elasticity (prior mean = 1) (posterior mean = 0,591)

$\alpha$  = wage-price indexation (prior mean = 0,75) (posterior mean = 0,696)

$\theta_h$  = Calvo: domestic prices (prior mean = 0,75) (posterior mean = 0,539)

$\theta_f$  = Calvo: imported prices (prior mean = 0,75) (posterior mean = 0,672)

Taylor rule weights:

$\phi_\pi$  = inflation (prior mean = 1,5) (posterior mean = 1,389)

$\phi_y$  = Output (prior mean = 0,5) (posterior mean = 0,625)

Persistence parameters:

$\rho_\alpha$  = AR(1): productivity (prior mean = 0,8) (posterior mean = 0,727)

$\rho_d$  = AR(1): demand (prior mean = 0,8) (posterior mean = 0,639)

$\rho_p$  = AR(1): domestic prices (prior mean = 0,8) (posterior mean = 0,743)

Standard deviations of domestic shocks:

$\sigma_\alpha$  = iid shock: productivity (prior mean = 2) (posterior mean = 1,151)

$\sigma_d$  = iid shock: demand (prior mean = 2) (posterior mean = 0,483)

$\sigma_w$  = iid shock: wages (prior mean = 2) (posterior mean = 1,403)

$\sigma_p$  = iid shock: costs (prior mean = 2) (posterior mean = 1,952)

$\sigma_r$  = iid shock: monetary policy (prior mean = 2) (posterior mean = 0,366)

With regard to the degree of price stickiness, the Calvo parameters for domestic firms ( $\theta_h = 0,539$ ), and importing firms ( $\theta_f = 0,672$ ), utilised by Steinbach et al (2009) imply that the average duration of domestic and imported prices is 2 to 3 quarters. This is a somewhat lower degree of price stickiness than that estimated by Alpana et al (2009) in their recent study of the South African economy where the average duration of prices is found to extend to about 5 quarters for both domestic and imported prices.

Furthermore, Steinbach et al's (2009) model calibrates the degree of price indexation ( $\delta$ ) at 0,25, which compares to 0,22 for Sweden (in Adolfson et al (2005)) and below the 0,2 value employed for the small open economies of Australia, Canada and New Zealand by Justiniano and Preston (2004).

#### **5.4.2 Comparative Analysis**

In order to understand the comparative dynamic effects of various pricing scenarios, the open economy DSGE model was then run using alternative parameter levels for  $\delta$ ,  $\theta_h$  and  $\theta_f$ . For comparative purposes, alternative parameters are set at an upper (sticky) level and a lower (flexible) level. Higher levels for  $\theta_h$  and  $\theta_f$  indicate a higher degree of price stickiness, as a smaller proportion of domestically producing firms and importing firms, re-optimize prices in each period, given by  $(1-\theta_h)$  and  $(1-\theta_f)$  respectively. A higher  $\delta$  indicates a higher degree of backward indexation in pricing, and a lower  $\delta$  indicates a lower degree of backward indexation in pricing. These upper (sticky) and



lower (flexible) parameters are then compared to the open economy DSGE model's baseline case, as outlined in Table 56.

**Table 56 Comparison of pricing conduct**

|            | Baseline scenario | Sticky price scenario | Flexible price scenario |
|------------|-------------------|-----------------------|-------------------------|
| $\theta_h$ | 0,539             | 0,839                 | 0,239                   |
| $\theta_f$ | 0,672             | 0,972                 | 0,372                   |
| $\delta$   | 0,25              | 0,5                   | 0                       |

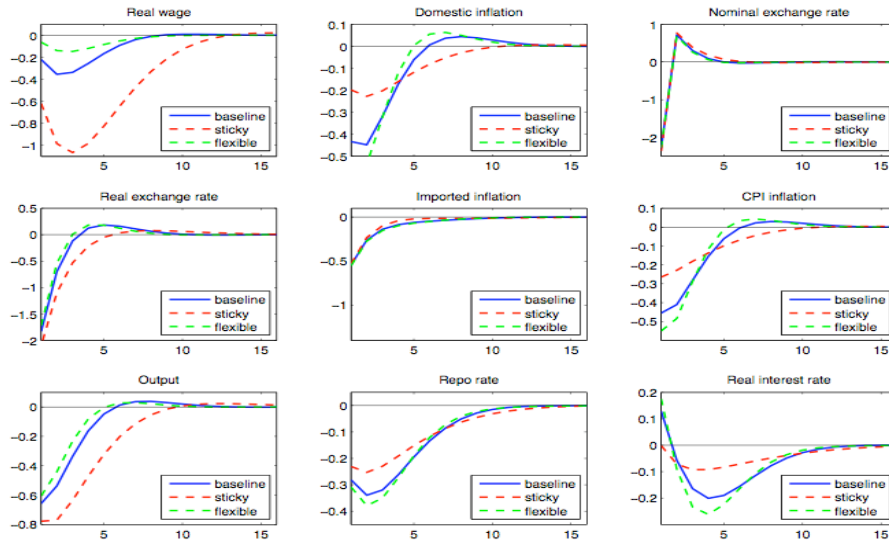
Such a comparison is made in the context of a number of possible shocks that the economy may experience, such as, a fall in aggregate demand (“a demand shock”), an increase in the policy interest rate (“a policy shock”), an increase in costs (“a price shock”), or an increase in wages (“a wage shock”). The impulse responses to a standard deviation temporary shock for each of these types of shocks is reported below and in *Appendices 11 - 12*, for real wage levels, domestic inflation, the nominal exchange rate, the real exchange rate, imported inflation, CPI inflation, output, the Repo rate and the real interest rate. The discussion below offers a comparison of various degrees of domestically-producing-firm price stickiness ( $\theta_h$ ). *Appendix 11* outlines a comparison of various degrees of importing-firm price stickiness ( $\theta_f$ ). *Appendix 12* outlines a comparison of various degrees of backward price indexation ( $\delta$ ).

The main result is that the degree of price stickiness for domestically-producing-firms ( $\theta_h$ ) has a significant effect on the economic outcomes in the context of various shocks, as discussed below. On the other hand, the degree of price stickiness for importing-firms ( $\theta_f$ ) does not have a comparably significant effect, except on the degree of imported inflation, as outlined in *Appendix 11*. The degree of backward price indexation ( $\delta$ ) does not have a significant effect on economic outcomes, as outlined in *Appendix 12*.

### 5.4.2.1 Comparing responses to a negative demand shock

As reported in Fig. 32, in response to a negative demand shock, the decline in domestic inflation ( $\pi_{h,t}$ ) and CPI inflation ( $\pi_t$ ) is of smaller magnitude, but is more persistent in the sticky price scenario. Domestic inflation ( $\pi_{h,t}$ ) and CPI inflation ( $\pi_t$ ) decline more sharply, that is by a larger magnitude, in the flexible price scenario. In the flexible price scenario, CPI inflation ( $\pi_t$ ) stabilises after about 5 quarters, whereas it takes about 10 quarters for CPI inflation ( $\pi_t$ ) to stabilise in the sticky price scenario. There is no significant difference amongst the various price scenarios for imported inflation ( $\pi_{f,t}$ ), which in all scenarios initially decline and then stabilises after about 5 quarters.<sup>35</sup>

**Fig. 32 Comparing responses to a negative demand shock for various scenarios where  $\theta_h$  is set at baseline ( $\theta_h = 0,539$ ) sticky ( $\theta_h = 0,839$ ) and flexible ( $\theta_h = 0,239$ ) levels**



Output ( $y_t$ ) declines more sharply and over a longer period, in the sticky price scenario. In the flexible price scenario, output ( $y_t$ ) stabilises after about 5 quarters, whereas it takes about 10 quarters for output ( $y_t$ ) to stabilise in the sticky price scenario.

<sup>35</sup> In general, the effect of higher or lower degrees of price stickiness for importing-firms ( $\theta_f$ ) has a smaller economic impact than such changes in pricing conduct by domestically producing firms ( $\theta_h$ ). In the sticky price scenario for ( $\theta_f$ ), a negative demand shock basically results in no change in imported inflation, whereas the flexible price scenario results in a sharp decrease in imported inflation for a short period.

There are no significant differences for the nominal exchange rate ( $\Delta e_t$ ) among the baseline, sticky price and flexible price scenarios, as in all cases there is a brief appreciation followed by a depreciation of the nominal exchange rate. The appreciation of the real exchange rate ( $q_t$ ) is more persistent in the sticky price scenario. This prolonged period of real exchange rate appreciation adds impetus to the persistent decline in inflation and output in the sticky price scenario.

Due to this relatively muted disinflation effect, the sticky price scenario results in a relatively sharp decline in real wages ( $\varpi_t$ ) in response to a negative demand shock.

In the context of reduced output and reduced inflation, the monetary authorities reduce the policy interest rate (Repo rate)( $r_t$ ), as per the Taylor rule. As a result of output and inflation persistence, the reduction in the Repo rate is less aggressive, but is more persistent, in the sticky price scenario. This lower level of aggression is mainly due to the fact that the sticky price scenario results in a smaller reduction in inflation than is the case with the flexible price scenario.

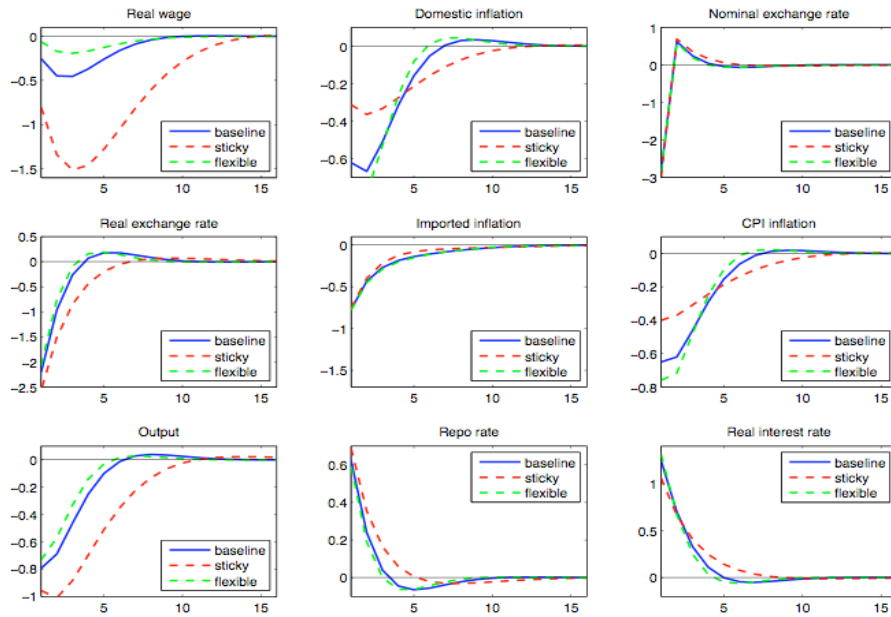
Furthermore, in the sticky price scenario, the decline in the real interest rate ( $r_t - E_t\{\pi_{t+1}\}$ ) is less aggressive than in the flexible price scenario. For the baseline and flexible price scenarios there is initially an increase in the real interest rate ( $r_t - E_t\{\pi_{t+1}\}$ ) and then a sharp decline in the real interest rate as relative price flexibility means that initial low inflation level results in a higher real interest rate (for the first and second quarters) and then as inflation stabilises more rapidly the real interest rate falls sharply (by the third and fourth quarter). This fall in the real interest rate, facilitated by stabilizing inflation, allows for more rapid output ( $y_t$ ) recovery in the baseline and flexible price scenarios.

#### **5.4.2.2 Comparing responses to a positive policy interest rate shock**

As outlined in Fig. 33, in response to a positive policy interest rate shock, the decline in domestic inflation ( $\pi_{h,t}$ ) and CPI inflation ( $\pi_t$ ) is less sharp, but is more persistent in the

sticky price scenario. Domestic inflation ( $\pi_{h,t}$ ) and CPI inflation ( $\pi_t$ ) decline more sharply in the flexible price scenario. In the flexible price scenario, CPI inflation ( $\pi_t$ ) stabilises after about 5 quarters, whereas it takes about 10 quarters for CPI inflation ( $\pi_t$ ) to stabilise in the sticky price scenario. There is no net cost-channel effect, where higher interest rates result in higher inflation, as the net effect of reduced aggregate demand, inter alia as a result of increased borrowing costs, is to lead to lower levels of inflation. There is no significant difference amongst the various price scenarios for imported inflation ( $\pi_{f,t}$ ), which in all scenarios initially declines and then stabilises after about 10 quarters.<sup>36</sup>

**Fig. 33 Comparing responses to a positive interest rate shock for various scenarios where  $\theta_h$  is set at baseline ( $\theta_h = 0,539$ ) sticky ( $\theta_h = 0,839$ ) and flexible ( $\theta_h = 0,239$ ) levels**



As a result of the policy rate increase, output ( $y_t$ ) declines more sharply and more persistently and only stabilises after about 10 quarters, in the sticky price scenario. In the flexible price and baseline scenarios, output ( $y_t$ ) stabilises after about 5 quarters.

<sup>36</sup> In the sticky price scenario for ( $\theta_f$ ), a positive policy rate shock basically results in no change in imported inflation, whereas the flexible price scenario results in a sharp decrease in imported inflation for a short period.

There are no significant differences for the nominal exchange rate ( $\Delta e_t$ ) among the baseline, sticky price and flexible price scenarios, as in all cases there is a brief appreciation followed by a depreciation. The appreciation of the real exchange rate ( $q_t$ ), in response to the interest rate hike, is more persistent in the sticky price scenario, adding impetus to the persistent decline in inflation and output in this scenario.

Due to relatively muted disinflation effect, the sticky price scenario results in a relatively sharp decline in real wages ( $\varpi_t$ ) in response to a positive interest rate shock and the associated decrease in output and aggregate demand.

The increase in the policy interest rate (Repo rate)( $r_t$ ) is more persistent in the sticky price scenario lasting for about 5 quarters, as compared to about half that time for the flexible price and baseline scenarios. Furthermore, in the sticky price scenario, the increase in the real interest rate ( $r_t - E_t\{\pi_{t+1}\}$ ) is more persistent than in the flexible price scenario.

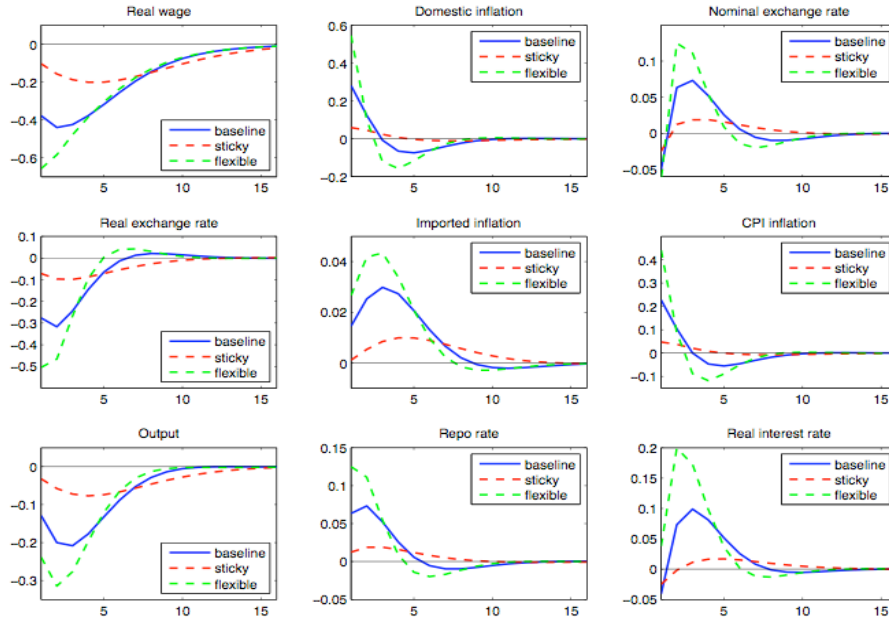
#### **5.4.2.3 Comparing responses for a positive price shock or cost shock**

As outlined in Fig. 34, in response to a positive price shock, or cost shock, the increase in domestic inflation ( $\pi_{h,t}$ ) and CPI inflation ( $\pi_t$ ) is greater for the flexible price scenario than for the sticky price scenario, but inflation is more persistent in the sticky price scenario as it takes 5 quarters to stabilise in the sticky price scenario as compared to about half that time in the flexible price scenario. Similarly, for imported inflation ( $\pi_{f,t}$ ), the flexible price scenario experiences a sharper but less persistent inflation increase than the sticky price scenario, although in all scenarios imported inflation ( $\pi_{f,t}$ ) initially rises for some time and then begins to fall.<sup>37</sup>

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<sup>37</sup> In the sticky price scenario for ( $\theta_f$ ), a positive price shock, or cost shock, basically results in no change in imported inflation, whereas the flexible price scenario results in a sharp increase in imported inflation for a period of about 8 quarters.

**Fig. 34 Comparing responses to a positive price shock or cost shock for various scenarios where  $\theta_h$  is set at baseline ( $\theta_h = 0,539$ ) sticky ( $\theta_h = 0,839$ ) and flexible ( $\theta_h = 0,239$ ) levels**



Output ( $y_t$ ) declines less sharply and over a longer period, in the sticky price scenario. In the flexible price scenario, output ( $y_t$ ) stabilises after about 10 quarters, whereas it takes about 15 quarters for output ( $y_t$ ) to stabilise in the sticky price scenario. This is due to the fact that the smaller price increases in the sticky price scenario are necessarily associated with a smaller interest rate response and therefore less output contraction.

In response to a positive price shock, the real exchange rate ( $q_t$ ) initially appreciates more sharply in the flexible price scenario due to the larger real interest rate differential with the foreign economy, which in turn is due to the higher policy rate response (based on the Taylor rule) in the flexible price scenario. For the sticky price scenario, the real exchange rate ( $q_t$ ) appreciates less sharply, but more persistently. In all price scenarios the nominal exchange rate ( $\Delta e_t$ ) initially appreciates and then depreciates - more sharply, but less persistently for the flexible price scenario than for the sticky price scenario.

As price stickiness means a smaller inflation response in the context of a positive cost shock, the sticky price scenario results in a relatively small decline in real wages ( $\varpi_t$ ). In the flexible price scenario, real wages ( $\varpi_t$ ) drop sharply due to the relatively high inflation level in the overall context of decreased output and aggregate demand.

In the flexible price scenario both the policy rate ( $r_t$ ) and the real interest rate ( $r_t - E_t\{\pi_{t+1}\}$ ) increases are higher than in the sticky price scenario. This is due to the Taylor rule's responsiveness to the flexible prices scenario's higher rate of inflation. In the sticky price scenario, both the policy rate ( $r_t$ ) and the real interest rate ( $r_t - E_t\{\pi_{t+1}\}$ ) responses are less aggressive, but more persistent.

#### 5.4.2.4 Comparing responses for a positive wage shock

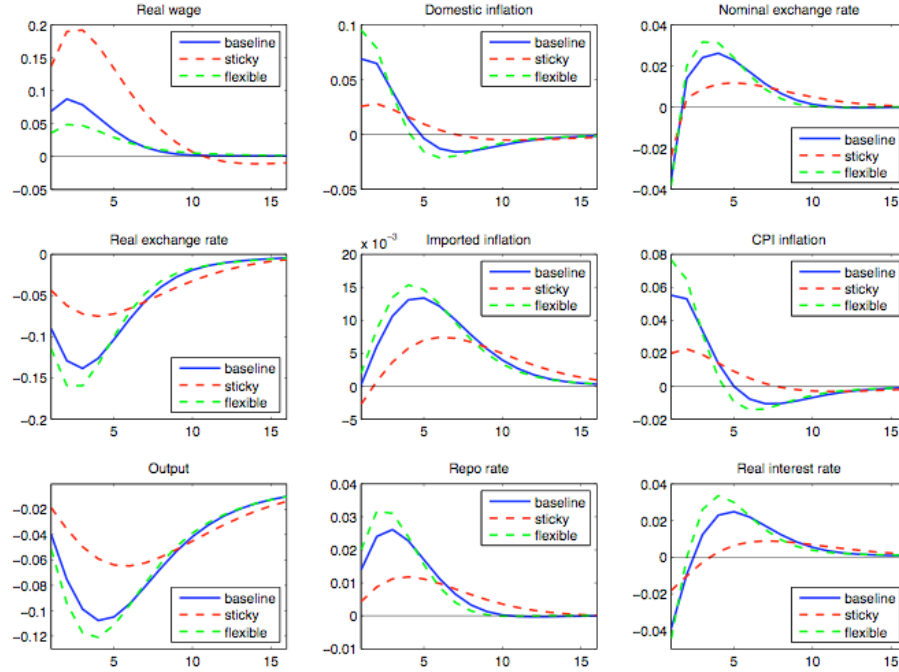
As outlined in Fig. 35, in response to a positive wage shock, the increase in domestic inflation ( $\pi_{h,t}$ ) and CPI inflation ( $\pi_t$ ) is less sharp, but more persistent, in the sticky price scenario. Both  $\pi_{h,t}$  and  $\pi_t$  rise more sharply in the flexible price scenario. In the flexible price scenario,  $\pi_t$  stabilises after about 4 quarters, whereas it takes about 8 quarters for  $\pi_t$  to stabilise in the sticky price scenario. Imported inflation ( $\pi_{f,t}$ ) also increases in all scenarios, but less aggressively and more persistently in the sticky price scenario.<sup>38</sup>

Output ( $y_t$ ) declines less sharply in the sticky price scenario. And in all scenarios it takes about 15 quarters for output ( $y_t$ ) to stabilise. Even though the sticky price scenario is associated with the sharpest increase in real wages, the lower inflation in this scenario results in a less aggressive interest rates response, which means that output is less severely affected in the sticky price scenario.

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<sup>38</sup> In the sticky price scenario for ( $\theta_f$ ), a positive wage shock basically results in no change in imported inflation, whereas the flexible price scenario results in an initial decrease in imported inflation followed by an increase in imported inflation for a period of about 10 quarters.

**Fig. 35 Comparing responses to a positive wage shock for various scenarios where  $\theta_h$  is set at baseline ( $\theta_h = 0,539$ ) sticky ( $\theta_h = 0,839$ ) and flexible ( $\theta_h = 0,239$ ) levels**



In all cases there is a brief appreciation followed by a depreciation of the nominal exchange rate ( $\Delta e_t$ ). The appreciation of the real exchange rate ( $q_t$ ) is relatively persistent in all scenarios, lasting about 15 quarters, but is less sharp in the sticky price scenario.

The muted inflation associated with the sticky price scenario means that a positive wage shock results in a relatively large increase in real wages ( $\varpi_t$ ). In the flexible price scenario, real wages ( $\varpi_t$ ) rise less sharply due to the relatively high inflation level. In all scenarios real wages stabilise after about 10 quarters.

In response to a wage shock, the flexible price scenario sees both the policy rate ( $r_t$ ) and the real interest rate ( $r_t - E_t\{\pi_{t+1}\}$ ) increase more sharply than the sticky price scenario. This is due to the Taylor rule's responsiveness to the higher rate of inflation which prevails when prices are flexible. In the sticky price scenario, both the policy rate ( $r_t$ ) and the real interest rate ( $r_t - E_t\{\pi_{t+1}\}$ ) responses are less aggressive, but more persistent.



### 5.4.3 Incorporating the results from the CPI and PPI microdata

It is instructive to compare the various assumptions on pricing used in the open economy DSGE model simulations to the findings on price setting from the CPI and PPI microdata. The parameters  $\theta_h$  and  $\theta_f$  indicate the degree of price stickiness, with increases in  $\theta_h$  and  $\theta_f$  indicating an increasing degree of price stickiness as a declining proportion of firms, given by  $(1-\theta_h)$  and  $(1-\theta_f)$ , re-optimize prices in each period.

The South African microdata for the period 2001m12 to 2007m12 indicates that the frequency of price changes, or the proportion of firms changing their prices in each month, varies over time and shows some evidence of time-dependency and dependency on the state of the economy. Using the CPI microdata, the directly measured mean duration of prices is 3,9 months for the full data set, which translates to 4,0 months (1,3 quarters) when the CPI or CPIX weighting is utilised.<sup>39</sup> For the PPI microdata, the directly measured mean duration of prices is 3,4 months, which translates to 3,5 months (1,2 quarters) when re-weighting in terms of the weighting given to the industry categories in the PPI. The PPI microdata reveals that the prices for local products have a somewhat longer mean duration of 3,7 months, the prices of exported products have a mean duration of 3,5 months and prices of imported products have a mean duration of 3,0 months.

The open economy DSGE model estimates Calvo parameters for domestic firms ( $\theta_h$ ) at 0,539 and for importing firms ( $\theta_f$ ) at 0,672. The inverses of  $(1-\theta_h)$  and  $(1-\theta_f)$  are used to calculate the monthly duration of prices from the Calvo parameter. This translates to an average price duration of  $(1-0,539)^{-1}$ , equaling 2,2 quarters (6,5 months) for domestic

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<sup>39</sup> As noted previously, longer unbroken data periods lend themselves to the measurement of longer price durations and as a result the average duration of prices for uncensored price spells for the period before the break in the data is 4,2 months.

prices and average price duration  $(1 - 0,672)^{-1}$ , equaling 3,1 quarters (9,14 months) for imported prices.

Therefore, the price microdata offers evidence that on average measured price durations are shorter than the mean price durations estimated in Steinbach et al.'s (2009) open economy DSGE model. In summary, measured prices are less sticky than those used in the DSGE model, as:

- for the DSGE model pricing by domestic firms ( $\theta_h$ ) estimates a 2,2 quarter average price duration (where  $\theta_h = 0,539$ ), whereas from the CPI microdata the average price duration for domestically producing firms is about 1,3 quarters (or  $\theta_h = 0,231$ )<sup>40</sup>; and
- for the DSGE model pricing by importing firms ( $\theta_f$ ) estimates a 3,1 quarter average price duration (where  $\theta_f = 0,672$ ), whereas from the PPI microdata the average price duration for importing firms is about 1 quarter (or  $\theta_f = 0,0$ ).

It is then possible to compare the open economy DSGE model's 'baseline' scenario - where  $\theta_h = 0,539$ ,  $\theta_f = 0,672$  and  $\delta = 0,25$ , with the 'alternative' scenario, informed by the pricing microdata, where:  $\theta_h = 0,231$ ,  $\theta_f = 0,0$  and  $\delta = 0,25$ , as outlined in Table 57.

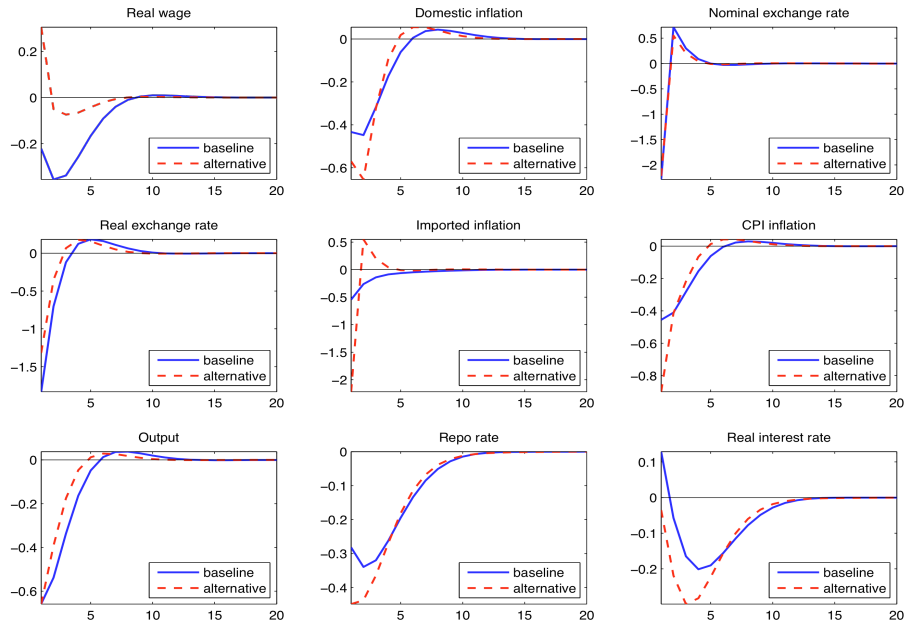
**Table 57 Comparison the 'baseline' and microfounded 'alternative' scenarios**

|            | Baseline scenario | Alternative scenario |
|------------|-------------------|----------------------|
| $\theta_h$ | 0,539             | 0,231                |
| $\theta_f$ | 0,672             | 0,0                  |
| $\delta$   | 0,25              | 0,25                 |

<sup>40</sup> Here the result for the entire sample of the CPI microdata is used to estimate  $\theta_h$  as the disaggregation of the CPI microdata into a domestic and an imported component is not provided for in the underlying data, although a study by Blignaut et al (2006) estimates that imports make up around 15% of the CPIX and around 14% of the CPI, implying that about 85% (86%) of the movement in the CPIX (CPI) is accounted for by domestic factors.

In Figs. 36 to 39 it is possible to compare how the ‘baseline’ and ‘alternative’ scenarios respond to various shocks, such as, a negative demand shock (Fig. 36), a positive policy rate shock (Fig. 37), a positive price shock (Fig. 38), and a positive wage shock (Fig. 39).

**Fig. 36 Comparing ‘baseline’ scenario with ‘alternative’ microfounded scenario in the context of a negative demand shock**



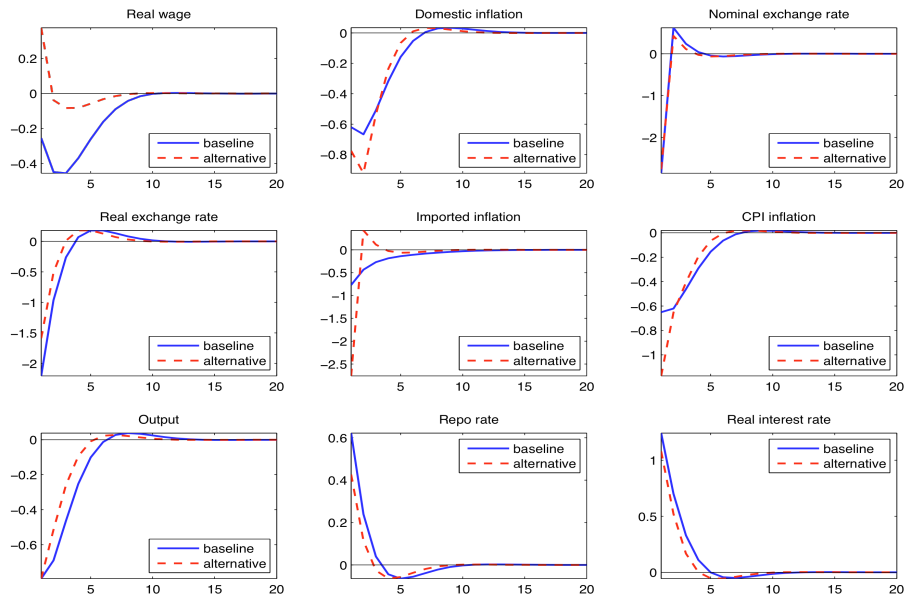
In response to a negative demand shock, the impulse responses of the ‘alternative’ scenario (as compared to the ‘baseline’ scenario) reveal the following:

- a sharper decline in the rate of overall inflation, domestic inflation and imported inflation but this effect is less persistent in the ‘alternative’ scenario, as in this scenario all measures of inflation return more rapidly to their steady state levels (after overshooting briefly);
- a less sharp and less persistent decline in output, probably driven by the sharper decrease in interest rates associated with the ‘alternative’ scenario;
- an initial appreciation of the real and nominal exchange rate is followed by some overshooting before a return to a steady state (which is broadly equivalent to the result in the ‘baseline’ scenario);
- a sharper initial increase in real wages, due to the ‘alternative’ scenario’s relative price flexibility and sharper deflation in response to a negative

demand shock (given that wage setting assumptions remain the same across the ‘alternative’ and ‘baseline’ scenarios and only price setting assumptions are adjusted); and

- a larger magnitude reduction in the Repo rate and real interest rate is required in the ‘alternative’ scenario due to the sharper deflation in this scenario (and this may assist in the speedier recovery of output), although the persistence of the interest rate responses is broadly equivalent across the two scenarios.

**Fig. 37 Comparing ‘baseline’ scenario with ‘alternative’ microfounded scenario in the context of a positive policy shock**



In response to a positive policy shock (or interest rate increase), the impulse responses of the ‘alternative’ scenario (as compared to the ‘baseline’ scenario) reveal the following:

- a sharper decline in the rate of CPI inflation, domestic inflation and imported inflation in the ‘alternative’ scenario as compared to the ‘baseline’ scenario, with some overshooting of imported inflation on its return to steady state, and with the overall CPI and domestic inflation

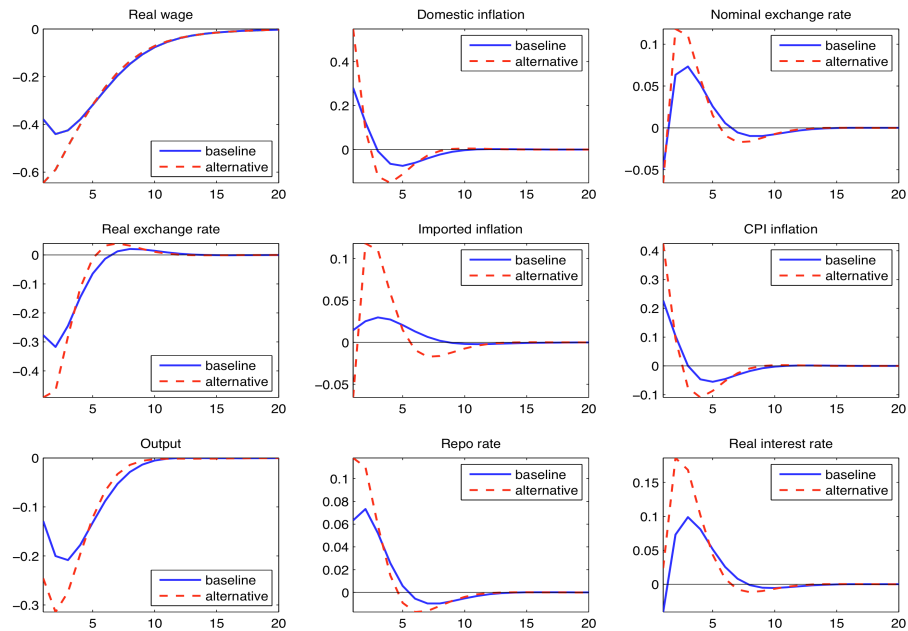
being marginally less persistent in the ‘alternative’ scenario as compared to the ‘baseline’ scenario;<sup>41</sup>

- a marginally less persistent decline in output, probably driven by the ‘alternative’ scenario’s marginally less persistent increase in interest rates;
- an appreciation and overshoot of the nominal and real exchange rates, which is marginally less persistent in the ‘alternative’ scenario as compared to ‘baseline’ scenario;
- a brief but non-persistent increase in real wages is a feature of the ‘alternative’ scenario which is likely due to the sharper reduction in prices in this scenario; and
- the magnitude of the increases in the repo rate and real interest rate are equivalent across the ‘alternative’ and ‘baseline’ scenarios, but the interest rate response is marginally less persistent in the ‘alternative’ scenario, mainly due to the fact that this scenario’s greater price flexibility results in less persistent output and inflation responses.

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<sup>41</sup> It is noteworthy that for both the ‘baseline’ and ‘alternative’ scenarios, the open economy DSGE model lacks a positive inflation response to an interest rate increase, even though such a positive association is reported through the regression analysis undertaken in the previous Chapter and is suggestive of ‘cost channel’ effects. The open economy DSGE model allows for no real-time or lagged ‘cost channel’ effect as the interest rate increase is immediately associated with declines in the various measured rates of inflation, which is sharper but less persistent in the ‘alternative’ (more flexible price) scenario.

**Fig. 38 Comparing ‘baseline’ scenario with ‘alternative’ microfounded scenario in the context of a positive price shock or cost shock**



In response to a positive price shock or cost shock, the impulse responses of the ‘alternative’ scenario (as compared to the ‘baseline’ scenario) reveal the following:<sup>42</sup>

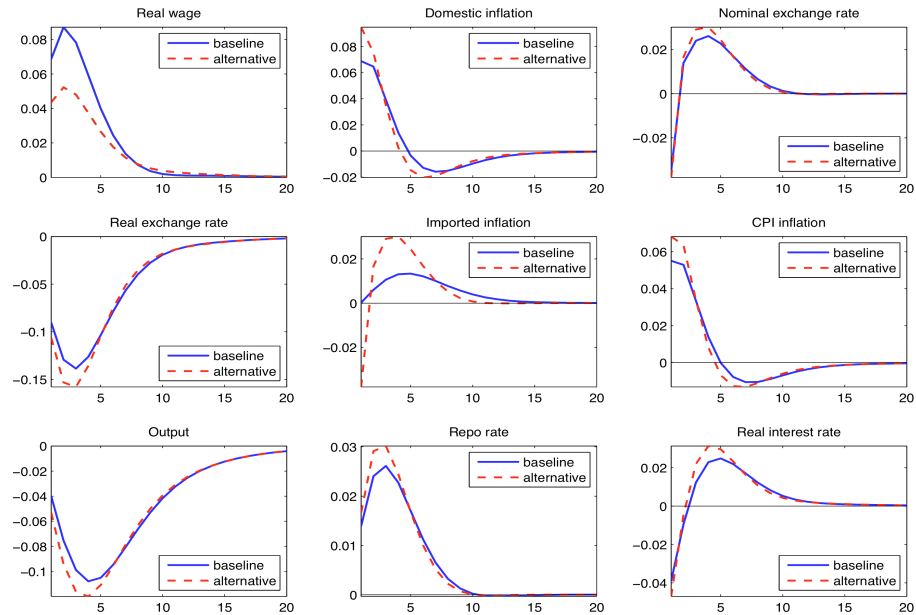
- for all measures of inflation – domestic, imported and overall CPI - there is a sharper, but less persistent increase in inflation in the ‘alternative’ scenario as compared to the ‘baseline’ scenario, in all cases there is also some overshooting before the inflation rate returns to its steady state;
- the decline in output is sharper and marginally less persistent in the ‘alternative’ scenario as compared to the ‘baseline’ scenario;
- an initial appreciation, followed by an overshooting depreciation of the nominal and real exchange rates, with the overshooting depreciation of the

<sup>42</sup> This result in the wake of a cost shock, is also in line with key implication of the basic theoretical model, where a positive cost shock, in the context of relatively less sticky prices, results in the following: a relatively large, but less persistent, increase in inflation; a relatively large, but less persistent, negative deviation from trend output; and a relatively large, but less persistent, interest rate response.

nominal exchange rate being significantly sharper in the ‘alternative’ scenario as compared to the ‘baseline’ scenario;

- a decrease in real wages is a feature of both the ‘alternative’ scenario and the ‘baseline’ scenario, although there is no significant difference in the degree of persistence of the decrease in real wages between the two scenarios, the decrease is sharper in the ‘alternative’ scenario as a result of the sharper inflation response ; and
- the increase in the Repo rate and real interest rate is of a significantly larger magnitude in the ‘alternative scenario’ and is marginally less persistent, mainly due to the fact that the ‘alternative’ scenario’s greater price flexibility results in less persistent output and inflation responses.

**Fig. 39 Comparing ‘baseline’ scenario with ‘alternative’ microfounded scenario in the context of a positive wage shock**



In response to a positive wage shock, the impulse responses of the ‘alternative’ scenario (as compared to the ‘baseline’ scenario) reveal the following:

- for all measures of inflation – domestic, imported and overall CPI - there is a sharper, but less persistent increase in inflation in the ‘alternative’ scenario as compared to the ‘baseline’ scenario;
- the decline in output is sharper in the ‘alternative’ scenario as compared to the ‘baseline’ scenario, but there is no significant difference in the persistence of the fall in output below the steady state level;
- an initial appreciation, followed by an overshooting depreciation of the nominal exchange rate, occurs in both the ‘alternative’ scenario and the ‘baseline’ scenario. The effect is marginally sharper in the ‘alternative’ scenario, but there is no significant difference in persistence between the two scenarios, with the real exchange rate response being similarly persistent in the two scenarios, but marginally larger in magnitude in the ‘alternative’ scenario;
- the increase in real wages is of a larger magnitude in the ‘baseline’ scenario than in the ‘alternative’ scenario, mainly due to the sharper rise in inflation in the ‘alternative’ scenario which erodes the effect of the positive wage shock, although there is no significant difference in the degree of persistence of the increase in real wages between the two scenarios; and
- the increase in the Repo rate and real interest rate is of a larger magnitude in the ‘alternative scenario’, but there is no significant difference in the persistence of the interest rate response between the two scenarios.

#### **5.4.4 Decomposition of price changes into re-optimisations and indexations**

In the above ‘alternative’ scenario all price durations indentified from the CPI and PPI microdata are regarded as implying levels of  $\theta_h$  and  $\theta_f$  on the basis that there is no distinction made between price changes and price optimisations. All price changes identified through the microdata studies are regarded as being re-optimisations and as a result all price changes are taken into account in calibrating  $\theta_h$  and  $\theta_f$ . A preferable approach may be to decompose price changes into two groups, that is, those price



changes that are price re-optimisations and those price changes that are not re-optimisations, but are indexed to prevailing inflation levels in the previous period.

One possible method for decomposing price changes into price re-optimisations, on the one hand, and inflation-indexed price changes, on the other, is to identify as price re-optimisations those price changes that have a price change magnitude *above* a certain ‘indexation threshold’. Or, on the flip-side, to identify as inflation-indexed price changes those prices that have a price change magnitude *below* a certain ‘indexation threshold’.<sup>43</sup>

For example, basing the ‘indexation threshold’ on the partial indexation parameter  $\delta = 0,25$  as utilised in Steinbach et al.’s (2009) open economy DSGE model, those price changes with a magnitude greater than 0,25 times the magnitude of the prevailing inflation rate would be regarded as price re-optimisations, and those price changes with a magnitude of less than 0,25 times the magnitude of the prevailing inflation rate would be regarded as inflation-indexed price changes. The prevailing inflation rate is based on the overall CPI inflation rate for the CPI microdata and the overall PPI inflation rate for the PPI microdata. For both the CPI and PPI the relevant inflation rate is that from two months prior, as this is the published inflation rate in the month when price setting takes place. The Stata code for this decomposition method is outlined in *Appendix 13*, where to improve the robustness of the ultimate findings, the indexation parameter is set alternatively at  $\delta = 0,25$ ,  $\delta = 0,5$  and  $\delta = 1$  resulting in a rising ‘indexation threshold’ until the level of full indexation at  $\delta = 1$ .

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<sup>43</sup> This is not a method without its flaws, but it serves as a tractable and useful proxy measure of the degree of indexation that is prevalent in overall pricing conduct. One weakness with the method is that in certain circumstances the non-change of prices, or small price changes below the ‘indexation threshold’, may in fact constitute an optimal (or profit maximising) pricing strategy. But, the proposed decomposition method would (by definition) classify such price changes as indexations rather than re-optimisations. On the other hand, the proposed decomposition method has the advantage that it is relatively easy to implement, it correctly treats large magnitude price changes as non-indexed price changes, suggesting that such price changes represent price re-optimisations, and it offers a useful insight into how information on pricing conduct, as revealed by pricing microdata, can be used to guide the paramaterisation of economic models.

The overall effect of the decomposition is to raise the  $\theta_h$  and  $\theta_f$  values, as only a portion of price changes are due to re-optimisations, with the other portion of price changes being attributed to indexation.

The analysis of the microdata, as per the calculations outlined in *Appendix 13*, indicates that where the ‘indexation threshold’ is based on  $\delta = 0,25$ , 10,56% of all price changes in the CPI microdata can be described as inflation-indexed price changes. As a result, the proportion of re-optimised domestic price changes ( $1 - \theta_{h\delta 0,25}$ ), and hence  $\theta_{h\delta 0,25}$ , is calculated as follows:

$$(1 - \theta_{h\delta 0,25}) = (1 - 0,1056)(1 - 0,231)$$

$$(1 - \theta_{h\delta 0,25}) = 0,688$$

$$\theta_{h\delta 0,25} = 0,312$$

Similarly, where the ‘indexation threshold’ is based on  $\delta = 0,25$ , 12,53% of all price changes in the imported component of the PPI microdata can be described as inflation-indexed price changes. As a result, the proportion of re-optimised imported price changes ( $1 - \theta_{f\delta 0,25}$ ), and hence  $\theta_{f\delta 0,25}$ , is calculated as follows:

$$(1 - \theta_{f\delta 0,25}) = (1 - 0,1253)(1 - 0,0)$$

$$(1 - \theta_{f\delta 0,25}) = 0,8747$$

$$\theta_{f\delta 0,25} = 0,125$$

Based on the same calculation method, for  $\delta = 0,5$ , where 15,41% of all price changes in the CPI microdata can be described as inflation-indexed price changes, therefore,  $\theta_{h\delta 0,5} = 0,350$ ; and where 18,14% of all price changes in the imported component of the PPI microdata can be described as inflation-indexed price changes, therefore,  $\theta_{f\delta 0,5} = 0,181$ . For  $\delta = 1,0$ , where 15,41% of all price changes in the CPI microdata can be described as inflation-indexed price changes, therefore,  $\theta_{h\delta 1,0} = 0,426$ , and where 25,49% of all price changes in the imported component of the PPI microdata can be described as inflation-indexed price changes, therefore,  $\theta_{f\delta 1,0} = 0,255$ .

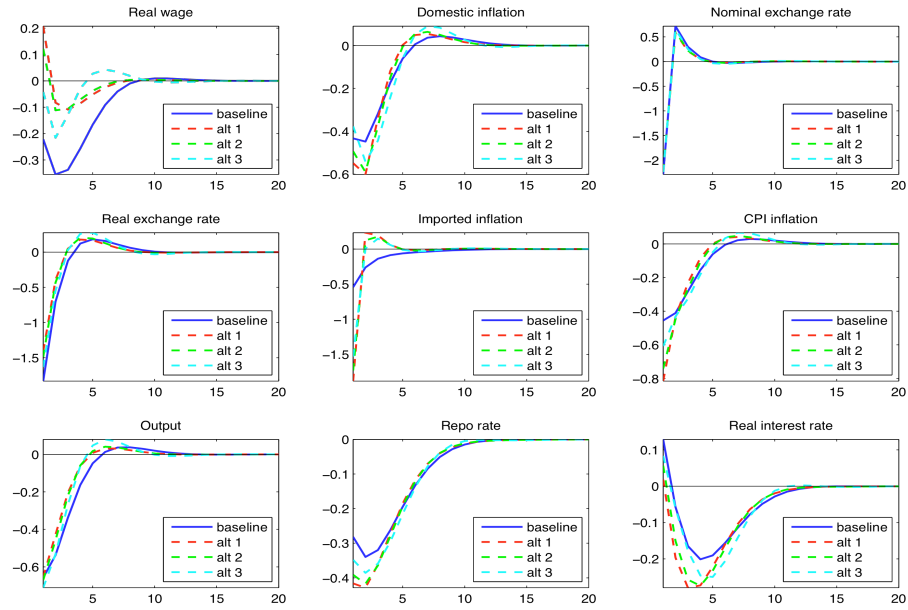
As outlined in Table 58, a rise in  $\delta$  from 0,25 to 0,5 to 1 results in a situation where a larger portion of price changes are attributed to inflation-indexed price changes. Therefore, as the proportion of inflation-indexed price changes rises, and the proportion of price re-optimisations, given by  $(1 - \theta_h)$  and  $(1 - \theta_f)$ , falls,  $\theta_h$  and  $\theta_f$  rise. This rise in  $\theta_h$  and  $\theta_f$  has an equivalent effect to an increase in price stickiness.

**Table 58 Decomposing price changes into re-optimisations and indexations**

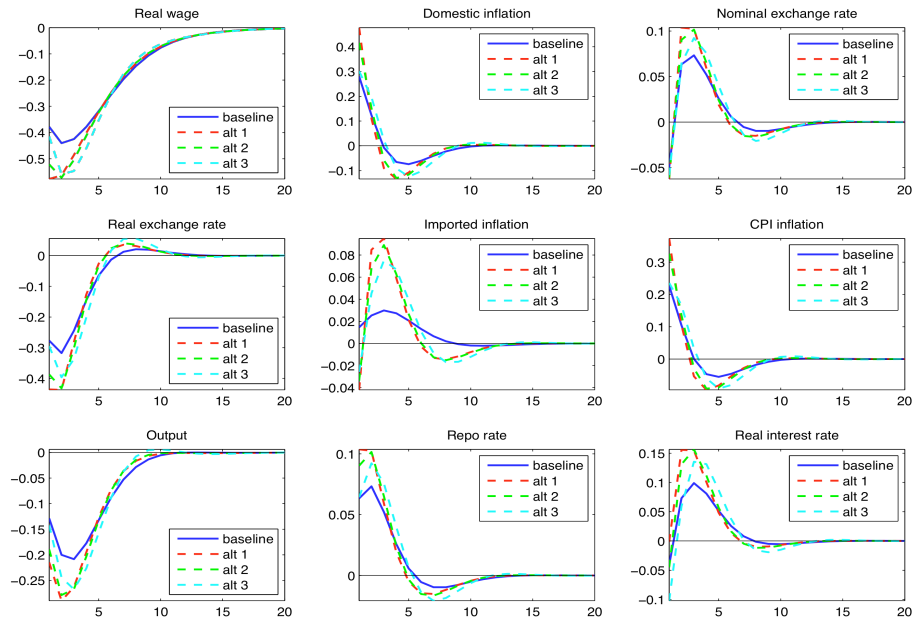
|            | Baseline<br>scenario | Alternative<br>scenario<br>(from<br>previous<br>section) | Alternative<br>scenario 1<br>(‘alt 1’)<br>( $\delta = 0,25$ ) | Alternative<br>scenario 2<br>(‘alt 2’)<br>( $\delta = 0,5$ ) | Alternative<br>scenario 3<br>(‘alt 3’)<br>( $\delta = 1,0$ ) |
|------------|----------------------|----------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------|
| $\theta_h$ | 0,539                | 0,231                                                    | 0,312                                                         | 0,350                                                        | 0,426                                                        |
| $\theta_f$ | 0,672                | 0,0                                                      | 0,125                                                         | 0,181                                                        | 0,255                                                        |
| $\delta$   | 0,25                 | 0,25                                                     | 0,25                                                          | 0,5                                                          | 1,0                                                          |

Ultimately, the findings for the decomposed pricing data do not change the overall results, as to differing extents the various microfounded ‘alternative’ scenarios all exhibit a greater degree of price flexibility (or lower values of  $\theta_h$  and  $\theta_f$ ) than is assumed in the ‘baseline’ scenario of the open economy DSGE model developed by Steinbach et al (2009). As is indicated in Fig. 40 and Fig. 41, where in the context of a negative demand shock and a positive price shock respectively, across the various degrees of price indexation (as  $\delta$  rises from 0,25 (labeled ‘alt 1’) to 0,5 (labeled ‘alt 2’) to 1 (labeled ‘alt 3’)), prices continue to be more flexible in the various ‘alternative’ scenarios than in the ‘baseline’ scenario.

**Fig. 40 Comparing effects of a negative demand shock on the ‘baseline’ scenario and on ‘alternative’ scenarios ‘alt 1’ ( $\delta = 0,25$ ), ‘alt 2’ ( $\delta = 0,5$ ) and ‘alt 3’ ( $\delta = 1,0$ )**



**Fig. 41 Comparing effects of a positive price shock on the ‘baseline’ scenario and on ‘alternative’ scenarios ‘alt 1’ ( $\delta = 0,25$ ), ‘alt 2’ ( $\delta = 0,5$ ) and ‘alt 3’ ( $\delta = 1,0$ )**



The higher degree of price flexibility in ‘alt 1’, ‘alt 2’ and ‘alt 3’, even when combined with higher more significant levels of indexation, has similar consequences to the ‘alternative’ scenario discussed in the previous section, such as, a larger magnitude of inflation, output and interest rates responsiveness to various shocks, and some evidence of less persistence in these responses. The responsiveness of the various alternative scenarios to a policy shock and a wage shock are reported in *Appendix 14*.

#### **5.4.5 Qualifications in comparing macro estimates and microdata, and implications for the Phillips curve**

A key result is that South Africa’s microdata shows prices to be more flexible, or less sticky, than the pricing parameters estimated in the open economy DSGE model, with the implication that there is less inflation persistence, and that interest rate responses to a variety of shocks may need to be sharper, but less persistent, than those predicted by the baseline open economy DSGE model. It is, nonetheless, important to frame this finding within the general qualification that there is an identified tendency for microdata to reveal shorter average price durations (or greater price flexibility) than those implied by estimated Calvo parameters in New Keynesian models.

In this regard, Dennis (2006) reports that Calvo-shares estimated with the New Keynesian Phillips curve find a level of price rigidity that is greater than that measured using microdata on the frequency of price adjustment. For example, Sbordone (2002) estimates the  $\theta$  to be around 0,8 for the United States, that is, about 20 percent of firms reset prices each quarter, implying an average price duration of about 5 quarters, or 15 months, as  $(1-0,8)^{-1} = 5$  quarters or 15 months. But, using the US Bureau of Labour Statistics microdata on price change, Bils and Klenow (2004) report that the average duration between price changes is about 4,3 months. Similarly, as has been noted, in the South African case, the open economy DSGE model’s estimations for both  $\theta_h$  and  $\theta_f$  imply

price durations that are significantly longer than the price durations revealed by the microdata study.

Dennis (2006) argues that “care must be taken when comparing macro-models to microdata” (p.2). He suggests the following key reason for the tendency for macro models to estimate a higher degree of price stickiness than that which is revealed by the microdata. The Calvo-share describes the proportion of firms that make an optimal price change, whereas microdata reveal whether a price has changed at all, whether the change is optimal or not. In fact, some price changes may be suboptimal and it may be optimal not to change prices on occasions.<sup>44</sup> A particular problem is that an analysis of the microdata is unable to distinguish between optimal and non-optimal price changes, whereas certain macro models “require a price change and an optimal price change to be the same thing” (Dennis (2006), p.2). This is a problem which the decomposition method utilised in the previous section goes some way to addressing.

Another approach which addresses this problem is a model developed by Gali and Gertler (1999), as “it has a structure that can be compared more readily to microdata than the Calvo model” (Dennis (2006), p.3). In the Gali-Gertler model certain firms change prices optimally, certain firms change their prices by a ‘rule of thumb’ (indexing price changes to the previous period’s inflation) and certain firms do not change their prices at all.<sup>45</sup> Such a model incorporates a role for menu costs and for information-gathering costs.

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<sup>44</sup> Dennis (2006) discusses two further reasons for the disjuncture between macro estimates and microdata, which are not taken further here:

- the Calvo model assumes that firms change prices once per period at most, whereas in practice price may change more frequently; and
- the Calvo model ignores the possibility that there may be heterogeneity in the frequency of price adjustment across firms

<sup>45</sup> This insight is confirmed by South Africa’s CPI and PPI microdata that in a given period some prices do not change and other prices do change (where either the changing price is optimised or it is fully or partially indexed to the prevailing rate of inflation). Using the price change frequencies for the CPI monthly data as the basis for the calculation and assuming that price changes are limited to one change per quarter, on average from 2001m12 to 2007m12, each quarter 49,42% of prices do not change, 45,24% of prices are re-optimised and 5,34% of prices are indexed to prevailing inflation (based on the decomposition method discussed in the previous section with  $\delta=0,25$ ). For the import component of the PPI monthly data, on average from 2001m12 to 2007m12, each quarter 30,55% of prices do not change, 60,75% of prices are re-optimised and 8,41% of prices are indexed to prevailing inflation (based on the decomposition method discussed in the previous section with  $\delta=0,25$ ).

When menu costs are high, a larger share of firms will not change their prices. When information-gathering costs are high then a larger share of firms will resort to ‘rule of thumb’ pricing.

Formally expressed, the Gali-Gertler model allows that in each period a proportion of firms  $\theta$  do not change their prices, a proportion of firms  $\omega(1 - \theta)$  change their prices by ‘rule of thumb’ and a proportion of firms  $(1 - \omega)(1 - \theta)$  set their firms prices optimally to maximize profits, where  $(1 - \omega), \omega[0,1)$  is the proportion of firms that change prices optimally. Firms fall randomly into one of the three categories each period, independently of their history of price changes. Menu costs are associated with  $\theta$  as these costs are incurred by firms whenever they change prices whether or not the price change is optimal. Information costs are associated with  $\omega$  as the costs with information gathering are associated with the efforts involved in establishing the optimal price.

The Gali-Gertler-Dennis Phillips curve is expressed as follows<sup>46</sup>:

$$\dot{\pi}_t = \frac{\omega(1 - \theta)}{\theta + \omega(1 - \theta)(1 + \beta)} \dot{\pi}_{t-1} + \frac{\beta[\theta + \omega(1 - \theta)]}{\theta + \omega(1 - \theta)(1 + \beta)} E_t \dot{\pi}_{t+1} + \frac{(1 - \omega)(1 - \theta)(1 - \beta\mu)}{\theta + \omega(1 - \theta)(1 + \beta)} mc_t$$

The properties of modified Gali-Gertler-Dennis Phillips curve are such that:

- when  $\omega = 0$  and  $\theta \neq 0$ , no firms index prices and backward dynamics are eliminated so that the equation collapses into the Calvo Phillips curve, as follows

$$\dot{\pi}_t = \beta E_t \dot{\pi}_{t+1} + \frac{(1 - \theta)(1 - \beta\theta)}{\theta} mc_t$$

- when  $\theta = 0$  and  $\omega \neq 0$ , all firms change prices in each period so that the equation is simplified into the full-indexation Phillips curve (as per Christiano et al (2005)),

$$\text{as follows: } \dot{\pi}_t = \frac{1}{1 + \beta} \pi_{t-1} + \frac{\beta}{1 + \beta} E_t \pi_{t+1} + \frac{(1 - \omega)(1 - \beta\omega)}{(1 + \beta)\omega} mc_t$$

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<sup>46</sup> The original Gali-Gertler Phillips curve (1999) assumed that firms optimizing firms behave like Calvo-pricing firms, Dennis (2006) modifies this by assuming that optimising firms take into account that there is a probability that they will be indexing in subsequent periods when they do not optimise.

What remains is the partial indexation Phillips curve of Smets and Wouters (2003), which assumes that firms that do not optimise their prices index their price change magnitudes to a proportion of the previous period's inflation rate. This is expressed as follows:

$$\dot{\pi}_t = \frac{\eta}{1 + \eta\beta} \dot{\pi}_{t-1} + \frac{\beta}{1 + \eta\beta} E_t \dot{\pi}_{t+1} + \frac{(1 - \beta\xi)}{(1 + \eta\beta)\xi} mc_t$$

When  $\eta = 0$  this equation is equivalent to the Calvo Phillips curve and when  $\eta = 1$  it is equivalent to the full-indexation Phillips curve.

The implication of the partial indexation model is that it is costless to change prices, but costly to optimise prices. As a consequence, all prices are assumed to change every period, either optimally or through indexation. Such an assumption of continuous price changing is clearly at odds with the microdata. The open economy DSGE model suffers from the same disjuncture with the pricing microdata. This is because the model makes use of a partial indexation Phillips-curve – where, each period, prices change as they are either re-optimised or re-set as a proportion ( $\delta$ ) of the previous period's rate of inflation.

In conclusion, a key problem is that the form of Phillips curve relation generally used in open economy DSGE models, such as that developed by Steinbach et al (2009) is not supported by the non-continuous pricing conduct revealed in studies of the price microdata. A Gali-Gertler-Dennis style Phillips curve may be preferable as in each period it allows for a situation where certain prices are re-optimised, where certain prices are partially indexed to the prevailing inflation rate, and where certain prices do not change.

## 5.5 Conclusion: Summary of findings

There are two important implications of the analysis outlined in this Chapter, the first being at the policy level and the second at the level of methodology.

Firstly, when Calvo parameters aligned to the microdata findings for average price durations are used, then it is found that due to the higher degree of price flexibility



implied by the data, the conduct of interest rate policy should generally, in response to a range of positive and negative shocks, be *more aggressive, but less persistent* than that response-path implied by a standard open economy DSGE model such as that of Steinbach et al (2009).

This suggests, for example, that the correct interest rate response to the recent economic recession of 2008 and 2009 would have been a sharper, but somewhat less persistent, cut in the policy interest rate (Repo rate) and real interest rates than that implied by the open economy DSGE model. The higher degree of price flexibility for domestic and importing price-setters, respectively, means sharper but less persistent Repo rate and real interest rate cuts in response to the kind of negative demand shock characteristic of the recent global recession. On the other hand, a rising inflation rate due to a cost shock would require a comparatively sharp increase in the policy interest rate (Repo rate) over a somewhat shorter period.

Secondly, Robert King has recently highlighted that the modeling practice of allowing firms “to costlessly index frequently to the past inflation rate, but not to make frequent fully optimal adjustments... is dramatically inconsistent with the micro price data” (in King (2009) p.348). This comment pinpoints a key methodological issue, raised in this Chapter, that the form of Phillips curve relation used in open economy DSGE models is not supported by the non-continuous pricing conduct revealed in studies of the price microdata.

More specifically, it is argued that a Gali-Gertler-Dennis style Phillips curve may be preferable, in that it allows in each period for certain prices to be re-optimised, certain prices to be partially indexed to the prevailing inflation rate, and for certain prices that do not change. Furthermore, based on the evidence of the pricing microdata, there may be further refinements required to enable models to deal better with heterogeneity in pricing conduct, state dependency (particularly in the form of synchronisation), seasonality and cost channel effects in response to interest rate changes.

## CHAPTER 6: CONCLUSION

The study of the CPI and PPI microdata in the preceding Chapters constitutes fundamental research on pricing conduct in the South African economy. As it is the first time that such a data set has been made available by the South African statistical authorities, this research provides important new insights into pricing behaviour and the implications for the conduct of monetary policy in the South African economy.

An important avenue of future research would be to consider further the important question of how insights from pricing data can be used to improve general equilibrium modeling, including through providing insight into the estimation and calibration of key pricing parameters, such as in the setting of priors for such estimations.

Furthermore, a research effort seems called for on the implications of introducing a New Keynesian Phillips curve which is more consistent with patterns of pricing conduct revealed through price microdata studies. The partial indexation New Keynesian Phillips curve utilised in Steinbach et al's (2009) model is at odds with the microdata findings as it implies that prices change continuously, when the price microdata reveals that price do not change in this manner. Additional methodological challenges include the need find ways to incorporate the heterogeneity of pricing activity across firms and sectors, as well as seasonality, state-dependence in pricing conduct, and possible cost channel effects revealed through the microdata.

In their forthcoming Chapter in the *Handbook of Monetary Economics*, Peter Klenow and Benjamin Malin (2010a) describe the last decade as having experienced a “burst of micro price studies” (p.1). As such, the research outlined in the previous chapters has been able to traverse a rich and exciting field of knowledge, which is in flux as a number of new areas, new methods and new insights are opening up. As such, there are quite a number of further questions that can be answered using pricing microdata which have not been addressed during this research effort. It is important that future research be undertaken to fill in these gaps in our knowledge of South African pricing conduct.

Klenow and Malin (2010a) bring some order to the taxonomy of pricing conduct by suggesting “ten facts modelers may want to know about pricing” (p.3). These ten facts are listed as follows:<sup>47</sup>

1. Prices change at least once a year
2. There is substantial heterogeneity in the frequency of price changes across goods
3. Price changes are big on average
4. Many small price changes occur
5. Price changes are typically not synchronised over the business cycle
6. Neither frequency or size is increasing in the age of the price
7. Sales and product turnover are often important for micro price flexibility
8. ‘Reference prices’ are often stickier and more persistent than regular prices
9. Cyclical goods prices change more frequently
10. Relative price changes are transitory

The research outlined in the preceding Chapters, provides clear confirmation from the South African pricing microdata of the first four stylised facts (1 - 4) marshaled by Klenow and Malin (2010a). On the other hand, there seems to be some evidence from the South African data that contradicts stylised facts 5 and 6. The questions raised by stylised facts 7 to 10 have not been canvassed in the preceding Chapters.

Addressing each of these points in turn, the main findings of this thesis are:

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<sup>47</sup> The list of ten facts has been drawn from Klenow and Malin (2010a), but the order in which the ten facts are presented has been altered to facilitate their comparison to the findings on the South African pricing microdata. In a more recent version of the paper Klenow and Malin (2010b), adjust their ten stylised facts by combining facts 3 and 4 into a single statement that “price changes are big on average, but many small changes occur”. This enables the authors to introduce a new tenth stylised fact, which is that “price changes are linked to wage changes”. Whether such a relationship between price and wages can be shown to exist in the South African context is not a matter addressed in the research undertaken in the preceding Chapters and is an important issue, which requires further investigation. Such an investigation would also assist in shedding light on the issue highlighted in the first Chapter that there would be great merit in analysing the underlying causes of differential pricing conduct across various sectors, such as, how factors like the degree of labour intensity, or raw material input, are associated with pricing conduct for particular product categories or industrial sectors.

First, on average individual prices change more frequently than once per year for the CPI (average price duration of 3,9 months) and PPI (average price duration of 3,4 months).

Second, there is substantial heterogeneity in pricing conduct across goods and industries, and as is typical services prices change less frequently than goods prices, mainly due to the fact that services prices decrease less frequently than goods prices.

Third, price changes are found to be bigger on average than they need to be to keep up with inflation. For Klenow and Malin (2010a) this suggests the dominance of idiosyncratic forces in pricing conduct, such as, intertemporal price discrimination and inventory clearance, but while the fact of the large magnitude of price changes is revealed in the preceding Chapters, the possible interpretations suggested by Klenow and Malin (2010a) require future investigation.

Fourth, there is evidence in the South African data of many small price changes, where price changes are decomposed into those price changes that are partially indexed to the prevailing rate of inflation and those prices that are re-optimised. Klenow and Malin (2010a) suggest that such a finding may be at odds with menu cost models and may favour time-dependent or information constrained pricing models.

Fifth, Klenow and Malin's (2010a) fifth stylised fact is contradicted by the regression analysis findings of this study which reveal some evidence that price changes are synchronised, in that, the frequency of price increases rises with the prevailing rate of inflation. It fact, rather than contradicting a stylised fact, it might be more accurate to argue that in this characteristic pricing conduct in South Africa is more like pricing conduct in Mexico than it is like pricing conduct in the United States. Klenow and Malin (2010a) themselves note that while in the United States there is little evidence of such synchronisation as movements in inflation are due to changes in the magnitude of price changes rather than changes the frequency of price adjustments, in a country like Mexico,

in the context of volatile inflation, the frequency of price changes has shown meaningful synchronisation across firms (drawing on Gagnon (2009)).<sup>48</sup>

Sixth, Klenow and Malin's (2010a) sixth stylised fact seems to be partially contradicted by the South African microdata. At the aggregate level, the South African evidence for the CPI and PPI microdata (see Fig. 1 and Fig. 2 in Chapter 1) is in line with Klenow and Malin's (2010a) finding that "the hazard rate of price changes falls with the age of a price for the first few months... and is largely flat thereafter (other than a spike at one year..." (p.5). As explained by Alvarez et al (2005b), such a downward sloping hazard function at the aggregate level is likely the result of heterogeneity in pricing conduct. On the other hand, Klenow and Malin (2010a), do not discuss the fact that at the level of specific products at specific stores, hazard functions tend to be upward sloping indicating an increasing likelihood of price changes as time passes. Furthermore, Klenow and Malin's (2010a) sixth stylised fact is clearly contradicted by the evidence from the South African microdata which shows that the magnitude of CPI and PPI price changes is increasing in the age of the price (see Fig.3 in Chapter 1). Klenow and Malin (2010a) suggest that their sixth stylised fact, that pricing conduct is unrelated to the age of a price, provides evidence of state-dependent pricing, where price duration is endogenous to the accumulation of shocks, rather than dependent on the passing of time. A potentially fruitful avenue of future research on the South African economy, could answer the question as to whether the fact that magnitude of price changes is increasing in the age of the price offers evidence of time-dependence in pricing conduct.

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<sup>48</sup> Klenow et al (2008) decompose monthly inflation into the fraction ( $fr_t$ ) of items with price changes and the average size ( $sz_t$ ) of those changes, that is,  $\pi_t = fr_t \times sz_t$ . They find that for the United States between 1988 and 2004, movements in inflation are mainly due to changes in the magnitude of price changes, rather than the changes in the frequency of price changes. Gagnon (2009) further decomposes inflation into terms due to price increases and price decreases, such that,  $\pi_t = fr^+ sz^+ + fr^- sz^-$ , where  $fr = fr^+ + fr^-$ , and  $fr^+$  and  $fr^-$  ( $sz^+$  and  $sz^-$ ) denote the frequency (absolute size) of price increases and price decreases, respectively. Using this technique the finding for Mexico from 1994 to 2002 is that when the annual inflation rate was below 10-15%, the average frequency (size) of prices changes co-moves weakly (strongly) with inflation due to offsetting movements in the frequency of price increases and decreases. On the other hand, when inflation rose above 15%, few price decreases were observed and both the frequency and the average size of price changes were found to be important determinants of inflation.

Finally, further research is required in order to test whether there is evidence in the South African pricing microdata to support the remaining four stylised facts (7 – 10). Such a research agenda would assist in answering the following important questions:

- how important are temporary sales prices in micro-level price flexibility, do they play an important role in South Africa, as in the US, or a lesser role, as in the Euro Area countries;
- if a broad set of short-lived prices (including temporary sales prices) are excluded from the data, does a stickier ‘reference’ price emerge that changes about once per year, as in the US data;
- is there evidence in the South African data that cyclical goods (such as cars and clothing) exhibit greater micro price flexibility than goods that display less cyclical behaviour (such as medical care); and
- is there evidence in South Africa that relative price changes are transitory, as this will shed light on the relative importance of idiosyncratic versus aggregate shocks and will have implications for price-setting models.

Answers to these questions would undoubtedly contribute further to our knowledge of pricing conduct in the South African economy, and armed with such knowledge further refinements could be made in the arena of macroeconomic modeling and policy implementation.

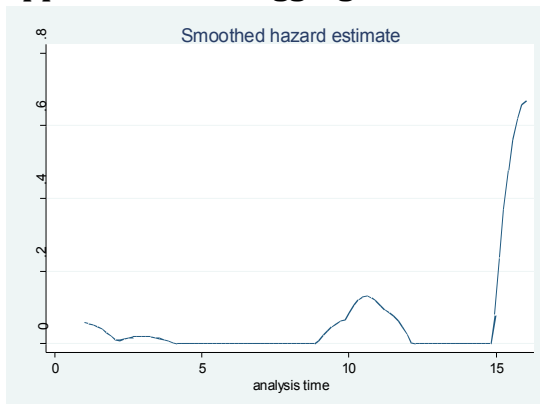
It is hoped, that the research effort in the preceding Chapters has made a decisive first step in the direction of improving the understanding of pricing conduct in the South Africa economy and that it has helped to shed some new light on the micro foundations of South Africa’s macroeconomic models and policy conduct.

## APPENDICES

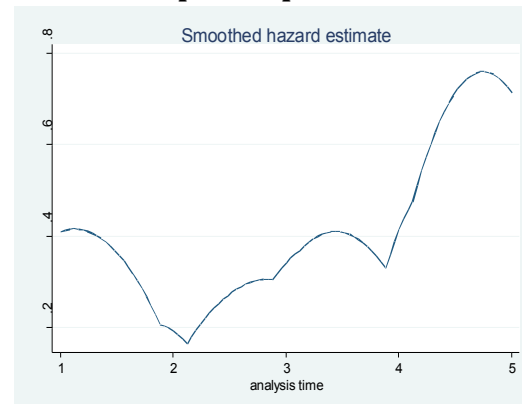
### Appendix 1: Stata code for estimating hazard functions

```
gen firstobs=0
replace firstobs=1 if id~=1.id
gen observed_time=0 if firstobs==1
replace observed_time=1.observed_time+1 if firstobs~=1
gen duration_all=duration
replace duration_all=observed_time if duration==.
snapspan id edate2 change changedummy duration duration_uncensored
duration_all observed_time lnprice changelnprice absolutechange price,
gen(date0) replace
stset duration_all, failure(changedummy)
sts graph, hazard width(1)
sts graph, hazard width(0.5)
sts graph
stset duration, failure(changedummy)
sts graph, hazard width(1)
sts graph, hazard width(0.5)
stdes
```

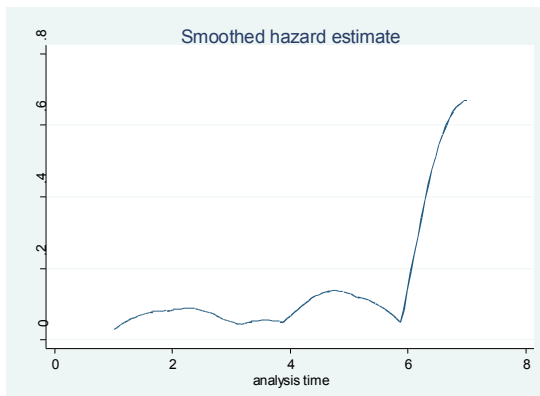
## Appendix 2: Dissaggregated hazard functions for specific products



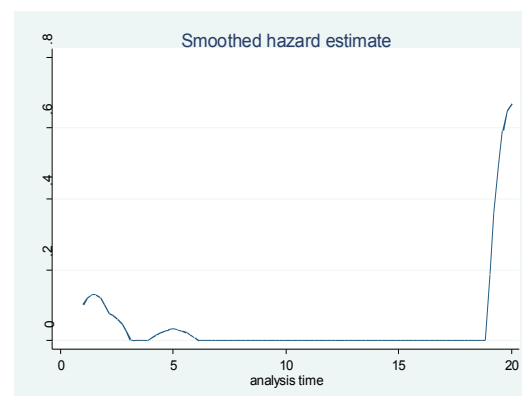
**Brown Bread**



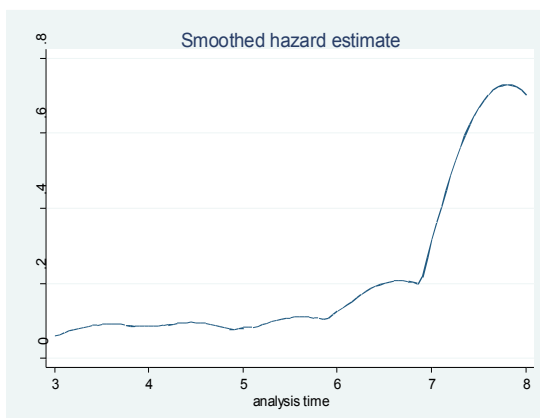
**Oranges**



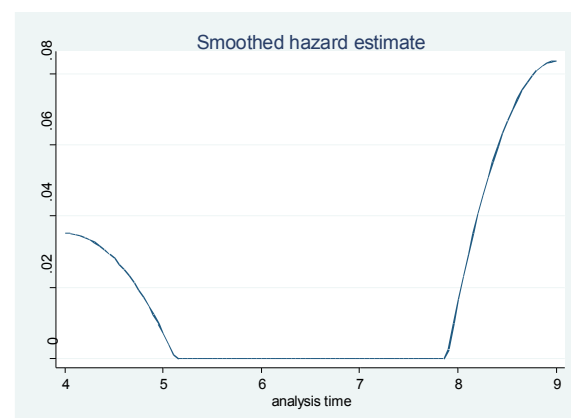
**Instant Coffee**



**Imported Whisky**

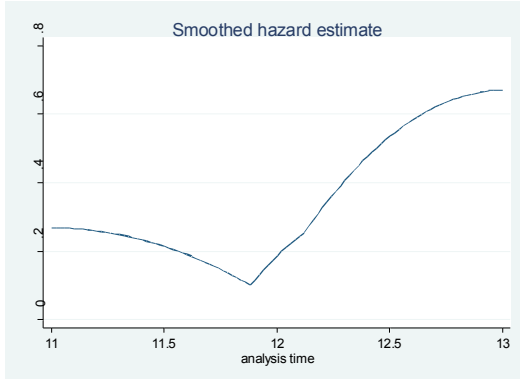


**Packet of 20 Virginia Type Cigarettes**

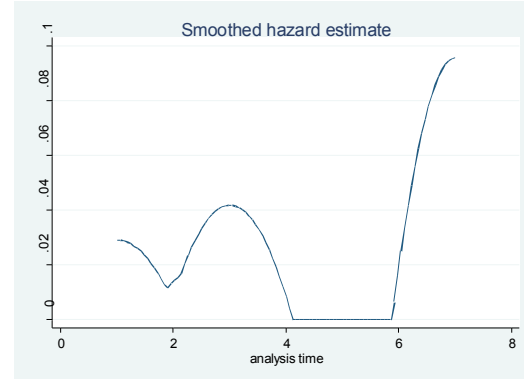


**Soccer ball**

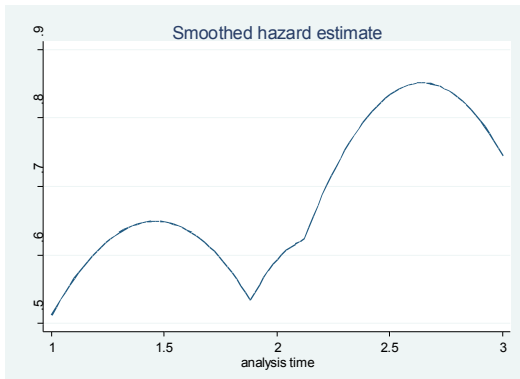




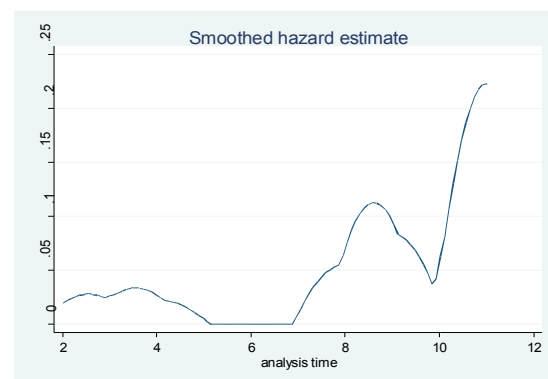
**Cinema tickets**



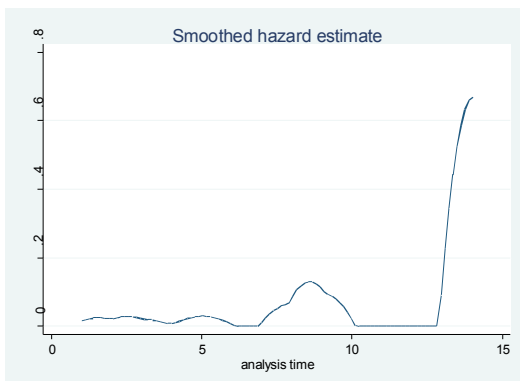
**Dog Food Pellets**



**Magazines**



**Dental Floss**



**Toilet Paper**

### Appendix 3: Stata code for setting up data sets

```
infile store stccode productcode strl0(date1) _skip strl0(price) unitcode
capturecode using "C:\CPI Unit Data\PriceData_Full_Data_Set.txt"
keep if capturecode==0 | capturecode==1 | capturecode==4 | capturecode==5 |
capturecode==6
drop if productcode>=3100000 & productcode<=3200000
drop if productcode==6111501
drop if productcode>=6120000 & productcode<=619999
drop if productcode>=50110000 & productcode<=5019999
drop if productcode==6110901
drop if productcode>=6201000 & productcode<=6201202
drop if productcode>=6111000 & productcode<=6111101
drop if productcode>=7300000 & productcode<=7999999
drop if productcode==6202101
drop if productcode>=3112001 & productcode<=3114999
drop if productcode==9011503
drop if productcode>=5050000 & productcode<=5999999
drop if productcode>=3115000 & productcode<=3115999
drop if productcode>=5020000 & productcode<=5029999
drop if productcode==3121001
drop if productcode==3200001
drop if productcode>=4210000 & productcode<=4219999
drop if productcode==7111001
drop if productcode==3111001
split price, gen(stprice) parse(.)
gen atprice00=0 if stprice2~="" & stprice2~="00"
replace atprice00=1 if stprice2=="00"
gen atprice99=0 if stprice2~="" & stprice2~="99"
replace atprice99=1 if stprice2=="99"
gen atprice95=0 if stprice2~="" & stprice2~="95"
replace atprice95=1 if stprice2=="95"
gen atprice49=0 if stprice2~="" & stprice2~="49"
replace atprice49=1 if stprice2=="49"
gen atprice98=0 if stprice2~="" & stprice2~="98"
replace atprice98=1 if stprice2=="98"
gen atprice90=0 if stprice2~="" & stprice2~="90"
replace atprice90=1 if stprice2=="90"
gen atprice50=0 if stprice2~="" & stprice2~="50"
replace atprice50=1 if stprice2=="50"
gen atprice25=0 if stprice2~="" & stprice2~="25"
replace atprice25=1 if stprice2=="25"
gen atprice20=0 if stprice2~="" & stprice2~="20"
replace atprice20=1 if stprice2=="20"
gen atprice10=0 if stprice2~="" & stprice2~="10"
replace atprice10=1 if stprice2=="10"
gen atprice05=0 if stprice2~="" & stprice2~="05"
replace atprice05=1 if stprice2=="05"
destring price, replace
/*generating dummy variable for first dataset*/
gen firstset=1
gen secondset=0
split date1, gen(date1) parse(-)
gen year=date11
gen month=date12
/*converting from a string to a numeric variable*/
destring year month, replace
gen edate2=ym(year, month)
format edate2 %tm
/*now saving*/
```

```

save "C:\CPI Unit Data\save_aggregate_firstset.dta", replace
clear

infile str1(pricetypecode) str10(currentprice) str6(surveyperiod)
str10(commoditycode) str1(commoditysubcode) str8(newalias) str2(itemstatuscode)
str5(itemunitcode) using "C:\CPI Unit Data\CPIsecondsetv2.txt"
keep if itemstatuscode=="20" | itemstatuscode=="21" | itemstatuscode=="23" |
itemstatuscode=="24"
split currentprice, gen(stprice) parse(.)
gen atprice00=0 if currentprice~="" & currentprice~="00"
replace atprice00=1 if stprice2=="00"
gen atprice99=0 if currentprice~="" & currentprice~="99"
replace atprice99=1 if stprice2=="99"
gen atprice95=0 if currentprice~="" & currentprice~="95"
replace atprice95=1 if stprice2=="95"
gen atprice49=0 if currentprice~="" & currentprice~="49"
replace atprice49=1 if stprice2=="49"
gen atprice90=0 if currentprice~="" & currentprice~="90"
replace atprice90=1 if stprice2=="90"
gen atprice50=0 if currentprice~="" & currentprice~="50"
replace atprice50=1 if stprice2=="50"
gen atprice25=0 if currentprice~="" & currentprice~="25"
replace atprice25=1 if stprice2=="25"
gen atprice20=0 if currentprice~="" & currentprice~="20"
replace atprice20=1 if stprice2=="20"
destring currentprice, replace
destring itemunitcode newalias surveyperiod commoditycode, replace

gen firstset=0
gen secondset=1
rename currentprice price
rename commoditycode productcode
rename newalias store /*we are going to have to keep in mind that these stores
are different*/
rename itemunitcode unitcode
drop if productcode>=3100000 & productcode<=3200000
drop if productcode==6111501
drop if productcode>=6120000 & productcode<=619999
drop if productcode>=50110000 & productcode<=5019999
drop if productcode==6110901
drop if productcode>=6201000 & productcode<=6201202
drop if productcode>=6111000 & productcode<=6111101
drop if productcode>=7300000 & productcode<=7999999
drop if productcode==6202101
drop if productcode>=3112001 & productcode<=3114999
drop if productcode==9011503
drop if productcode>=5050000 & productcode<=5999999
drop if productcode>=3115000 & productcode<=3115999
drop if productcode>=5020000 & productcode<=5029999
drop if productcode==3121001
drop if productcode==3200001
drop if productcode>=4210000 & productcode<=4219999
drop if productcode==7111001
drop if productcode==3111001

gen year=2006 if surveyperiod >=200600 & surveyperiod<200700
replace year=2007 if surveyperiod >=200700 & surveyperiod<200800
gen month=surveyperiod-200600 if surveyperiod >=200600 & surveyperiod<200700
replace month=surveyperiod-200700 if surveyperiod >=200700 & surveyperiod<200800
gen edate2=ym(year, month)
format edate2 %tm
append using "C:\CPI Unit Data\save_aggregate_firstset.dta"
sort store productcode edate2

```

```

/*creating unique ids*/
gen double uniq_store=store*1000000000000
gen double uniq_productcode=productcode*10000
gen double id=uniq_store+uniq_productcode+unitcode+1000000000000000 if
firstset==1
replace id=uniq_store+uniq_productcode+unitcode+2000000000000000 if secondset==1
format uniq_store uniq_productcode id %16.0f
duplicates drop id edate2, force
sort id edate2
tsset id edate2
gen change=price-l.price
gen changedummy=1 if change~=0 & change~=.
replace changedummy=0 if change==0
gen lagchangedummy=l.changedummy
gen changedate=edate2 if changedummy==1
gen lastchangedate=l.edate2 if l.changedummy==1
local k=2
while `k'<=51{
replace lastchangedate=l`k'.edate2 if lastchangedate==. & l`k'.changedummy==1
local k=`k'+1
}
format changedate lastchangedate %tm
gen duration=edate2-lastchangedate
gen duration_uncensored=changedate-lastchangedate /*this is the duration for the
uncensored spells*/
tabstat duration_uncensored, s(mean p50 n sd min max)

/*then save joint file*/
save "C:\CPI Unit Data\save_aggregate_joint2.dta", replace

```

## Appendix 4: Stata code for analysis of CPI data

```
use "C:\CPI Unit Data\save_aggregate_joint.dta", clear
/*Analysis of frequency of price changes*/
tabstat changedummy, stat(mean p50 n) by(edate2)
gen increasedummy=1 if change>0 & change~=.
replace increasedummy=0 if change<=0 & change~=.
tabstat increasedummy, stat(mean p50 n) by(edate2)
gen decreasedummy=1 if change<0 & change~=.
replace decreasedummy=0 if change>=0 & change~=.
tabstat decreasedummy, stat(mean p50 n) by(edate2)
/*Analysis of size of price change*/
gen lnprice=log(price)
gen changelnprice=lnprice-1.lnprice
gen absolutechangelnprice=changelnprice if changelnprice~=0 & changelnprice~=.
replace absolutechangelnprice=-changelnprice if changelnprice<0
tabstat absolutechangelnprice, stat(mean p50 n) by(edate2)
tabstat changelnprice if changelnprice~=0 & changelnprice~=., stat(mean p50 n)
by(edate2)
tabstat changelnprice if changelnprice>0, stat(mean p50 n) by(edate2)
tabstat changelnprice if changelnprice<0, stat(mean p50 n) by(edate2)
/*Analysis of duration of prices*/
tabstat duration_uncensored, s(mean p50 n sd min max) by(edate2)

/*Disaggregated data (by product type)*/
tabstat productcode if productcode>=1100000 & productcode<1200000, stat(n)
by(edate2)
tabstat productcode if productcode>=1200000 & productcode<1300000, stat(n)
by(edate2)
tabstat productcode if productcode>=1300000 & productcode<1400000, stat(n)
by(edate2)
tabstat productcode if productcode>=1400000 & productcode<2000000, stat(n)
by(edate2)
tabstat productcode if productcode>=2100000 & productcode<2200000, stat(n)
by(edate2)
tabstat productcode if productcode>=2200000 & productcode<3100000, stat(n)
by(edate2)
tabstat productcode if productcode>=3100000 & productcode<3200000, stat(n)
by(edate2)
tabstat productcode if productcode>=3200000 & productcode<4100000, stat(n)
by(edate2)
tabstat productcode if productcode>=4100000 & productcode<4200000, stat(n)
by(edate2)
tabstat productcode if productcode>=4200000 & productcode<5000000, stat(n)
by(edate2)
tabstat productcode if productcode>=5000000 & productcode<6100000, stat(n)
by(edate2)
tabstat productcode if productcode>=6100000 & productcode<6200000, stat(n)
by(edate2)
tabstat productcode if productcode>=6200000 & productcode<7100000, stat(n)
by(edate2)
tabstat productcode if productcode>=7100000 & productcode<7200000, stat(n)
by(edate2)
tabstat productcode if productcode>=7200000 & productcode<7300000, stat(n)
by(edate2)
tabstat productcode if productcode>=7300000 & productcode<8000000, stat(n)
by(edate2)
tabstat productcode if productcode>=8000000 & productcode<9000000, stat(n)
by(edate2)
tabstat productcode if productcode>=9000000 & productcode<9999999, stat(n)
by(edate2)
```

## Appendix 5: Stata code for computation of price duration

Direct calculation of duration of price spells is coded in Stata as follows. The reason that 'k'≤51 is due to the impact of the break in the data, where the unique store numbers become incomparable. This has the effect that the longest possible duration of any price spell may be over the period of the first data set of 51 months, rather than the 73 months over which the study is conducted.

```
gen change=price-l.price
gen changedummy=1 if change~=0 & change~=.
replace changedummy=0 if change==0
gen lagchangedummy=l.changedummy
gen changedate=edate2 if changedummy==1
gen lastchangedate=l.edate2 if l.changedummy==1
local k=2
while `k'≤51{
  replace lastchangedate=l`k'.edate2 if lastchangedate==. & l`k'.changedummy==1
  local k=`k'+1
}
format changedate lastchangedate %tm
gen duration=edate2-lastchangedate
gen duration_uncensored=changedate-lastchangedate
```

## Appendix 6: Stata code for analysis of attractive prices

```
tabstat atprice00, stat(mean p50 n) by(edate2)
tabstat atprice99, stat(mean p50 n) by(edate2)
tabstat atprice95, stat(mean p50 n) by(edate2)
tabstat atprice49, stat(mean p50 n) by(edate2)
tabstat atprice98, stat(mean p50 n) by(edate2)
tabstat atprice90, stat(mean p50 n) by(edate2)
tabstat atprice50, stat(mean p50 n) by(edate2)
tabstat atprice25, stat(mean p50 n) by(edate2)
tabstat atprice20, stat(mean p50 n) by(edate2)
tabstat atprice10, stat(mean p50 n) by(edate2)
tabstat atprice05, stat(mean p50 n) by(edate2)
tabstat atprice89, stat(mean p50 n) by(edate2)
tabstat atprice79, stat(mean p50 n) by(edate2)
tabstat atprice69, stat(mean p50 n) by(edate2)
tabstat atprice59, stat(mean p50 n) by(edate2)
tabstat atprice39, stat(mean p50 n) by(edate2)
tabstat atprice29, stat(mean p50 n) by(edate2)
tabstat atprice19, stat(mean p50 n) by(edate2)
tabstat atprice09, stat(mean p50 n) by(edate2)

/* testing frequency and magnitude of attractive price changes */
gen lag_atprice00=l.atprice00
tabstat changedummy, stat(mean p50 n) by(lag_atprice00)
tabstat increasedummy, stat(mean p50 n) by(lag_atprice00)
tabstat decreasedummy, stat(mean p50 n) by(lag_atprice00)
gen lag_atprice99=l.atprice99
tabstat changedummy, stat(mean p50 n) by(lag_atprice99)
tabstat increasedummy, stat(mean p50 n) by(lag_atprice99)
tabstat decreasedummy, stat(mean p50 n) by(lag_atprice99)

gen lag_atprice95=l.atprice95
tabstat changedummy, stat(mean p50 n) by(lag_atprice95)
tabstat increasedummy, stat(mean p50 n) by(lag_atprice95)
tabstat decreasedummy, stat(mean p50 n) by(lag_atprice95)

gen lag_atprice50=l.atprice50
tabstat changedummy, stat(mean p50 n) by(lag_atprice50)
tabstat increasedummy, stat(mean p50 n) by(lag_atprice50)
tabstat decreasedummy, stat(mean p50 n) by(lag_atprice50)

tabstat absolutechangelnprice, stat(mean p50 n) by(lag_atprice00)
tabstat absolutechangelnprice, stat(mean p50 n) by(lag_atprice99)
tabstat absolutechangelnprice, stat(mean p50 n) by(lag_atprice95)
tabstat absolutechangelnprice, stat(mean p50 n) by(lag_atprice50)

tabstat changelnprice if changelnprice>0, stat(mean p50 n) by(lag_atprice00)
tabstat changelnprice if changelnprice>0, stat(mean p50 n) by(lag_atprice99)
tabstat changelnprice if changelnprice>0, stat(mean p50 n) by(lag_atprice95)
tabstat changelnprice if changelnprice>0, stat(mean p50 n) by(lag_atprice50)

tabstat changelnprice if changelnprice<0, stat(mean p50 n) by(lag_atprice00)
tabstat changelnprice if changelnprice<0, stat(mean p50 n) by(lag_atprice99)
tabstat changelnprice if changelnprice<0, stat(mean p50 n) by(lag_atprice95)
tabstat changelnprice if changelnprice<0, stat(mean p50 n) by(lag_atprice50)

/*does price change to another similar attractive price? */
tab lag_atprice00 atprice00 if changedummy==1
tab lag_atprice99 atprice99 if changedummy==1
tab lag_atprice95 atprice95 if changedummy==1
tab lag_atprice50 atprice50 if changedummy==1
```

```

gen atprice_group=8888 if atprice00==0 /*this is non-attractive price
group*/replace atprice_group=00 if atprice00==1
replace atprice_group=50 if atprice50==1
replace atprice_group=95 if atprice95==1
replace atprice_group=99 if atprice99==1
gen lag_atprice_group=l.atprice_group
tab lag_atprice_group atprice_group if changedummy==1

/*by attractive prices group as a whole */
tabstat changedummy, stat(mean p50 n) by(atprice_group)
tabstat increasedummy, stat(mean p50 n) by(atprice_group)
tabstat decreasedummy, stat(mean p50 n) by(atprice_group)
tabstat absolutechangelnprice, stat(mean p50 n) by(atprice_group)
tabstat changelnprice if changelnprice>0, stat(mean p50 n) by(atprice_group)
tabstat changelnprice if changelnprice<0, stat(mean p50 n) by(atprice_group)

```



## Appendix 7: Stata code for integrating PPI data sets

```
insheet using "C:\Documents and
Settings\Administrator\Desktop\pricedata\PPIFINAL\PPIfirstset.txt"

rename v1 store
rename v2 questiontype_LIE
rename v3 siccode
rename v4 productcode
rename v5 date
rename v6 price
rename v7 unitcode
rename v8 capturecode

recast double price, force
format price %9.2f

gen sstore=store
gen sproductcode=productcode
gen sunitcode=unitcode
tostring sstore sproductcode, replace
destring unitcode, replace

gen id1=sstore+sproductcode+sunitcode
egen idx=group(id1)
gen yearx=substr(date,1,4)
gen monthx=substr(date,5,2)

/*generating dummy variable for first dataset*/
gen firstset=1
gen secondset=0

/*converting from a string to a numeric variable*/
destring yearx monthx, replace
gen edate2=ym(year, month)
format edate2 %tm

/*duplicates list idx edate2 capturecode
duplicates list idx edate2 store productcode unitcode*/

duplicates drop idx edate2, force /*this drops repeated observations*/

tsset idx edate2

save "C:\Documents and
Settings\Administrator\Desktop\pricedata\PPIFINAL\save_ppi2_firstset.dta",
replace

clear
insheet using "C:\Documents and
Settings\Administrator\Desktop\pricedata\PPIFINAL\PPIsecondset.txt"
rename v1 store
rename v2 siccode
rename v3 questno
rename v4 questiontype_LIE
rename v5 productcode
rename v6 unitcode
rename v7 date
rename v8 price
rename v9 capturecode

recast double price, force
```

```

format price %9.2f
gen sstore=store
gen sproductcode=productcode
gen sunitcode=unitcode
tostring sstore sproductcode sunitcode, replace
gen id1=sstore+sproductcode+sunitcode
egen idx=group(id1)

destring unitcode, replace
tostring date, replace
gen yearx=substr(date,1,4)
gen monthx=substr(date,5,2)

/*generating dummy variable for second dataset*/
gen firstset=0
gen secondset=1

/*converting from a string to a numeric variable*/
destring yearx monthx, replace
gen edate2=ym(year, month)
format edate2 %tm
sort idx edate2
duplicates drop idx edate2, force
tsset idx edate2

append using "C:\Documents and
Settings\Administrator\Desktop\pricedata\PPIFINAL\save_ppi2_firstset.dta"

gen id=10000+idx if firstset==1
replace id=20000+idx if firstset==0
tsset id edate2

save "C:\Documents and
Settings\Administrator\Desktop\pricedata\PPIFINAL\save_ppi2_combined.dta",
replace

```

## Appendix 8: Stata code for analysis of PPI data

```
destring capturecode, replace
keep if capturecode==0 | capturecode==1 | capturecode==4 | capturecode==5 |
capturecode==6
sort id edate2
tsset id edate2

/*disaggregated*/

keep if siccode>=50000 & siccode<=59999

/*Analysis of frequency of price changes*/

gen change=price-l.price
gen changedummy=1 if change~=0 & change~=.
replace changedummy=0 if change==0
tabstat changedummy, stat(mean p50 n) by(edate2)
gen increasedummy=1 if change>0 & change~=.
replace increasedummy=0 if change<=0 & change~=.
tabstat increasedummy, stat(mean p50 n) by(edate2)
gen decreasedummy=1 if change<0 & change~=.
replace decreasedummy=0 if change>=0 & change~=.
tabstat decreasedummy, stat(mean p50 n) by(edate2)

/*Analysis of size of price change*/

gen lnprice=log(price)
gen changelnprice=lnprice-l.lnprice
gen absolutechangelnprice=changelnprice if changelnprice~=0 & changelnprice~=.
replace absolutechangelnprice=-changelnprice if changelnprice<0
tabstat absolutechangelnprice, stat(mean p50 n) by(edate2)

/*tabstat changelnprice if changelnprice~=0 & changelnprice~., stat(mean p50 n)
by(edate2)*/

tabstat changelnprice if changelnprice>0, stat(mean p50 n) by(edate2)
tabstat changelnprice if changelnprice<0, stat(mean p50 n) by(edate2)

/*Duration*/

gen lagchangedummy=1.changedummy
gen changedate=edate2 if changedummy==1
gen lastchangedate=1.edate2 if 1.changedummy==1
local k=2
while `k'<=51{
    replace lastchangedate=l`k'.edate2 if lastchangedate==. & l`k'.changedummy==1
    local k=`k'+1
}
format changedate lastchangedate %tm

gen duration=edate2-lastchangedate
gen duration_uncensored=changedate-lastchangedate /*this is the duration for the
uncensored spells*/

tabstat duration_uncensored, s(mean p50 n sd min max)
tabstat duration_uncensored, s(mean p50 n sd min max)by(edate2)
```

## Appendix 9: Stata code for regressions

```
insheet using "C:\Documents and  
Settings\Administrator\Desktop\pricedata\FiNALRegression\finalregressiondata.csv  
"
```

```
cd "C:\Documents and  
Settings\Administrator\Desktop\pricedata\FiNALRegression\regressionresults"
```

```
*split date, p(-)  
*destring date1 date2, replace  
gen edate2=ym(date1, date2)  
format edate2 %tm
```

```
tsset edate2
```

```
local k=1  
while `k'<=12{  
gen month`k'=0  
replace month`k'=1 if date2==`k'  
local k=`k'+1  
}
```

```
gen Repochange=reporate-1.reporate  
gen repochangedum=0 if Repochange~=.  
replace repochangedum=1 if Repochange~=0 & Repochange~=.  
gen CPIchange=cpimetropolitanandotherurbanarea-  
1.cpimetropolitanandotherurbanarea  
gen CPIchangedum=0 if CPIchange~=.  
replace CPIchangedum=1 if CPIchange~=0 & CPIchange~=.  
gen Exchangeratechange=nominaleffectiveexchangerate-  
1.nominaleffectiveexchangerate  
gen Exchangeratechangedum=0 if Exchangeratechange~=.  
replace Exchangeratechangedum=1 if Exchangeratechange~=0 & Exchangeratechange~=.  
gen Breakdummy=0  
replace Breakdummy=1 if edate2>=554  
gen PPIchange=ppitotal7140a-1.ppitotal7140a
```

```
**//Real time regressions (CPI)  
/*Frequency of price changes*/  
reg cpifrequencyofpricechange month1-month11 cpimetropolitanandotherurbanarea  
outreg using finalregCPIchange.doc, 3aster replace  
reg cpifrequencyofpricechange month1-month11 CPIchange  
outreg using finalregCPIchange.doc, 3aster append  
reg cpifrequencyofpricechange month1-month11 reporate  
outreg using finalregCPIchange.doc, 3aster append  
reg cpifrequencyofpricechange month1-month11 Repochange  
outreg using finalregCPIchange.doc, 3aster append  
reg cpifrequencyofpricechange month1-month11 nominaleffectiveexchangerate  
outreg using finalregCPIchange.doc, 3aster append  
reg cpifrequencyofpricechange month1-month11 Exchangeratechange  
outreg using finalregCPIchange.doc, 3aster append  
reg cpifrequencyofpricechange month1-month11 Breakdummy  
outreg using finalregCPIchange.doc, 3aster append  
reg cpifrequencyofpricechange month1-month11 cpimetropolitanandotherurbanarea  
CPIchange reporate Repochange nominaleffectiveexchangerate Exchangeratechange  
Breakdummy  
outreg using finalregCPIchange.doc, 3aster append
```

```
/*Frequency of price increases*/  
reg cpifrequencyofpriceincrease month1-month11 cpimetropolitanandotherurbanarea
```

```

outreg using finalregCPIincrease.doc, 3aster replace
reg cpifrequencyofpriceincrease month1-month11 CPIchange
outreg using finalregCPIincrease.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 reporate
outreg using finalregCPIincrease.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 Repochange
outreg using finalregCPIincrease.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 nominaleffectiveexchangerate
outreg using finalregCPIincrease.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 Exchangeratechange
outreg using finalregCPIincrease.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 Breakdummy
outreg using finalregCPIincrease.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 cpimetropolitanandotherurbanarea
CPIchange reporate Repochange nominaleffectiveexchangerate Exchangeratechange
Breakdummy
outreg using finalregCPIincrease.doc, 3aster append

```

```

/*Frequency of price decreases*/

```

```

reg cpifrequencyofpricedecrease month1-month11 cpimetropolitanandotherurbanarea
outreg using finalregCPIdecrease.doc, 3aster replace
reg cpifrequencyofpricedecrease month1-month11 CPIchange
outreg using finalregCPIdecrease.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 reporate
outreg using finalregCPIdecrease.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 Repochange
outreg using finalregCPIdecrease.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 nominaleffectiveexchangerate
outreg using finalregCPIdecrease.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 Exchangeratechange
outreg using finalregCPIdecrease.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 Breakdummy
outreg using finalregCPIdecrease.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 cpimetropolitanandotherurbanarea
CPIchange reporate Repochange nominaleffectiveexchangerate Exchangeratechange
Breakdummy
outreg using finalregCPIdecrease.doc, 3aster append

```

```

/*Lagged*/

```

```

/*Frequency of price change*/

```

```

reg cpifrequencyofpricechange month1-month11 13.cpimetropolitanandotherurbanarea
outreg using finalregCPIchangelagged.doc, 3aster replace
reg cpifrequencyofpricechange month1-month11 13.CPIchange
outreg using finalregCPIchangelagged.doc, 3aster append
reg cpifrequencyofpricechange month1-month11 13.reporate
outreg using finalregCPIchangelagged.doc, 3aster append
reg cpifrequencyofpricechange month1-month11 13.Repochange
outreg using finalregCPIchangelagged.doc, 3aster append
reg cpifrequencyofpricechange month1-month11 13.nominaleffectiveexchangerate
outreg using finalregCPIchangelagged.doc, 3aster append
reg cpifrequencyofpricechange month1-month11 13.Exchangeratechange
outreg using finalregCPIchangelagged.doc, 3aster append
reg cpifrequencyofpricechange month1-month11 13.Breakdummy
outreg using finalregCPIchangelagged.doc, 3aster append
reg cpifrequencyofpricechange month1-month11 13.cpimetropolitanandotherurbanarea
13.CPIchange 13.reporate 13.Repochange 13.nominaleffectiveexchangerate
13.Exchangeratechange 13.Breakdummy
outreg using finalregCPIchangelagged.doc, 3aster append

```

```

/*Frequency of price increases*/
reg cpifrequencyofpriceincrease month1-month11
l3.cpimetropolitanandotherurbanarea
outreg using finalregCPIincreaselagged.doc, 3aster replace
reg cpifrequencyofpriceincrease month1-month11 l3.CPIchange
outreg using finalregCPIincreaselagged.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 l3.reporate
outreg using finalregCPIincreaselagged.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 l3.Repochange
outreg using finalregCPIincreaselagged.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 l3.nominaleeffectiveexchangerate
outreg using finalregCPIincreaselagged.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 l3.Exchangeratechange
outreg using finalregCPIincreaselagged.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 l3.Breakdummy
outreg using finalregCPIincreaselagged.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11
l3.cpimetropolitanandotherurbanarea l3.CPIchange l3.reporate l3.Repochange
l3.nominaleeffectiveexchangerate l3.Exchangeratechange l3.Breakdummy
outreg using finalregCPIincreaselagged.doc, 3aster append

```

```

/*Frequency of price decreases*/
reg cpifrequencyofpricedecrease month1-month11
l3.cpimetropolitanandotherurbanarea
outreg using finalregCPIdecreaselagged.doc, 3aster replace
reg cpifrequencyofpricedecrease month1-month11 l3.CPIchange
outreg using finalregCPIdecreaselagged.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 l3.reporate
outreg using finalregCPIdecreaselagged.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 l3.Repochange
outreg using finalregCPIdecreaselagged.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 l3.nominaleeffectiveexchangerate
outreg using finalregCPIdecreaselagged.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 l3.Exchangeratechange
outreg using finalregCPIdecreaselagged.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 l3.Breakdummy
outreg using finalregCPIdecreaselagged.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11
l3.cpimetropolitanandotherurbanarea l3.CPIchange l3.reporate l3.Repochange
l3.nominaleeffectiveexchangerate l3.Exchangeratechange l3.Breakdummy
outreg using finalregCPIdecreaselagged.doc, 3aster append

```

```

/*Magnitude*/
/*Magnitude of price change*/
reg cpisizeofpricechange month1-month11 cpimetropolitanandotherurbanarea
outreg using finalregCPImagnitudechange.doc, 3aster replace
reg cpisizeofpricechange month1-month11 CPIchange
outreg using finalregCPImagnitudechange.doc, 3aster append
reg cpisizeofpricechange month1-month11 reporate
outreg using finalregCPImagnitudechange.doc, 3aster append
reg cpisizeofpricechange month1-month11 Repochange
outreg using finalregCPImagnitudechange.doc, 3aster append
reg cpisizeofpricechange month1-month11 nominaleeffectiveexchangerate
outreg using finalregCPImagnitudechange.doc, 3aster append
reg cpisizeofpricechange month1-month11 Exchangeratechange
outreg using finalregCPImagnitudechange.doc, 3aster append
reg cpisizeofpricechange month1-month11 Breakdummy
outreg using finalregCPImagnitudechange.doc, 3aster append
reg cpisizeofpricechange month1-month11 cpimetropolitanandotherurbanarea
CPIchange reporate Repochange nominaleeffectiveexchangerate Exchangeratechange
Breakdummy

```

outreg using finalregCPImagnitudechange.doc, 3aster append

/\*Magnitude of price increase\*/

```
reg cpifrequencyofpriceincrease month1-month11 cpimetropolitanandotherurbanarea
outreg using finalregCPImagnitudeincrease.doc, 3aster replace
reg cpifrequencyofpriceincrease month1-month11 CPIchange
outreg using finalregCPImagnitudeincrease.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 reporate
outreg using finalregCPImagnitudeincrease.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 Repochange
outreg using finalregCPImagnitudeincrease.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 nominaleffectiveexchangerate
outreg using finalregCPImagnitudeincrease.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 Exchangeratechange
outreg using finalregCPImagnitudeincrease.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 Breakdummy
outreg using finalregCPImagnitudeincrease.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 cpimetropolitanandotherurbanarea
CPIchange reporate Repochange nominaleffectiveexchangerate Exchangeratechange
Breakdummy
outreg using finalregCPImagnitudeincrease.doc, 3aster append
```

/\*Magnitude of price decrease\*/

```
reg cpifrequencyofpricedecrease month1-month11 cpimetropolitanandotherurbanarea
outreg using finalregCPImagnitudedecrease.doc, 3aster replace
reg cpifrequencyofpricedecrease month1-month11 CPIchange
outreg using finalregCPImagnitudedecrease.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 reporate
outreg using finalregCPImagnitudedecrease.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 Repochange
outreg using finalregCPImagnitudedecrease.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 nominaleffectiveexchangerate
outreg using finalregCPImagnitudedecrease.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 Exchangeratechange
outreg using finalregCPImagnitudedecrease.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 Breakdummy
outreg using finalregCPImagnitudedecrease.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 cpimetropolitanandotherurbanarea
CPIchange reporate Repochange nominaleffectiveexchangerate Exchangeratechange
Breakdummy
outreg using finalregCPImagnitudedecrease.doc, 3aster append
```

/\*Magnitude of price change lagged\*/

```
reg cpisizeofpricechange month1-month11 13.cpimetropolitanandotherurbanarea
outreg using finalregCPImagnitudechangelagged.doc, 3aster replace
reg cpisizeofpricechange month1-month11 13.CPIchange
outreg using finalregCPImagnitudechangelagged.doc, 3aster append
reg cpisizeofpricechange month1-month11 13.reporate
outreg using finalregCPImagnitudechangelagged.doc, 3aster append
reg cpisizeofpricechange month1-month11 13.Repochange
outreg using finalregCPImagnitudechangelagged.doc, 3aster append
reg cpisizeofpricechange month1-month11 13.nominaleffectiveexchangerate
outreg using finalregCPImagnitudechangelagged.doc, 3aster append
reg cpisizeofpricechange month1-month11 13.Exchangeratechange
outreg using finalregCPImagnitudechangelagged.doc, 3aster append
reg cpisizeofpricechange month1-month11 13.Breakdummy
outreg using finalregCPImagnitudechangelagged.doc, 3aster append
reg cpisizeofpricechange month1-month11 13.cpimetropolitanandotherurbanarea
13.CPIchange 13.reporate 13.Repochange 13.nominaleffectiveexchangerate
13.Exchangeratechange 13.Breakdummy
```

outreg using finalregCPImagnitudechangelagged.doc, 3aster append

```
/*Magnitude of price increase lagged*/
reg cpifrequencyofpriceincrease month1-month11
l3.cpimetropolitanandotherurbanarea
outreg using finalregCPImagnitudeincreaselagged.doc, 3aster replace
reg cpifrequencyofpriceincrease month1-month11 l3.CPIchange
outreg using finalregCPImagnitudeincreaselagged.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 l3.reporate
outreg using finalregCPImagnitudeincreaselagged.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 l3.Repochange
outreg using finalregCPImagnitudeincreaselagged.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 l3.nominaleeffectiveexchangerate
outreg using finalregCPImagnitudeincreaselagged.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 l3.Exchangeratechange
outreg using finalregCPImagnitudeincreaselagged.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 l3.Breakdummy
outreg using finalregCPImagnitudeincreaselagged.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11
l3.cpimetropolitanandotherurbanarea l3.CPIchange l3.reporate l3.Repochange
l3.nominaleeffectiveexchangerate l3.Exchangeratechange l3.Breakdummy
outreg using finalregCPImagnitudeincreaselagged.doc, 3aster append
```

```
/*Magnitude of price decrease lagged*/
reg cpifrequencyofpricedecrease month1-month11
l3.cpimetropolitanandotherurbanarea
outreg using finalregCPImagnitudedecreaselagged.doc, 3aster replace
reg cpifrequencyofpricedecrease month1-month11 l3.CPIchange
outreg using finalregCPImagnitudedecreaselagged.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 l3.reporate
outreg using finalregCPImagnitudedecreaselagged.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 l3.Repochange
outreg using finalregCPImagnitudedecreaselagged.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 l3.nominaleeffectiveexchangerate
outreg using finalregCPImagnitudedecreaselagged.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 l3.Exchangeratechange
outreg using finalregCPImagnitudedecreaselagged.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 l3.Breakdummy
outreg using finalregCPImagnitudedecreaselagged.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11
l3.cpimetropolitanandotherurbanarea l3.CPIchange l3.reporate l3.Repochange
l3.nominaleeffectiveexchangerate l3.Exchangeratechange l3.Breakdummy
outreg using finalregCPImagnitudedecreaselagged.doc, 3aster append
```

```
/*inflation expectations - spreads daily and surveys quarterly */
**//Real time regressions (bond yields)
reg cpifrequencyofpricechange month1-month11 spreadbetweenr189andr153bondsmat
outreg using finalregCPIchangebondyields.doc, 3aster replace
reg cpifrequencyofpricechange month1-month11 spreadbetweenr197andr186bondsmat
outreg using finalregCPIchangebondyields.doc, 3aster append
reg cpifrequencyofpricechange month1-month11 spreadbetweenr189andr153bondsmat
spreadbetweenr197andr186bondsmat
outreg using finalregCPIchangebondyields.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 spreadbetweenr189andr153bondsmat
outreg using finalregCPIchangebondyields.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 spreadbetweenr197andr186bondsmat
outreg using finalregCPIchangebondyields.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 spreadbetweenr189andr153bondsmat
spreadbetweenr197andr186bondsmat
outreg using finalregCPIchangebondyields.doc, 3aster append
```



```

reg cpifrequencyofpricedecrease month1-month11 spreadbetweenr189andr153bondsmat
outreg using finalregCPIchangebondyields.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 spreadbetweenr197andr186bondsmat
outreg using finalregCPIchangebondyields.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 spreadbetweenr189andr153bondsmat
spreadbetweenr197andr186bondsmat
outreg using finalregCPIchangebondyields.doc, 3aster append

```

**\*\*//Real time regressions (Inflation Surveys)**

```

reg cpifrequencyofpricechange month1-month11 surveyedinflationexpectationscur
outreg using finalregCPIchangeinflationssurvey.doc, 3aster replace
reg cpifrequencyofpricechange month1-month11 surveyedinflationexpectationsone
outreg using finalregCPIchangeinflationssurvey.doc, 3aster append
reg cpifrequencyofpricechange month1-month11 surveyedinflationexpectationstwo
outreg using finalregCPIchangeinflationssurvey.doc, 3aster append
reg cpifrequencyofpricechange month1-month11 surveyedinflationexpectationscur
surveyedinflationexpectationsone surveyedinflationexpectationstwo
outreg using finalregCPIchangeinflationssurvey.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 surveyedinflationexpectationscur
outreg using finalregCPIchangeinflationssurvey.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 surveyedinflationexpectationsone
outreg using finalregCPIchangeinflationssurvey.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 surveyedinflationexpectationstwo
outreg using finalregCPIchangeinflationssurvey.doc, 3aster append
reg cpifrequencyofpriceincrease month1-month11 surveyedinflationexpectationscur
surveyedinflationexpectationsone surveyedinflationexpectationstwo
outreg using finalregCPIchangeinflationssurvey.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 surveyedinflationexpectationscur
outreg using finalregCPIchangeinflationssurvey.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 surveyedinflationexpectationsone
outreg using finalregCPIchangeinflationssurvey.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 surveyedinflationexpectationstwo
outreg using finalregCPIchangeinflationssurvey.doc, 3aster append
reg cpifrequencyofpricedecrease month1-month11 surveyedinflationexpectationscur
surveyedinflationexpectationsone surveyedinflationexpectationstwo
outreg using finalregCPIchangeinflationssurvey.doc, 3aster append

```

**\*\*//Real time regressions (PPI) /\*\***

**/\*Frequency of price changes\*/**

```

reg ppifrequencyofpricechange month1-month11 ppitotal7140a
outreg using finalregPPIchange.doc, 3aster replace
reg ppifrequencyofpricechange month1-month11 PPIchange
outreg using finalregPPIchange.doc, 3aster append
reg ppifrequencyofpricechange month1-month11 reporate
outreg using finalregPPIchange.doc, 3aster append
reg ppifrequencyofpricechange month1-month11 Repochange
outreg using finalregPPIchange.doc, 3aster append
reg ppifrequencyofpricechange month1-month11 nominaleffectiveexchangerate
outreg using finalregPPIchange.doc, 3aster append
reg ppifrequencyofpricechange month1-month11 Exchangeratechange
outreg using finalregPPIchange.doc, 3aster append
reg ppifrequencyofpricechange month1-month11 Breakdummy
outreg using finalregPPIchange.doc, 3aster append
reg ppifrequencyofpricechange month1-month11 ppitotal7140a PPIchange reporate
Repochange nominaleffectiveexchangerate Exchangeratechange Breakdummy
outreg using finalregPPIchange.doc, 3aster append

```

**/\*Frequency of price increases\*/**

```

reg ppifrequencyofpriceincrease month1-month11 ppitotal7140a
outreg using finalregPPIincrease.doc, 3aster replace
reg ppifrequencyofpriceincrease month1-month11 PPIchange

```

```

outreg using finalregPPIincrease.doc, 3aster append
reg ppifrequencyofpriceincrease month1-month11 reporate
outreg using finalregPPIincrease.doc, 3aster append
reg ppifrequencyofpriceincrease month1-month11 Repochange
outreg using finalregPPIincrease.doc, 3aster append
reg ppifrequencyofpriceincrease month1-month11 nominaleffectiveexchangerate
outreg using finalregPPIincrease.doc, 3aster append
reg ppifrequencyofpriceincrease month1-month11 Exchangeratechange
outreg using finalregPPIincrease.doc, 3aster append
reg ppifrequencyofpriceincrease month1-month11 Breakdummy
outreg using finalregPPIincrease.doc, 3aster append
reg ppifrequencyofpriceincrease month1-month11 ppitotal7140a PPIchange reporate
Repochange nominaleffectiveexchangerate Exchangeratechange Breakdummy
outreg using finalregPPIincrease.doc, 3aster append

```

```

/*Frequency of price decreases*/
reg ppifrequencyofpricedecrease month1-month11 ppitotal7140a
outreg using finalregPPIdecrease.doc, 3aster replace
reg ppifrequencyofpricedecrease month1-month11 PPIchange
outreg using finalregPPIdecrease.doc, 3aster append
reg ppifrequencyofpricedecrease month1-month11 reporate
outreg using finalregPPIdecrease.doc, 3aster append
reg ppifrequencyofpricedecrease month1-month11 Repochange
outreg using finalregPPIdecrease.doc, 3aster append
reg ppifrequencyofpricedecrease month1-month11 nominaleffectiveexchangerate
outreg using finalregPPIdecrease.doc, 3aster append
reg ppifrequencyofpricedecrease month1-month11 Exchangeratechange
outreg using finalregPPIdecrease.doc, 3aster append
reg ppifrequencyofpricedecrease month1-month11 Breakdummy
outreg using finalregPPIdecrease.doc, 3aster append
reg ppifrequencyofpricedecrease month1-month11 ppitotal7140a PPIchange reporate
Repochange nominaleffectiveexchangerate Exchangeratechange Breakdummy
outreg using finalregPPIdecrease.doc, 3aster append

```

```

/*Lagged (PPI)*/
/*Frequency of price change*/

```

```

reg ppifrequencyofpricechange month1-month11 13.ppitotal7140a
outreg using finalregPPIchangelagged.doc, 3aster replace
reg ppifrequencyofpricechange month1-month11 13.PPIchange
outreg using finalregPPIchangelagged.doc, 3aster append
reg ppifrequencyofpricechange month1-month11 13.reporate
outreg using finalregPPIchangelagged.doc, 3aster append
reg ppifrequencyofpricechange month1-month11 13.Repochange
outreg using finalregPPIchangelagged.doc, 3aster append
reg ppifrequencyofpricechange month1-month11 13.nominaleffectiveexchangerate
outreg using finalregPPIchangelagged.doc, 3aster append
reg ppifrequencyofpricechange month1-month11 13.Exchangeratechange
outreg using finalregPPIchangelagged.doc, 3aster append
reg ppifrequencyofpricechange month1-month11 13.Breakdummy
outreg using finalregPPIchangelagged.doc, 3aster append
reg ppifrequencyofpricechange month1-month11 13.ppitotal7140a 13.PPIchange
13.reporate 13.Repochange 13.nominaleffectiveexchangerate 13.Exchangeratechange
13.Breakdummy
outreg using finalregPPIchangelagged.doc, 3aster append

```

```

/*Frequency of price increases*/
reg ppifrequencyofpriceincrease month1-month11 13.ppitotal7140a
outreg using finalregPPIincreaselagged.doc, 3aster replace
reg ppifrequencyofpriceincrease month1-month11 13.PPIchange
outreg using finalregPPIincreaselagged.doc, 3aster append
reg ppifrequencyofpriceincrease month1-month11 13.reporate

```

```

outreg using finalregPPIincreaselagged.doc, 3aster append
reg ppifrequencyofpriceincrease month1-month11 13.Repochange
outreg using finalregPPIincreaselagged.doc, 3aster append
reg ppifrequencyofpriceincrease month1-month11 13.nominaleeffectiveexchangerate
outreg using finalregPPIincreaselagged.doc, 3aster append
reg ppifrequencyofpriceincrease month1-month11 13.Exchangeratechange
outreg using finalregPPIincreaselagged.doc, 3aster append
reg ppifrequencyofpriceincrease month1-month11 13.Breakdummy
outreg using finalregPPIincreaselagged.doc, 3aster append
reg ppifrequencyofpriceincrease month1-month11 13.ppitotal7140a 13.PPIchange
13.reporate 13.Repochange 13.nominaleeffectiveexchangerate 13.Exchangeratechange
13.Breakdummy
outreg using finalregPPIincreaselagged.doc, 3aster append

```

```

/*Frequency of price decreases*/
reg ppifrequencyofpricedecrease month1-month11 13.ppitotal7140a
outreg using finalregPPIdecreaselagged.doc, 3aster replace
reg ppifrequencyofpricedecrease month1-month11 13.PPIchange
outreg using finalregPPIdecreaselagged.doc, 3aster append
reg ppifrequencyofpricedecrease month1-month11 13.reporate
outreg using finalregPPIdecreaselagged.doc, 3aster append
reg ppifrequencyofpricedecrease month1-month11 13.Repochange
outreg using finalregPPIdecreaselagged.doc, 3aster append
reg ppifrequencyofpricedecrease month1-month11 13.nominaleeffectiveexchangerate
outreg using finalregPPIdecreaselagged.doc, 3aster append
reg ppifrequencyofpricedecrease month1-month11 13.Exchangeratechange
outreg using finalregPPIdecreaselagged.doc, 3aster append
reg ppifrequencyofpricedecrease month1-month11 13.Breakdummy
outreg using finalregPPIdecreaselagged.doc, 3aster append
reg ppifrequencyofpricedecrease month1-month11 13.ppitotal7140a 13.PPIchange
13.reporate 13.Repochange 13.nominaleeffectiveexchangerate 13.Exchangeratechange
13.Breakdummy
outreg using finalregPPIdecreaselagged.doc, 3aster append

```

```

/*Magnitude of price changes*/
reg ppisizeofpricechange month1-month11 ppitotal7140a
outreg using finalregPPImagnitudechange.doc, 3aster replace
reg ppisizeofpricechange month1-month11 PPIchange
outreg using finalregPPImagnitudechange.doc, 3aster append
reg ppisizeofpricechange month1-month11 reporate
outreg using finalregPPImagnitudechange.doc, 3aster append
reg ppisizeofpricechange month1-month11 Repochange
outreg using finalregPPImagnitudechange.doc, 3aster append
reg ppisizeofpricechange month1-month11 nominaleeffectiveexchangerate
outreg using finalregPPImagnitudechange.doc, 3aster append
reg ppisizeofpricechange month1-month11 Exchangeratechange
outreg using finalregPPImagnitudechange.doc, 3aster append
reg ppisizeofpricechange month1-month11 Breakdummy
outreg using finalregPPImagnitudechange.doc, 3aster append
reg ppisizeofpricechange month1-month11 ppitotal7140a PPIchange reporate
Repochange nominaleeffectiveexchangerate Exchangeratechange Breakdummy
outreg using finalregPPImagnitudechange.doc, 3aster append

```

```

/*Magnitude of price increases*/
reg ppisizeofpriceincrease month1-month11 ppitotal7140a
outreg using finalregPPImagnitudeincrease.doc, 3aster replace
reg ppisizeofpriceincrease month1-month11 PPIchange
outreg using finalregPPImagnitudeincrease.doc, 3aster append
reg ppisizeofpriceincrease month1-month11 reporate
outreg using finalregPPImagnitudeincrease.doc, 3aster append
reg ppisizeofpriceincrease month1-month11 Repochange
outreg using finalregPPImagnitudeincrease.doc, 3aster append
reg ppisizeofpriceincrease month1-month11 nominaleeffectiveexchangerate

```

```

outreg using finalregPPImagnitudeincrease.doc, 3aster append
reg ppisizeofpriceincrease month1-month11 Exchangeratechange
outreg using finalregPPImagnitudeincrease.doc, 3aster append
reg ppisizeofpriceincrease month1-month11 Breakdummy
outreg using finalregPPImagnitudeincrease.doc, 3aster append
reg ppisizeofpriceincrease month1-month11 ppitotal7140a PPIchange reporate
Repochange nominaleffectiveexchangerate Exchangeratechange Breakdummy
outreg using finalregPPImagnitudeincrease.doc, 3aster append

/*Magnitude of price decreases*/
reg ppisizeofpricedecrease month1-month11 ppitotal7140a
outreg using finalregPPImagnitudedecrease.doc, 3aster replace
reg ppisizeofpricedecrease month1-month11 PPIchange
outreg using finalregPPImagnitudedecrease.doc, 3aster append
reg ppisizeofpricedecrease month1-month11 reporate
outreg using finalregPPImagnitudedecrease.doc, 3aster append
reg ppisizeofpricedecrease month1-month11 Repochange
outreg using finalregPPImagnitudedecrease.doc, 3aster append
reg ppisizeofpricedecrease month1-month11 nominaleffectiveexchangerate
outreg using finalregPPImagnitudedecrease.doc, 3aster append
reg ppisizeofpricedecrease month1-month11 Exchangeratechange
outreg using finalregPPImagnitudedecrease.doc, 3aster append
reg ppisizeofpricedecrease month1-month11 Breakdummy
outreg using finalregPPImagnitudedecrease.doc, 3aster append
reg ppisizeofpricedecrease month1-month11 ppitotal7140a PPIchange reporate
Repochange nominaleffectiveexchangerate Exchangeratechange Breakdummy
outreg using finalregPPImagnitudedecrease.doc, 3aster append

/*Lagged (PPI)*/
/*Magnitude of price changes*/
reg ppisizeofpricechange month1-month11 13.ppitotal7140a
outreg using finalregPPImagnitudechangelagged.doc, 3aster replace
reg ppisizeofpricechange month1-month11 13.PPIchange
outreg using finalregPPImagnitudechangelagged.doc, 3aster append
reg ppisizeofpricechange month1-month11 13.reporate
outreg using finalregPPImagnitudechangelagged.doc, 3aster append
reg ppisizeofpricechange month1-month11 13.Repochange
outreg using finalregPPImagnitudechangelagged.doc, 3aster append
reg ppisizeofpricechange month1-month11 13.nominaleffectiveexchangerate
outreg using finalregPPImagnitudechangelagged.doc, 3aster append
reg ppisizeofpricechange month1-month11 13.Exchangeratechange
outreg using finalregPPImagnitudechangelagged.doc, 3aster append
reg ppisizeofpricechange month1-month11 13.Breakdummy
outreg using finalregPPImagnitudechangelagged.doc, 3aster append
reg ppisizeofpricechange month1-month11 13.ppitotal7140a 13.PPIchange
13.reporate 13.Repochange 13.nominaleffectiveexchangerate 13.Exchangeratechange
13.Breakdummy
outreg using finalregPPImagnitudechangelagged.doc, 3aster append

/*Magnitude of price increases*/
reg ppisizeofpriceincrease month1-month11 13.ppitotal7140a
outreg using finalregPPImagnitudeincreaselagged.doc, 3aster replace
reg ppisizeofpriceincrease month1-month11 13.PPIchange
outreg using finalregPPImagnitudeincreaselagged.doc, 3aster append
reg ppisizeofpriceincrease month1-month11 13.reporate
outreg using finalregPPImagnitudeincreaselagged.doc, 3aster append
reg ppisizeofpriceincrease month1-month11 13.Repochange
outreg using finalregPPImagnitudeincreaselagged.doc, 3aster append
reg ppisizeofpriceincrease month1-month11 13.nominaleffectiveexchangerate
outreg using finalregPPImagnitudeincreaselagged.doc, 3aster append
reg ppisizeofpriceincrease month1-month11 13.Exchangeratechange
outreg using finalregPPImagnitudeincreaselagged.doc, 3aster append
reg ppisizeofpriceincrease month1-month11 13.Breakdummy

```

```

outreg using finalregPPImagnitudeincreaselagged.doc, 3aster append
reg ppisizeofpriceincrease month1-month11 13.ppitotal7140a 13.PPIchange
13.reporate 13.Repochange 13.nominaleffectiveexchangerate 13.Exchangeratechange
13.Breakdummy
outreg using finalregPPImagnitudeincreaselagged.doc, 3aster append

/*Magnitude of price decreases*/
reg ppisizeofpricedecrease month1-month11 13.ppitotal7140a
outreg using finalregPPImagnitudedecreaselagged.doc, 3aster replace
reg ppisizeofpricedecrease month1-month11 13.PPIchange
outreg using finalregPPImagnitudedecreaselagged.doc, 3aster append
reg ppisizeofpricedecrease month1-month11 13.reporate
outreg using finalregPPImagnitudedecreaselagged.doc, 3aster append
reg ppisizeofpricedecrease month1-month11 13.Repochange
outreg using finalregPPImagnitudedecreaselagged.doc, 3aster append
reg ppisizeofpricedecrease month1-month11 13.nominaleffectiveexchangerate
outreg using finalregPPImagnitudedecreaselagged.doc, 3aster append
reg ppisizeofpricedecrease month1-month11 13.Exchangeratechange
outreg using finalregPPImagnitudedecreaselagged.doc, 3aster append
reg ppisizeofpricedecrease month1-month11 13.Breakdummy
outreg using finalregPPImagnitudedecreaselagged.doc, 3aster append
reg ppisizeofpricedecrease month1-month11 13.ppitotal7140a 13.PPIchange
13.reporate 13.Repochange 13.nominaleffectiveexchangerate 13.Exchangeratechange
13.Breakdummy
outreg using finalregPPImagnitudedecreaselagged.doc, 3aster append

```

## Appendix 10: Further regression results

### 10.1 Frequency of price increases

|                                                      | (1)                | (2)                | (3)                | (4)                | (5)                 | (6)                | (7)                | (8)                |
|------------------------------------------------------|--------------------|--------------------|--------------------|--------------------|---------------------|--------------------|--------------------|--------------------|
|                                                      | CPI                | CPI                | CPI                | CPI                | CPI                 | CPI                | CPI                | CPI                |
| January                                              | 0.022<br>(1.76)*   | 0.018<br>(1.17)    | 0.018<br>(1.39)    | 0.015<br>(1.02)    | 0.010<br>(0.97)     | 0.018<br>(1.04)    | 0.021<br>(1.35)    | 0.018<br>(1.86)*   |
| February                                             | 0.004<br>(0.36)    | 0.001<br>(0.09)    | 0.001<br>(0.05)    | 0.002<br>(0.14)    | -0.006<br>(0.55)    | 0.000<br>(0.01)    | 0.003<br>(0.22)    | 0.002<br>(0.16)    |
| March                                                | 0.055<br>(4.32)*** | 0.052<br>(3.14)*** | 0.049<br>(3.58)*** | 0.050<br>(3.16)*** | 0.042<br>(3.98)***  | 0.053<br>(3.04)*** | 0.056<br>(3.43)*** | 0.046<br>(4.59)*** |
| April                                                | 0.024<br>(1.95)*   | 0.019<br>(1.24)    | 0.020<br>(1.56)    | 0.025<br>(1.62)    | 0.018<br>(1.77)*    | 0.020<br>(1.23)    | 0.020<br>(1.31)    | 0.019<br>(1.99)*   |
| May                                                  | 0.014<br>(1.18)    | 0.011<br>(0.71)    | 0.011<br>(0.84)    | 0.013<br>(0.87)    | 0.006<br>(0.57)     | 0.011<br>(0.66)    | 0.011<br>(0.71)    | 0.010<br>(0.99)    |
| June                                                 | 0.031<br>(2.56)**  | 0.028<br>(1.78)*   | 0.028<br>(2.12)**  | 0.028<br>(1.87)*   | 0.018<br>(1.79)*    | 0.029<br>(1.63)    | 0.028<br>(1.82)*   | 0.024<br>(2.39)**  |
| July                                                 | 0.012<br>(0.95)    | 0.008<br>(0.51)    | 0.009<br>(0.67)    | 0.011<br>(0.76)    | 0.002<br>(0.23)     | 0.009<br>(0.57)    | 0.009<br>(0.60)    | 0.005<br>(0.49)    |
| August                                               | 0.005<br>(0.45)    | 0.003<br>(0.18)    | 0.004<br>(0.29)    | 0.008<br>(0.53)    | -0.004<br>(0.44)    | 0.004<br>(0.25)    | 0.004<br>(0.25)    | 0.001<br>(0.06)    |
| September                                            | 0.022<br>(1.78)*   | 0.020<br>(1.28)    | 0.021<br>(1.57)    | 0.023<br>(1.50)    | 0.011<br>(1.05)     | 0.021<br>(1.23)    | 0.021<br>(1.32)    | 0.017<br>(1.74)*   |
| October                                              | 0.018<br>(1.49)    | 0.016<br>(1.04)    | 0.019<br>(1.42)    | 0.022<br>(1.46)    | 0.009<br>(0.92)     | 0.018<br>(1.09)    | 0.018<br>(1.16)    | 0.014<br>(1.53)    |
| November                                             | 0.009<br>(0.70)    | 0.009<br>(0.56)    | 0.009<br>(0.69)    | 0.010<br>(0.69)    | 0.004<br>(0.38)     | 0.008<br>(0.51)    | 0.008<br>(0.54)    | 0.007<br>(0.78)    |
| CPI - metropolitan<br>and other urban<br>areas 7112A | 0.005              |                    |                    |                    |                     |                    |                    | -0.001             |
|                                                      | (6.97)***          |                    |                    |                    |                     |                    |                    | (0.97)             |
| CPIchange                                            |                    | 0.012<br>(2.62)**  |                    |                    |                     |                    |                    | 0.008<br>(2.00)*   |
| Repo Rate                                            |                    |                    | 0.007<br>(5.98)*** |                    |                     |                    |                    | 0.006<br>(2.27)**  |
| Breakdummy                                           |                    |                    |                    |                    |                     |                    | 0.021<br>(2.91)*** | 0.019<br>(3.45)*** |
| Exchangeratechange                                   |                    |                    |                    |                    |                     | 0.000<br>(0.10)    |                    | 0.001<br>(0.59)    |
| Nominal Effective<br>Exchange Rate -<br>5376M        |                    |                    |                    |                    | -0.002              |                    |                    | -0.001             |
|                                                      |                    |                    |                    |                    | (9.89)***           |                    |                    | (2.65)**           |
| Repochange                                           |                    |                    |                    | 0.025<br>(3.45)*** |                     |                    |                    | 0.004<br>(0.66)    |
| Constant                                             | 0.060<br>(6.13)*** | 0.091<br>(8.23)*** | 0.024<br>(1.68)*   | 0.090<br>(8.38)*** | 0.278<br>(13.81)*** | 0.092<br>(7.56)*** | 0.085<br>(7.58)*** | 0.130<br>(2.50)**  |
| Observations                                         | 71                 | 71                 | 71                 | 71                 | 71                  | 71                 | 71                 | 71                 |
| R-squared                                            | 0.57               | 0.29               | 0.51               | 0.34               | 0.71                | 0.21               | 0.31               | 0.78               |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

## 10.2 Frequency of price decreases

|                                                      | (1)                 | (2)                 | (3)                | (4)                 | (5)                | (6)                 | (7)                 | (8)                 |
|------------------------------------------------------|---------------------|---------------------|--------------------|---------------------|--------------------|---------------------|---------------------|---------------------|
|                                                      | CPI                 | CPI                 | CPI                | CPI                 | CPI                | CPI                 | CPI                 | CPI                 |
| January                                              | -0.012<br>(1.53)    | -0.012<br>(1.51)    | -0.011<br>(1.52)   | -0.011<br>(1.48)    | -0.011<br>(1.43)   | -0.015<br>(1.97)*   | -0.008<br>(1.53)    | -0.007<br>(1.41)    |
| February                                             | -0.008<br>(1.09)    | -0.008<br>(1.07)    | -0.008<br>(1.07)   | -0.008<br>(1.06)    | -0.008<br>(1.01)   | -0.009<br>(1.25)    | -0.005<br>(0.90)    | -0.004<br>(0.89)    |
| March                                                | -0.004<br>(0.52)    | -0.004<br>(0.48)    | -0.003<br>(0.44)   | -0.004<br>(0.48)    | -0.003<br>(0.42)   | -0.006<br>(0.74)    | -0.001<br>(0.26)    | -0.001<br>(0.30)    |
| April                                                | -0.005<br>(0.67)    | -0.005<br>(0.63)    | -0.005<br>(0.65)   | -0.005<br>(0.66)    | -0.005<br>(0.62)   | -0.006<br>(0.75)    | -0.005<br>(0.91)    | -0.007<br>(1.49)    |
| May                                                  | -0.004<br>(0.49)    | -0.004<br>(0.47)    | -0.004<br>(0.47)   | -0.004<br>(0.48)    | -0.003<br>(0.42)   | -0.008<br>(0.97)    | -0.004<br>(0.66)    | -0.005<br>(1.06)    |
| June                                                 | 0.008<br>(1.01)     | 0.008<br>(1.04)     | 0.008<br>(1.06)    | 0.008<br>(1.04)     | 0.009<br>(1.11)    | 0.003<br>(0.36)     | 0.008<br>(1.48)     | 0.007<br>(1.54)     |
| July                                                 | -0.003<br>(0.35)    | -0.002<br>(0.31)    | -0.002<br>(0.32)   | -0.003<br>(0.34)    | -0.002<br>(0.27)   | -0.003<br>(0.44)    | -0.002<br>(0.46)    | -0.003<br>(0.61)    |
| August                                               | -0.002<br>(0.32)    | -0.002<br>(0.29)    | -0.002<br>(0.31)   | -0.003<br>(0.33)    | -0.002<br>(0.24)   | -0.005<br>(0.72)    | -0.002<br>(0.44)    | -0.003<br>(0.53)    |
| September                                            | -0.001<br>(0.15)    | -0.001<br>(0.13)    | -0.001<br>(0.14)   | -0.001<br>(0.15)    | -0.000<br>(0.06)   | -0.004<br>(0.56)    | -0.001<br>(0.19)    | -0.000<br>(0.05)    |
| October                                              | -0.005<br>(0.69)    | -0.005<br>(0.66)    | -0.005<br>(0.71)   | -0.005<br>(0.71)    | -0.005<br>(0.62)   | -0.007<br>(0.93)    | -0.005<br>(0.98)    | -0.004<br>(0.89)    |
| November                                             | -0.006<br>(0.77)    | -0.006<br>(0.78)    | -0.006<br>(0.79)   | -0.006<br>(0.78)    | -0.006<br>(0.73)   | -0.006<br>(0.82)    | -0.006<br>(1.09)    | -0.005<br>(1.06)    |
| CPI - metropolitan<br>and other urban<br>areas 7112A | -0.000<br>(0.73)    |                     |                    |                     |                    |                     |                     | -0.002<br>(3.22)*** |
| CPIchange                                            |                     | -0.001<br>(0.64)    |                    |                     |                    |                     |                     | 0.001<br>(0.76)     |
| Repo Rate                                            |                     |                     | -0.001<br>(1.36)   |                     |                    |                     |                     | 0.005<br>(3.61)***  |
| Breakdummy                                           |                     |                     |                    |                     |                    |                     | 0.019<br>(7.76)***  | 0.027<br>(9.93)***  |
| Exchangeratechange                                   |                     |                     |                    |                     |                    | -0.001<br>(1.81)*   |                     | -0.000<br>(0.64)    |
| Nominal Effective<br>Exchange Rate -<br>5376M        |                     |                     |                    |                     | 0.000<br>(0.77)    |                     |                     | 0.001<br>(2.72)***  |
| Repochange                                           |                     |                     |                    | -0.001<br>(0.32)    |                    |                     |                     | -0.004<br>(1.52)    |
| Constant                                             | 0.067<br>(10.95)*** | 0.065<br>(12.00)*** | 0.074<br>(8.75)*** | 0.065<br>(11.95)*** | 0.054<br>(3.55)*** | 0.067<br>(12.35)*** | 0.058<br>(15.05)*** | -0.021<br>(0.81)    |
| Observations                                         | 71                  | 71                  | 71                 | 71                  | 71                 | 71                  | 71                  | 71                  |
| R-squared                                            | 0.13                | 0.13                | 0.15               | 0.13                | 0.13               | 0.17                | 0.57                | 0.73                |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

### 10.3 Frequency of price increases (lagged)

|                                                             | (1)                | (2)                | (3)                | (4)                | (5)                 | (6)                | (7)                | (8)                |
|-------------------------------------------------------------|--------------------|--------------------|--------------------|--------------------|---------------------|--------------------|--------------------|--------------------|
|                                                             | CPI                | CPI                | CPI                | CPI                | CPI                 | CPI                | CPI                | CPI                |
| January                                                     | 0.020<br>(1.35)    | 0.018<br>(1.11)    | 0.019<br>(1.24)    | 0.022<br>(1.45)    | 0.018<br>(1.53)     | 0.017<br>(1.08)    | 0.021<br>(1.38)    | 0.023<br>(2.06)**  |
| February                                                    | 0.002<br>(0.14)    | 0.001<br>(0.05)    | 0.001<br>(0.08)    | 0.000<br>(0.00)    | 0.004<br>(0.30)     | 0.005<br>(0.28)    | 0.004<br>(0.24)    | 0.008<br>(0.69)    |
| March                                                       | 0.054<br>(3.56)*** | 0.054<br>(3.17)*** | 0.052<br>(3.30)*** | 0.053<br>(3.36)*** | 0.053<br>(4.24)***  | 0.054<br>(3.16)*** | 0.056<br>(3.47)*** | 0.055<br>(4.77)*** |
| April                                                       | 0.022<br>(1.55)    | 0.021<br>(1.30)    | 0.021<br>(1.37)    | 0.016<br>(1.05)    | 0.022<br>(1.85)*    | 0.019<br>(1.19)    | 0.024<br>(1.56)    | 0.022<br>(1.96)*   |
| May                                                         | 0.013<br>(0.93)    | 0.012<br>(0.74)    | 0.011<br>(0.75)    | 0.011<br>(0.73)    | 0.015<br>(1.21)     | 0.014<br>(0.88)    | 0.015<br>(0.95)    | 0.018<br>(1.60)    |
| June                                                        | 0.030<br>(2.11)**  | 0.029<br>(1.76)*   | 0.028<br>(1.84)*   | 0.024<br>(1.58)    | 0.032<br>(2.66)**   | 0.030<br>(1.84)*   | 0.028<br>(1.83)*   | 0.030<br>(2.65)**  |
| July                                                        | 0.011<br>(0.77)    | 0.009<br>(0.56)    | 0.009<br>(0.62)    | 0.012<br>(0.76)    | 0.016<br>(1.31)     | 0.014<br>(0.84)    | 0.009<br>(0.61)    | 0.018<br>(1.58)    |
| August                                                      | 0.005<br>(0.38)    | 0.004<br>(0.26)    | 0.004<br>(0.25)    | 0.004<br>(0.25)    | 0.008<br>(0.65)     | 0.003<br>(0.16)    | 0.004<br>(0.25)    | 0.006<br>(0.56)    |
| September                                                   | 0.022<br>(1.52)    | 0.021<br>(1.27)    | 0.020<br>(1.33)    | 0.018<br>(1.22)    | 0.020<br>(1.70)*    | 0.017<br>(1.07)    | 0.021<br>(1.33)    | 0.018<br>(1.59)    |
| October                                                     | 0.019<br>(1.30)    | 0.017<br>(1.07)    | 0.018<br>(1.16)    | 0.018<br>(1.19)    | 0.020<br>(1.70)*    | 0.022<br>(1.36)    | 0.018<br>(1.17)    | 0.022<br>(1.98)*   |
| November                                                    | 0.009<br>(0.60)    | 0.008<br>(0.50)    | 0.008<br>(0.55)    | 0.011<br>(0.70)    | 0.010<br>(0.81)     | 0.009<br>(0.53)    | 0.008<br>(0.54)    | 0.011<br>(0.97)    |
| L3. CPI -<br>metropolitan and<br>other urban areas<br>7112A | 0.004<br>(4.34)*** |                    |                    |                    |                     |                    |                    | -0.000<br>(0.12)   |
| L3.CPIchange                                                |                    | 0.007<br>(1.51)    |                    |                    |                     |                    |                    | -0.004<br>(0.81)   |
| L3.Repochange                                               |                    |                    |                    | 0.026<br>(3.49)*** |                     |                    |                    | 0.012<br>(1.80)*   |
| L3.Exchangeratechange                                       |                    |                    |                    |                    |                     | -0.002<br>(1.74)*  |                    | -0.001<br>(1.05)   |
| L3.Breakdummy                                               |                    |                    |                    |                    |                     |                    | 0.022<br>(3.06)*** | 0.017<br>(2.46)**  |
| L3. Repo Rate                                               |                    |                    | 0.005<br>(3.47)*** |                    |                     |                    |                    | 0.001<br>(0.32)    |
| L3. Nominal Effective<br>Exchange Rate - 5376M              |                    |                    |                    |                    | -0.002              |                    |                    | -0.001             |
| Constant                                                    | 0.069<br>(6.02)*** | 0.091<br>(7.92)*** | 0.046<br>(2.74)*** | 0.092<br>(8.61)*** | 0.240<br>(10.92)*** | 0.090<br>(7.88)*** | 0.084<br>(7.57)*** | 0.198<br>(3.17)*** |
| Observations                                                | 71                 | 71                 | 71                 | 71                 | 71                  | 71                 | 71                 | 71                 |
| R-squared                                                   | 0.40               | 0.24               | 0.35               | 0.35               | 0.59                | 0.25               | 0.32               | 0.69               |

Absolute value of t statistics in parentheses

significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%



## 10.4 Frequency of price decreases (lagged)

|                                                      | (1)                 | (2)                 | (3)                | (4)                 | (5)                           | (6)                 | (7)                 | (8)                           |
|------------------------------------------------------|---------------------|---------------------|--------------------|---------------------|-------------------------------|---------------------|---------------------|-------------------------------|
|                                                      | CPI                 | CPI                 | CPI                | CPI                 | CPI                           | CPI                 | CPI                 | CPI                           |
| January                                              | -0.011<br>(1.49)    | -0.012<br>(1.53)    | -0.012<br>(1.54)   | -0.011<br>(1.48)    | -0.012<br>(1.54)              | -0.011<br>(1.49)    | -0.008<br>(1.48)    | -0.007<br>(1.46)              |
| February                                             | -0.008<br>(1.05)    | -0.008<br>(1.09)    | -0.008<br>(1.09)   | -0.008<br>(1.05)    | -0.009<br>(1.14)              | -0.009<br>(1.13)    | -0.005<br>(0.87)    | -0.005<br>(1.11)              |
| March                                                | -0.004<br>(0.50)    | -0.004<br>(0.55)    | -0.004<br>(0.48)   | -0.004<br>(0.50)    | -0.004<br>(0.51)              | -0.004<br>(0.51)    | -0.001<br>(0.25)    | -0.001<br>(0.29)              |
| April                                                | -0.005<br>(0.64)    | -0.005<br>(0.68)    | -0.005<br>(0.66)   | -0.005<br>(0.64)    | -0.005<br>(0.69)              | -0.005<br>(0.62)    | -0.002<br>(0.31)    | -0.001<br>(0.32)              |
| May                                                  | -0.004<br>(0.46)    | -0.004<br>(0.52)    | -0.004<br>(0.48)   | -0.004<br>(0.46)    | -0.004<br>(0.54)              | -0.004<br>(0.53)    | -0.000<br>(0.07)    | -0.001<br>(0.28)              |
| June                                                 | 0.008<br>(1.04)     | 0.008<br>(1.03)     | 0.008<br>(1.06)    | 0.008<br>(1.03)     | 0.007<br>(0.99)               | 0.008<br>(1.01)     | 0.008<br>(1.43)     | 0.005<br>(1.15)               |
| July                                                 | -0.002<br>(0.33)    | -0.002<br>(0.32)    | -0.002<br>(0.33)   | -0.002<br>(0.32)    | -0.003<br>(0.46)              | -0.003<br>(0.42)    | -0.002<br>(0.45)    | -0.006<br>(1.28)              |
| August                                               | -0.002<br>(0.31)    | -0.002<br>(0.33)    | -0.002<br>(0.31)   | -0.002<br>(0.31)    | -0.003<br>(0.39)              | -0.002<br>(0.28)    | -0.002<br>(0.42)    | -0.004<br>(0.92)              |
| September                                            | -0.001<br>(0.14)    | -0.001<br>(0.14)    | -0.001<br>(0.13)   | -0.001<br>(0.14)    | -0.001<br>(0.14)              | -0.001<br>(0.07)    | -0.001<br>(0.19)    | -0.001<br>(0.27)              |
| October                                              | -0.005<br>(0.69)    | -0.005<br>(0.67)    | -0.005<br>(0.69)   | -0.005<br>(0.69)    | -0.006<br>(0.75)              | -0.006<br>(0.77)    | -0.005<br>(0.94)    | -0.007<br>(1.54)              |
| November                                             | -0.006<br>(0.77)    | -0.006<br>(0.76)    | -0.006<br>(0.78)   | -0.006<br>(0.76)    | -0.006<br>(0.81)              | -0.006<br>(0.77)    | -0.006<br>(1.06)    | -0.007<br>(1.41)              |
| L3. CPI -<br>metropolitan<br>and other urban         | -0.000<br>(0.02)    |                     |                    |                     |                               |                     |                     | -0.001<br>(0.95)              |
| L3.CPIchange                                         |                     | -0.003<br>(1.18)    |                    |                     |                               |                     | 0.019<br>(7.23)***  | 0.000<br>(0.13)               |
| L3.Repochange                                        |                     |                     |                    | 0.000<br>(0.07)     |                               |                     |                     | 0.001<br>(0.21)               |
| L3.Exchangerate<br>change                            |                     |                     |                    |                     |                               | 0.000               |                     | 0.000                         |
| L3.Breakdummy                                        |                     |                     |                    |                     |                               | (0.61)              |                     | (0.53)                        |
| L3. Repo Rate                                        |                     |                     | -0.001<br>(1.30)   |                     |                               |                     | 0.019<br>(7.23)***  | 0.025<br>(8.56)***            |
| L3. Nominal<br>Effective<br>Exchange Rate -<br>5376M |                     |                     |                    |                     | 0.000                         |                     |                     | (2.60)**<br>0.001             |
| Constant                                             | 0.065<br>(10.63)*** | 0.065<br>(12.12)*** | 0.073<br>(8.66)*** | 0.065<br>(11.94)*** | (1.76)*<br>0.042<br>(3.09)*** | 0.065<br>(11.99)*** | 0.058<br>(14.50)*** | (3.97)***<br>-0.040<br>(1.53) |
| Observations                                         | 71                  | 71                  | 71                 | 71                  | 71                            | 71                  | 71                  | 71                            |
| R-squared                                            | 0.13                | 0.15                | 0.15               | 0.13                | 0.17                          | 0.13                | 0.54                | 0.72                          |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

## 10.5 Magnitude of price changes

|                                                         | (1)                 | (2)                | (3)                | (4)                | (5)                | (6)                | (7)                 | (8)                |
|---------------------------------------------------------|---------------------|--------------------|--------------------|--------------------|--------------------|--------------------|---------------------|--------------------|
|                                                         | CPI Size            | CPI Size           | CPI Size           | CPI Size           | CPI Size           | CPI Size           | CPI Size            | CPI Size           |
| January                                                 | -0.002<br>(0.43)    | -0.001<br>(0.26)   | -0.001<br>(0.27)   | -0.001<br>(0.18)   | -0.000<br>(0.02)   | -0.000<br>(0.09)   | -0.003<br>(1.04)    | -0.005<br>(1.50)   |
| February                                                | -0.002<br>(0.42)    | -0.001<br>(0.24)   | -0.001<br>(0.24)   | -0.002<br>(0.31)   | -0.000<br>(0.06)   | -0.001<br>(0.17)   | -0.003<br>(0.99)    | -0.004<br>(1.32)   |
| March                                                   | -0.014<br>(2.79)*** | -0.013<br>(2.47)** | -0.013<br>(2.46)** | -0.013<br>(2.46)** | -0.012<br>(2.35)** | -0.013<br>(2.39)** | -0.015<br>(4.26)*** | -0.015<br>(4.61)** |
| April                                                   | -0.011<br>(2.28)**  | -0.010<br>(1.96)*  | -0.010<br>(2.03)** | -0.011<br>(2.20)** | -0.010<br>(2.06)** | -0.010<br>(1.94)*  | -0.010<br>(2.98)*** | -0.010<br>(3.37)** |
| May                                                     | -0.009<br>(2.05)**  | -0.009<br>(1.76)*  | -0.009<br>(1.81)*  | -0.009<br>(1.90)*  | -0.008<br>(1.73)*  | -0.008<br>(1.53)   | -0.009<br>(2.66)**  | -0.010<br>(3.15)** |
| June                                                    | -0.008<br>(1.69)*   | -0.007<br>(1.44)   | -0.007<br>(1.46)   | -0.007<br>(1.49)   | -0.006<br>(1.23)   | -0.006<br>(1.15)   | -0.007<br>(2.18)**  | -0.008<br>(2.62)** |
| July                                                    | -0.008<br>(1.77)*   | -0.008<br>(1.53)   | -0.008<br>(1.57)   | -0.008<br>(1.68)*  | -0.007<br>(1.44)   | -0.008<br>(1.51)   | -0.008<br>(2.34)**  | -0.008<br>(2.65)** |
| August                                                  | -0.007<br>(1.58)    | -0.007<br>(1.38)   | -0.007<br>(1.44)   | -0.008<br>(1.60)   | -0.006<br>(1.24)   | -0.006<br>(1.23)   | -0.007<br>(2.11)**  | -0.008<br>(2.59)** |
| September                                               | -0.010<br>(2.19)**  | -0.010<br>(1.96)*  | -0.010<br>(2.02)** | -0.010<br>(2.11)** | -0.008<br>(1.80)*  | -0.009<br>(1.78)*  | -0.010<br>(2.98)*** | -0.011<br>(3.54)** |
| October                                                 | -0.009<br>(2.03)**  | -0.009<br>(1.83)*  | -0.009<br>(1.92)*  | -0.010<br>(2.08)** | -0.008<br>(1.72)*  | -0.009<br>(1.77)*  | -0.009<br>(2.80)*** | -0.010<br>(3.37)** |
| November                                                | -0.007<br>(1.46)    | -0.007<br>(1.34)   | -0.007<br>(1.39)   | -0.007<br>(1.46)   | -0.006<br>(1.30)   | -0.007<br>(1.32)   | -0.007<br>(2.02)**  | -0.007<br>(2.37)** |
| CPI -<br>metropolitan and<br>other urban areas<br>7112A | -0.001<br>(3.33)*** |                    |                    |                    |                    |                    |                     | 0.000<br>(0.63)    |
| CPIchange                                               |                     | -0.001<br>(0.55)   |                    |                    |                    |                    |                     | 0.000<br>(0.18)    |
| Repo Rate                                               |                     |                    | -0.001<br>(1.91)*  |                    |                    |                    |                     | -0.002<br>(1.97)*  |
| Breakdummy                                              |                     |                    |                    |                    |                    |                    | -0.013<br>(8.69)*** | -0.015<br>(8.47)** |
| Exchangeratechang                                       |                     |                    |                    |                    |                    | 0.000<br>(0.56)    |                     | -0.000<br>(1.01)   |
| Nominal Effective<br>Exchange Rate -<br>5376M           |                     |                    |                    |                    | 0.000<br>(3.20)*** |                    |                     | -0.000<br>(0.28)   |
| Repochange                                              |                     |                    |                    | -0.005<br>(2.06)** |                    |                    |                     | -0.001<br>(0.29)   |
| Constant                                                | 0.144<br>(38.81)**  | 0.138<br>(38.71)** | 0.146<br>(26.71)** | 0.139<br>(40.05)** | 0.110<br>(11.91)** | 0.138<br>(37.37)** | 0.143<br>(59.09)**  | 0.161<br>(9.70)**  |
| Observations                                            | 71                  | 71                 | 71                 | 71                 | 71                 | 71                 | 71                  | 71                 |
| R-squared                                               | 0.32                | 0.19               | 0.24               | 0.25               | 0.31               | 0.19               | 0.65                | 0.75               |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

## 10.6 Magnitude of price decreases

|                                                      | (1)                 | (2)                 | (3)                | (4)                 | (5)                | (6)                 | (7)                 | (8)                 |
|------------------------------------------------------|---------------------|---------------------|--------------------|---------------------|--------------------|---------------------|---------------------|---------------------|
|                                                      | CPI                 | CPI                 | CPI                | CPI                 | CPI                | CPI                 | CPI                 | CPI                 |
| January                                              | -0.012<br>(1.53)    | -0.012<br>(1.51)    | -0.011<br>(1.52)   | -0.011<br>(1.48)    | -0.011<br>(1.43)   | -0.015<br>(1.97)*   | -0.008<br>(1.53)    | -0.007<br>(1.41)    |
| February                                             | -0.008<br>(1.09)    | -0.008<br>(1.07)    | -0.008<br>(1.07)   | -0.008<br>(1.06)    | -0.008<br>(1.01)   | -0.009<br>(1.25)    | -0.005<br>(0.90)    | -0.004<br>(0.89)    |
| March                                                | -0.004<br>(0.52)    | -0.004<br>(0.48)    | -0.003<br>(0.44)   | -0.004<br>(0.48)    | -0.003<br>(0.42)   | -0.006<br>(0.74)    | -0.001<br>(0.26)    | -0.001<br>(0.30)    |
| April                                                | -0.005<br>(0.67)    | -0.005<br>(0.63)    | -0.005<br>(0.65)   | -0.005<br>(0.66)    | -0.005<br>(0.62)   | -0.006<br>(0.75)    | -0.005<br>(0.91)    | -0.007<br>(1.49)    |
| May                                                  | -0.004<br>(0.49)    | -0.004<br>(0.47)    | -0.004<br>(0.47)   | -0.004<br>(0.48)    | -0.003<br>(0.42)   | -0.008<br>(0.97)    | -0.004<br>(0.66)    | -0.005<br>(1.06)    |
| June                                                 | 0.008<br>(1.01)     | 0.008<br>(1.04)     | 0.008<br>(1.06)    | 0.008<br>(1.04)     | 0.009<br>(1.11)    | 0.003<br>(0.36)     | 0.008<br>(1.48)     | 0.007<br>(1.54)     |
| July                                                 | -0.003<br>(0.35)    | -0.002<br>(0.31)    | -0.002<br>(0.32)   | -0.003<br>(0.34)    | -0.002<br>(0.27)   | -0.003<br>(0.44)    | -0.002<br>(0.46)    | -0.003<br>(0.61)    |
| August                                               | -0.002<br>(0.32)    | -0.002<br>(0.29)    | -0.002<br>(0.31)   | -0.003<br>(0.33)    | -0.002<br>(0.24)   | -0.005<br>(0.72)    | -0.002<br>(0.44)    | -0.003<br>(0.53)    |
| September                                            | -0.001<br>(0.15)    | -0.001<br>(0.13)    | -0.001<br>(0.14)   | -0.001<br>(0.15)    | -0.000<br>(0.06)   | -0.004<br>(0.56)    | -0.001<br>(0.19)    | -0.000<br>(0.05)    |
| October                                              | -0.005<br>(0.69)    | -0.005<br>(0.66)    | -0.005<br>(0.71)   | -0.005<br>(0.71)    | -0.005<br>(0.62)   | -0.007<br>(0.93)    | -0.005<br>(0.98)    | -0.004<br>(0.89)    |
| November                                             | -0.006<br>(0.77)    | -0.006<br>(0.78)    | -0.006<br>(0.79)   | -0.006<br>(0.78)    | -0.006<br>(0.73)   | -0.006<br>(0.82)    | -0.006<br>(1.09)    | -0.005<br>(1.06)    |
| CPI - metropolitan<br>and other urban<br>areas 7112A | -0.000<br>(0.73)    |                     |                    |                     |                    |                     |                     | -0.002<br>(3.22)*** |
| CPIchange                                            |                     | -0.001<br>(0.64)    |                    |                     |                    |                     |                     | 0.001<br>(0.76)     |
| Repo Rate                                            |                     |                     | -0.001<br>(1.36)   |                     |                    |                     |                     | 0.005<br>(3.61)***  |
| Breakdummy                                           |                     |                     |                    |                     |                    |                     | 0.019<br>(7.76)***  | 0.027<br>(9.93)***  |
| Exchangeratechange                                   |                     |                     |                    |                     |                    | -0.001<br>(1.81)*   |                     | -0.000<br>(0.64)    |
| Nominal Effective<br>Exchange Rate -<br>5376M        |                     |                     |                    |                     | 0.000<br>(0.77)    |                     |                     | 0.001<br>(2.72)***  |
| Repochange                                           |                     |                     |                    | -0.001<br>(0.32)    |                    |                     |                     | -0.004<br>(1.52)    |
| Constant                                             | 0.067<br>(10.95)*** | 0.065<br>(12.00)*** | 0.074<br>(8.75)*** | 0.065<br>(11.95)*** | 0.054<br>(3.55)*** | 0.067<br>(12.35)*** | 0.058<br>(15.05)*** | -0.021<br>(0.81)    |
| Observations                                         | 71                  | 71                  | 71                 | 71                  | 71                 | 71                  | 71                  | 71                  |
| R-squared                                            | 0.13                | 0.13                | 0.15               | 0.13                | 0.13               | 0.17                | 0.57                | 0.73                |

Absolute value of t statistics in parentheses  
significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

## 10.7 Magnitude of price changes (lagged)

|                       | (1)                 | (2)                 | (3)                 | (4)                 | (5)                 | (6)                 | (7)                 | (8)                 |
|-----------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                       | CPI Size            | CPI Size            | CPI Size            | CPI Size            | CPI Size            | CPI Size            | CPI Size            | CPI Size            |
| January               | -0.002<br>(0.37)    | -0.001<br>(0.27)    | -0.001<br>(0.27)    | -0.002<br>(0.35)    | -0.001<br>(0.28)    | -0.001<br>(0.25)    | -0.004<br>(1.09)    | -0.004<br>(1.35)    |
| February              | -0.002<br>(0.34)    | -0.001<br>(0.25)    | -0.001<br>(0.24)    | -0.001<br>(0.23)    | -0.002<br>(0.31)    | -0.002<br>(0.40)    | -0.003<br>(1.05)    | -0.005<br>(1.57)    |
| March                 | -0.013<br>(2.71)*** | -0.013<br>(2.53)**  | -0.013<br>(2.48)**  | -0.013<br>(2.51)**  | -0.013<br>(2.57)**  | -0.013<br>(2.53)**  | -0.015<br>(4.38)*** | -0.015<br>(5.01)*** |
| April                 | -0.010<br>(2.23)**  | -0.010<br>(2.00)**  | -0.010<br>(1.98)*   | -0.009<br>(1.88)*   | -0.010<br>(2.08)**  | -0.010<br>(1.95)*   | -0.012<br>(3.74)*** | -0.013<br>(4.36)*** |
| May                   | -0.009<br>(2.01)**  | -0.009<br>(1.80)*   | -0.009<br>(1.77)*   | -0.009<br>(1.77)*   | -0.009<br>(1.90)*   | -0.010<br>(1.89)*   | -0.011<br>(3.42)*** | -0.012<br>(4.14)*** |
| June                  | -0.008<br>(1.66)    | -0.007<br>(1.46)    | -0.007<br>(1.44)    | -0.007<br>(1.35)    | -0.008<br>(1.57)    | -0.008<br>(1.51)    | -0.008<br>(2.22)**  | -0.008<br>(2.65)**  |
| July                  | -0.008<br>(1.75)*   | -0.008<br>(1.54)    | -0.008<br>(1.55)    | -0.008<br>(1.61)    | -0.009<br>(1.74)*   | -0.009<br>(1.72)*   | -0.008<br>(2.39)**  | -0.008<br>(2.74)*** |
| August                | -0.007<br>(1.59)    | -0.007<br>(1.41)    | -0.007<br>(1.40)    | -0.007<br>(1.41)    | -0.008<br>(1.54)    | -0.007<br>(1.36)    | -0.007<br>(2.16)**  | -0.007<br>(2.33)**  |
| September             | -0.010<br>(2.19)**  | -0.010<br>(1.98)*   | -0.010<br>(1.97)*   | -0.010<br>(1.93)*   | -0.010<br>(2.03)**  | -0.009<br>(1.85)*   | -0.010<br>(3.04)*** | -0.010<br>(3.31)*** |
| October               | -0.010<br>(2.04)**  | -0.009<br>(1.84)*   | -0.009<br>(1.85)*   | -0.009<br>(1.87)*   | -0.010<br>(1.97)*   | -0.010<br>(2.02)**  | -0.009<br>(2.87)*** | -0.010<br>(3.35)*** |
| November              | -0.007<br>(1.45)    | -0.007<br>(1.33)    | -0.007<br>(1.34)    | -0.007<br>(1.40)    | -0.007<br>(1.41)    | -0.007<br>(1.36)    | -0.007<br>(2.06)**  | -0.007<br>(2.25)**  |
| L3. CPI -             | -0.001<br>(3.11)*** |                     |                     |                     |                     |                     |                     | -0.001<br>(1.48)    |
| L3.CPIchange          |                     | -0.001<br>(0.83)    |                     |                     |                     |                     |                     | -0.001<br>(0.83)    |
| L3.Repochange         |                     |                     |                     | -0.003<br>(1.21)    |                     |                     |                     | 0.002<br>(0.93)     |
| L3.Exchangerate       |                     |                     |                     |                     |                     | 0.000<br>(1.14)     |                     | 0.000<br>(1.40)     |
| L3.Breakdummy         |                     |                     |                     |                     |                     |                     | -0.014<br>(9.02)*** | -0.015<br>(7.76)*** |
| L3. Repo Rate         |                     |                     | -0.000<br>(0.85)    |                     |                     |                     |                     | -0.001<br>(0.97)    |
| L3. Nominal Effective |                     |                     |                     |                     | 0.000<br>(2.08)**   |                     |                     | -0.000<br>(1.26)    |
| Constant              | 0.143<br>(38.49)*** | 0.138<br>(38.84)*** | 0.142<br>(25.19)*** | 0.138<br>(39.09)*** | 0.121<br>(13.48)*** | 0.138<br>(39.02)*** | 0.143<br>(60.38)*** | 0.169<br>(10.20)*** |
| Observations          | 71                  | 71                  | 71                  | 71                  | 71                  | 71                  | 71                  | 71                  |
| R-squared             | 0.31                | 0.20                | 0.20                | 0.21                | 0.25                | 0.21                | 0.66                | 0.76                |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

## 10.8 Magnitude of price decreases (lagged)

|                                                             | (1)                 | (2)                 | (3)                | (4)                 | (5)                | (6)                 | (7)                 | (8)                |
|-------------------------------------------------------------|---------------------|---------------------|--------------------|---------------------|--------------------|---------------------|---------------------|--------------------|
|                                                             | CPI                 | CPI                 | CPI                | CPI                 | CPI                | CPI                 | CPI                 | CPI                |
| January                                                     | -0.011<br>(1.49)    | -0.012<br>(1.53)    | -0.012<br>(1.54)   | -0.011<br>(1.48)    | -0.012<br>(1.54)   | -0.011<br>(1.49)    | -0.008<br>(1.48)    | -0.007<br>(1.46)   |
| February                                                    | -0.008<br>(1.05)    | -0.008<br>(1.09)    | -0.008<br>(1.09)   | -0.008<br>(1.05)    | -0.009<br>(1.14)   | -0.009<br>(1.13)    | -0.005<br>(0.87)    | -0.005<br>(1.11)   |
| March                                                       | -0.004<br>(0.50)    | -0.004<br>(0.55)    | -0.004<br>(0.48)   | -0.004<br>(0.50)    | -0.004<br>(0.51)   | -0.004<br>(0.51)    | -0.001<br>(0.25)    | -0.001<br>(0.29)   |
| April                                                       | -0.005<br>(0.64)    | -0.005<br>(0.68)    | -0.005<br>(0.66)   | -0.005<br>(0.64)    | -0.005<br>(0.69)   | -0.005<br>(0.62)    | -0.002<br>(0.31)    | -0.001<br>(0.32)   |
| May                                                         | -0.004<br>(0.46)    | -0.004<br>(0.52)    | -0.004<br>(0.48)   | -0.004<br>(0.46)    | -0.004<br>(0.54)   | -0.004<br>(0.53)    | -0.000<br>(0.07)    | -0.001<br>(0.28)   |
| June                                                        | 0.008<br>(1.04)     | 0.008<br>(1.03)     | 0.008<br>(1.06)    | 0.008<br>(1.03)     | 0.007<br>(0.99)    | 0.008<br>(1.01)     | 0.008<br>(1.43)     | 0.005<br>(1.15)    |
| July                                                        | -0.002<br>(0.33)    | -0.002<br>(0.32)    | -0.002<br>(0.33)   | -0.002<br>(0.32)    | -0.003<br>(0.46)   | -0.003<br>(0.42)    | -0.002<br>(0.45)    | -0.006<br>(1.28)   |
| August                                                      | -0.002<br>(0.31)    | -0.002<br>(0.33)    | -0.002<br>(0.31)   | -0.002<br>(0.31)    | -0.003<br>(0.39)   | -0.002<br>(0.28)    | -0.002<br>(0.42)    | -0.004<br>(0.92)   |
| September                                                   | -0.001<br>(0.14)    | -0.001<br>(0.14)    | -0.001<br>(0.13)   | -0.001<br>(0.14)    | -0.001<br>(0.14)   | -0.001<br>(0.07)    | -0.001<br>(0.19)    | -0.001<br>(0.27)   |
| October                                                     | -0.005<br>(0.69)    | -0.005<br>(0.67)    | -0.005<br>(0.69)   | -0.005<br>(0.69)    | -0.006<br>(0.75)   | -0.006<br>(0.77)    | -0.005<br>(0.94)    | -0.007<br>(1.54)   |
| November                                                    | -0.006<br>(0.77)    | -0.006<br>(0.76)    | -0.006<br>(0.78)   | -0.006<br>(0.76)    | -0.006<br>(0.81)   | -0.006<br>(0.77)    | -0.006<br>(1.06)    | -0.007<br>(1.41)   |
| L3. CPI -<br>metropolitan<br>and other urban<br>areas 7112A | -0.000              |                     |                    |                     |                    |                     |                     | -0.001             |
|                                                             | (0.02)              |                     |                    |                     |                    |                     |                     | (0.95)             |
| L3.CPIchange                                                |                     | -0.003<br>(1.18)    |                    |                     |                    |                     |                     | 0.000<br>(0.13)    |
| L3.Repochange                                               |                     |                     |                    | 0.000<br>(0.07)     |                    |                     |                     | 0.001<br>(0.21)    |
| L3.Exchangerate                                             |                     |                     |                    |                     |                    | 0.000<br>(0.61)     |                     | 0.000<br>(0.53)    |
| L3.Breakdummy                                               |                     |                     |                    |                     |                    |                     | 0.019<br>(7.23)***  | 0.025<br>(8.56)*** |
| L3. Repo Rate                                               |                     |                     | -0.001<br>(1.30)   |                     |                    |                     |                     | 0.004<br>(2.60)**  |
| L3. Nominal<br>Effective<br>Exchange Rate -<br>5376M        |                     |                     |                    |                     | 0.000              |                     |                     | 0.001              |
|                                                             |                     |                     |                    |                     | (1.76)*            |                     |                     | (3.97)***          |
| Constant                                                    | 0.065<br>(10.63)*** | 0.065<br>(12.12)*** | 0.073<br>(8.66)*** | 0.065<br>(11.94)*** | 0.042<br>(3.09)*** | 0.065<br>(11.99)*** | 0.058<br>(14.50)*** | -0.040<br>(1.53)   |
| Observations                                                | 71                  | 71                  | 71                 | 71                  | 71                 | 71                  | 71                  | 71                 |
| R-squared                                                   | 0.13                | 0.15                | 0.15               | 0.13                | 0.17               | 0.13                | 0.54                | 0.72               |

Absolute value of t statistics in parentheses  
significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

\*

## 10.9 Frequency of price increases (PPI)

|                    | (1)                         | (2)                         | (3)                         | (4)                         | (5)                         | (6)                         | (7)                         | (8)                         |
|--------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|                    | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         |
|                    | Frequency of Price Increase | Frequency of Price Increase | Frequency of Price Increase | Frequency of Price Increase | Frequency of Price Increase | Frequency of Price Increase | Frequency of Price Increase | Frequency of Price Increase |
| January            | 0.067<br>(3.91)***          | 0.066<br>(2.79)***          | 0.066<br>(2.58)**           | 0.062<br>(2.78)***          | 0.056<br>(2.85)***          | 0.058<br>(2.18)**           | 0.074<br>(3.53)***          | 0.064<br>(5.42)***          |
| February           | 0.080<br>(4.67)***          | 0.078<br>(3.29)***          | 0.079<br>(3.09)***          | 0.083<br>(3.75)***          | 0.072<br>(3.66)***          | 0.076<br>(2.95)***          | 0.088<br>(4.15)***          | 0.077<br>(6.82)***          |
| March              | 0.033<br>(1.93)*            | 0.028<br>(1.20)             | 0.033<br>(1.29)             | 0.029<br>(1.31)             | 0.026<br>(1.33)             | 0.029<br>(1.10)             | 0.033<br>(1.58)             | 0.026<br>(2.33)**           |
| April              | 0.083<br>(4.85)***          | 0.082<br>(3.45)***          | 0.084<br>(3.29)***          | 0.093<br>(4.18)***          | 0.081<br>(4.17)***          | 0.083<br>(3.23)***          | 0.084<br>(4.01)***          | 0.083<br>(7.50)***          |
| May                | 0.068<br>(3.94)***          | 0.067<br>(2.83)***          | 0.069<br>(2.70)***          | 0.074<br>(3.32)***          | 0.063<br>(3.20)***          | 0.062<br>(2.30)**           | 0.069<br>(3.29)***          | 0.069<br>(5.99)***          |
| June               | 0.031<br>(1.82)*            | 0.029<br>(1.24)             | 0.034<br>(1.33)             | 0.034<br>(1.56)             | 0.021<br>(1.09)             | 0.025<br>(0.89)             | 0.034<br>(1.64)             | 0.026<br>(2.20)**           |
| July               | 0.080<br>(4.62)***          | 0.081<br>(3.44)***          | 0.083<br>(3.23)***          | 0.087<br>(3.94)***          | 0.074<br>(3.78)***          | 0.081<br>(3.16)***          | 0.083<br>(3.94)***          | 0.073<br>(6.59)***          |
| August             | 0.064<br>(3.74)***          | 0.068<br>(2.87)***          | 0.068<br>(2.63)**           | 0.076<br>(3.42)***          | 0.057<br>(2.90)***          | 0.061<br>(2.33)**           | 0.068<br>(3.20)***          | 0.061<br>(5.35)***          |
| September          | 0.039<br>(2.25)**           | 0.043<br>(1.80)*            | 0.041<br>(1.59)             | 0.045<br>(2.03)**           | 0.028<br>(1.43)             | 0.034<br>(1.30)             | 0.041<br>(1.93)*            | 0.031<br>(2.70)***          |
| October            | 0.076<br>(4.40)***          | 0.078<br>(3.30)***          | 0.077<br>(3.02)***          | 0.086<br>(3.86)***          | 0.066<br>(3.37)***          | 0.074<br>(2.85)***          | 0.077<br>(3.67)***          | 0.067<br>(5.85)***          |
| November           | 0.048<br>(2.80)***          | 0.051<br>(2.15)**           | 0.049<br>(1.90)*            | 0.053<br>(2.38)**           | 0.043<br>(2.18)**           | 0.048<br>(1.87)*            | 0.049<br>(2.30)**           | 0.042<br>(3.75)***          |
| PPI Total - 7140A  | 0.007<br>(8.66)***          |                             |                             |                             |                             |                             |                             | -0.001<br>(0.48)            |
| PPIchange          |                             | 0.017<br>(3.44)***          |                             |                             |                             |                             |                             | 0.006<br>(1.91)*            |
| Repo Rate          |                             |                             | 0.003<br>(1.17)             |                             |                             |                             |                             | -0.009<br>(3.46)***         |
| Breakdummy         |                             |                             |                             |                             |                             |                             | 0.052<br>(5.52)***          | 0.033<br>(5.23)***          |
| Exchangeratechange |                             |                             |                             |                             |                             | -0.002<br>(1.04)            |                             | 0.003<br>(2.41)**           |
| Nominal Effective  |                             |                             |                             |                             | -0.003<br>(6.71)***         |                             |                             | -0.004<br>(5.44)***         |
| Repochange         |                             |                             |                             | 0.051<br>(4.70)***          |                             |                             |                             | 0.012<br>(1.92)*            |
| Constant           | 0.026<br>(1.95)*            | 0.069<br>(4.13)***          | 0.043<br>(1.50)             | 0.064<br>(4.09)***          | 0.309<br>(8.04)***          | 0.073<br>(3.90)***          | 0.051<br>(3.35)***          | 0.489<br>(5.48)***          |
| Observations       | 72                          | 72                          | 72                          | 72                          | 72                          | 72                          | 72                          | 72                          |
| R-squared          | 0.68                        | 0.39                        | 0.29                        | 0.47                        | 0.59                        | 0.28                        | 0.52                        | 0.88                        |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

## 10.10 Frequency of price decreases (PPI)

|                    | (1)                         | (2)                         | (3)                         | (4)                         | (5)                         | (6)                         | (7)                         | (8)                         |
|--------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|                    | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         |
|                    | Frequency of Price Decrease | Frequency of Price Decrease | Frequency of Price Decrease | Frequency of Price Decrease | Frequency of Price Decrease | Frequency of Price Decrease | Frequency of Price Decrease | Frequency of Price Decrease |
| January            | 0.007<br>(0.71)             | 0.007<br>(0.81)             | 0.007<br>(0.76)             | 0.008<br>(0.84)             | 0.008<br>(0.80)             | 0.015<br>(1.44)             | 0.007<br>(0.71)             | 0.020<br>(2.81)***          |
| February           | 0.011<br>(1.14)             | 0.012<br>(1.36)             | 0.012<br>(1.20)             | 0.011<br>(1.07)             | 0.012<br>(1.19)             | 0.014<br>(1.44)             | 0.012<br>(1.12)             | 0.019<br>(2.87)***          |
| March              | -0.007<br>(0.70)            | -0.005<br>(0.51)            | -0.007<br>(0.73)            | -0.006<br>(0.61)            | -0.006<br>(0.62)            | -0.002<br>(0.24)            | -0.007<br>(0.68)            | -0.001<br>(0.21)            |
| April              | 0.013<br>(1.30)             | 0.014<br>(1.59)             | 0.013<br>(1.29)             | 0.011<br>(1.09)             | 0.013<br>(1.27)             | 0.014<br>(1.43)             | 0.013<br>(1.23)             | 0.014<br>(2.21)**           |
| May                | 0.012<br>(1.23)             | 0.013<br>(1.48)             | 0.012<br>(1.22)             | 0.011<br>(1.12)             | 0.013<br>(1.23)             | 0.020<br>(1.93)*            | 0.012<br>(1.16)             | 0.020<br>(2.91)***          |
| June               | 0.004<br>(0.41)             | 0.006<br>(0.70)             | 0.003<br>(0.35)             | 0.004<br>(0.37)             | 0.005<br>(0.46)             | 0.013<br>(1.28)             | 0.004<br>(0.35)             | 0.015<br>(2.18)**           |
| July               | 0.023<br>(2.35)**           | 0.023<br>(2.65)**           | 0.022<br>(2.29)**           | 0.022<br>(2.20)**           | 0.023<br>(2.29)**           | 0.024<br>(2.48)**           | 0.023<br>(2.20)**           | 0.027<br>(4.10)***          |
| August             | 0.008<br>(0.80)             | 0.007<br>(0.81)             | 0.007<br>(0.76)             | 0.006<br>(0.56)             | 0.008<br>(0.82)             | 0.013<br>(1.34)             | 0.007<br>(0.72)             | 0.015<br>(2.28)**           |
| September          | -0.007<br>(0.66)            | -0.008<br>(0.88)            | -0.007<br>(0.70)            | -0.008<br>(0.80)            | -0.006<br>(0.56)            | -0.001<br>(0.06)            | -0.007<br>(0.66)            | 0.002<br>(0.29)             |
| October            | 0.016<br>(1.66)             | 0.016<br>(1.79)*            | 0.016<br>(1.67)*            | 0.014<br>(1.45)             | 0.017<br>(1.68)*            | 0.020<br>(1.99)*            | 0.016<br>(1.57)             | 0.023<br>(3.37)***          |
| November           | 0.012<br>(1.22)             | 0.011<br>(1.23)             | 0.012<br>(1.25)             | 0.011<br>(1.12)             | 0.013<br>(1.23)             | 0.013<br>(1.28)             | 0.012<br>(1.17)             | 0.015<br>(2.22)**           |
| PPI Total - 7140A  | -0.001<br>(2.30)**          |                             |                             |                             |                             |                             |                             | -0.002<br>(2.38)**          |
| PPIchange          |                             | -0.009<br>(4.61)***         |                             |                             |                             |                             |                             | -0.001<br>(0.36)            |
| Repo Rate          |                             |                             | 0.002<br>(2.55)**           |                             |                             |                             |                             | 0.007<br>(4.62)***          |
| Breakdummy         |                             |                             |                             |                             |                             |                             | 0.000<br>(0.09)             | 0.019<br>(5.14)***          |
| Exchangeratechange |                             |                             |                             |                             |                             | 0.002<br>(2.67)***          |                             | 0.002<br>(2.47)**           |
| Nominal Effective  |                             |                             |                             |                             | 0.000<br>(1.15)             |                             |                             | 0.001<br>(2.09)**           |
| Repochange         |                             |                             |                             | -0.012<br>(2.44)**          |                             |                             |                             | -0.003<br>(0.85)            |
| Constant           | 0.080<br>(10.61)***         | 0.073<br>(11.68)***         | 0.052<br>(4.80)***          | 0.075<br>(10.69)***         | 0.052<br>(2.59)**           | 0.069<br>(9.68)***          | 0.073<br>(9.84)***          | -0.071<br>(1.34)            |
| Observations       | 72                          | 72                          | 72                          | 72                          | 72                          | 72                          | 72                          | 72                          |
| R-squared          | 0.28                        | 0.42                        | 0.30                        | 0.29                        | 0.24                        | 0.30                        | 0.22                        | 0.72                        |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

## 10.11 Frequency of price increases (lagged) (PPI)

|                       | (1)                         | (2)                         | (3)                         | (4)                         | (5)                         | (6)                         | (7)                         | (8)                         |
|-----------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|                       | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         |
|                       | Frequency of Price Increase | Frequency of Price Increase | Frequency of Price Increase | Frequency of Price Increase | Frequency of Price Increase | Frequency of Price Increase | Frequency of Price Increase | Frequency of Price Increase |
| January               | 0.068<br>(3.06)***          | 0.063<br>(2.58)**           | 0.065<br>(2.53)**           | 0.071<br>(2.86)***          | 0.066<br>(2.71)***          | 0.065<br>(2.76)***          | 0.076<br>(3.75)***          | 0.071<br>(4.13)***          |
| February              | 0.081<br>(3.66)***          | 0.077<br>(3.15)***          | 0.078<br>(3.04)***          | 0.079<br>(3.19)***          | 0.082<br>(3.33)***          | 0.092<br>(3.83)***          | 0.089<br>(4.40)***          | 0.093<br>(5.39)***          |
| March                 | 0.036<br>(1.62)             | 0.033<br>(1.34)             | 0.033<br>(1.27)             | 0.033<br>(1.35)             | 0.036<br>(1.48)             | 0.039<br>(1.64)             | 0.043<br>(2.14)**           | 0.044<br>(2.58)**           |
| April                 | 0.087<br>(3.94)***          | 0.083<br>(3.40)***          | 0.084<br>(3.27)***          | 0.079<br>(3.20)***          | 0.086<br>(3.50)***          | 0.082<br>(3.44)***          | 0.094<br>(4.67)***          | 0.091<br>(5.29)***          |
| May                   | 0.072<br>(3.25)***          | 0.067<br>(2.74)***          | 0.069<br>(2.68)***          | 0.069<br>(2.80)***          | 0.072<br>(2.94)***          | 0.079<br>(3.31)***          | 0.079<br>(3.92)***          | 0.082<br>(4.80)***          |
| June                  | 0.036<br>(1.62)             | 0.029<br>(1.18)             | 0.035<br>(1.35)             | 0.029<br>(1.19)             | 0.037<br>(1.52)             | 0.039<br>(1.63)             | 0.034<br>(1.71)*            | 0.037<br>(2.16)**           |
| July                  | 0.084<br>(3.80)***          | 0.079<br>(3.24)***          | 0.083<br>(3.23)***          | 0.086<br>(3.46)***          | 0.088<br>(3.58)***          | 0.096<br>(4.00)***          | 0.083<br>(4.13)***          | 0.091<br>(5.21)***          |
| August                | 0.068<br>(3.08)***          | 0.064<br>(2.62)**           | 0.068<br>(2.62)**           | 0.068<br>(2.73)***          | 0.070<br>(2.87)***          | 0.064<br>(2.71)***          | 0.068<br>(3.35)***          | 0.065<br>(3.78)***          |
| September             | 0.040<br>(1.81)*            | 0.035<br>(1.42)             | 0.041<br>(1.59)             | 0.038<br>(1.55)             | 0.041<br>(1.66)             | 0.032<br>(1.34)             | 0.041<br>(2.02)**           | 0.033<br>(1.93)*            |
| October               | 0.076<br>(3.46)***          | 0.074<br>(3.04)***          | 0.077<br>(3.01)***          | 0.077<br>(3.13)***          | 0.079<br>(3.23)***          | 0.089<br>(3.73)***          | 0.077<br>(3.84)***          | 0.083<br>(4.85)***          |
| November              | 0.048<br>(2.17)**           | 0.047<br>(1.94)*            | 0.049<br>(1.88)*            | 0.051<br>(2.06)**           | 0.049<br>(2.02)**           | 0.049<br>(2.08)**           | 0.049<br>(2.41)**           | 0.048<br>(2.83)***          |
| L3. PPI Total - 7140A | 0.005<br>(4.77)***          |                             |                             |                             |                             |                             |                             | 0.003<br>(1.96)*            |
| L3.PPIchange          |                             | 0.014<br>(2.77)***          |                             |                             |                             |                             |                             | 0.005<br>(0.98)             |
| L3.Repochange         |                             |                             |                             | 0.030<br>(2.46)**           |                             |                             |                             | -0.003<br>(0.28)            |
| L3.Exchangerate       |                             |                             |                             |                             |                             | -0.006<br>(3.43)***         |                             | -0.003<br>(2.29)**          |
| L3.Breakdummy         |                             |                             |                             |                             |                             |                             | 0.057<br>(6.25)***          | 0.035<br>(3.37)***          |
| L3. Repo Rate         |                             |                             | -0.002<br>(0.97)            |                             |                             |                             |                             | -0.003<br>(0.80)            |
| L3. Nominal           |                             |                             |                             |                             | -0.001<br>(2.69)***         |                             |                             | -0.000<br>(0.27)            |
| Constant              | 0.037<br>(2.16)**           | 0.071<br>(4.08)***          | 0.090<br>(3.13)***          | 0.068<br>(3.91)***          | 0.179<br>(4.01)***          | 0.064<br>(3.83)***          | 0.049<br>(3.33)***          | 0.084<br>(0.66)             |
| Observations          | 72                          | 72                          | 72                          | 72                          | 72                          | 72                          | 72                          | 72                          |
| R-squared             | 0.47                        | 0.35                        | 0.28                        | 0.34                        | 0.35                        | 0.39                        | 0.56                        | 0.72                        |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%



## 10.12 Frequency of price decreases (lagged) (PPI)

|                        | (1)                         | (2)                         | (3)                         | (4)                         | (5)                         | (6)                         | (7)                         | (8)                         |
|------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|                        | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         | PPI                         |
|                        | Frequency of Price Decrease | Frequency of Price Decrease | Frequency of Price Decrease | Frequency of Price Decrease | Frequency of Price Decrease | Frequency of Price Decrease | Frequency of Price Decrease | Frequency of Price Decrease |
| January                | 0.007<br>(0.70)             | 0.009<br>(0.91)             | 0.008<br>(0.89)             | 0.006<br>(0.62)             | 0.007<br>(0.72)             | 0.007<br>(0.75)             | 0.008<br>(0.73)             | 0.011<br>(1.29)             |
| February               | 0.012<br>(1.12)             | 0.012<br>(1.32)             | 0.012<br>(1.35)             | 0.012<br>(1.13)             | 0.012<br>(1.18)             | 0.008<br>(0.78)             | 0.012<br>(1.14)             | 0.012<br>(1.48)             |
| March                  | -0.007<br>(0.68)            | -0.007<br>(0.70)            | -0.006<br>(0.67)            | -0.007<br>(0.68)            | -0.006<br>(0.63)            | -0.009<br>(0.87)            | -0.007<br>(0.65)            | -0.005<br>(0.58)            |
| April                  | 0.013<br>(1.23)             | 0.013<br>(1.41)             | 0.013<br>(1.42)             | 0.014<br>(1.32)             | 0.013<br>(1.27)             | 0.014<br>(1.37)             | 0.013<br>(1.25)             | 0.016<br>(1.91)*            |
| May                    | 0.012<br>(1.16)             | 0.013<br>(1.39)             | 0.012<br>(1.34)             | 0.012<br>(1.17)             | 0.012<br>(1.22)             | 0.009<br>(0.93)             | 0.012<br>(1.18)             | 0.013<br>(1.51)             |
| June                   | 0.004<br>(0.35)             | 0.006<br>(0.66)             | 0.003<br>(0.36)             | 0.004<br>(0.43)             | 0.004<br>(0.40)             | 0.002<br>(0.24)             | 0.004<br>(0.35)             | 0.003<br>(0.31)             |
| July                   | 0.023<br>(2.20)**           | 0.025<br>(2.58)**           | 0.023<br>(2.48)**           | 0.022<br>(2.17)**           | 0.024<br>(2.31)**           | 0.019<br>(1.90)*            | 0.023<br>(2.20)**           | 0.020<br>(2.40)**           |
| August                 | 0.007<br>(0.72)             | 0.009<br>(0.96)             | 0.007<br>(0.81)             | 0.007<br>(0.73)             | 0.008<br>(0.79)             | 0.008<br>(0.85)             | 0.007<br>(0.72)             | 0.009<br>(1.03)             |
| September              | -0.007<br>(0.67)            | -0.004<br>(0.43)            | -0.007<br>(0.78)            | -0.006<br>(0.63)            | -0.007<br>(0.68)            | -0.004<br>(0.43)            | -0.007<br>(0.67)            | -0.005<br>(0.54)            |
| October                | 0.016<br>(1.57)             | 0.018<br>(1.86)*            | 0.016<br>(1.74)*            | 0.016<br>(1.58)             | 0.017<br>(1.62)             | 0.013<br>(1.28)             | 0.016<br>(1.57)             | 0.014<br>(1.67)             |
| November               | 0.012<br>(1.17)             | 0.013<br>(1.33)             | 0.012<br>(1.32)             | 0.012<br>(1.13)             | 0.012<br>(1.20)             | 0.012<br>(1.20)             | 0.012<br>(1.17)             | 0.012<br>(1.49)             |
| L3. PPI Total -        | 0.000<br>(0.04)             |                             |                             |                             |                             |                             |                             | -0.002<br>(2.18)**          |
| L3.PPIchange           |                             | -0.007<br>(3.35)***         |                             |                             |                             |                             |                             | -0.001<br>(1.79)*           |
| L3.Repochange          |                             |                             |                             | -0.005<br>(1.00)            |                             |                             |                             | -0.001<br>(0.17)            |
| L3.Exchangerate change |                             |                             |                             |                             |                             |                             | 0.002                       | -0.001                      |
| L3.Breakdummy          |                             |                             |                             |                             |                             |                             | (0.34)                      | (0.21)                      |
| L3. Repo Rate          |                             |                             | 0.003<br>(4.03)***          |                             |                             | 0.002<br>(2.40)**           |                             | 0.033<br>(3.27)***          |
| L3. Nominal            |                             |                             |                             |                             | -0.000<br>(1.24)            |                             |                             | 0.005<br>(2.50)**           |
| Constant               | 0.073<br>(9.25)***          | 0.073<br>(10.82)***         | 0.042<br>(4.09)***          | 0.074<br>(10.16)***         | 0.095<br>(5.10)***          | 0.075<br>(10.69)***         | 0.073<br>(9.77)***          | 0.052<br>(0.84)             |
| Observations           | 72                          | 72                          | 72                          | 72                          | 72                          | 72                          | 72                          | 72                          |
| R-squared              | 0.22                        | 0.34                        | 0.39                        | 0.23                        | 0.24                        | 0.29                        | 0.22                        | 0.56                        |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

### 10.13 Magnitude of price changes (PPI)

|                    | (1)                | (2)                | (3)                | (4)                | (5)                 | (6)                | (7)                | (8)                |
|--------------------|--------------------|--------------------|--------------------|--------------------|---------------------|--------------------|--------------------|--------------------|
|                    | PPI Size           | PPI Size           | PPI Size           | PPI Size           | PPI Size            | PPI Size           | PPI Size           | PPI Size           |
| January            | -0.003<br>(0.20)   | -0.005<br>(0.20)   | -0.004<br>(0.19)   | -0.007<br>(0.33)   | -0.013<br>(0.73)    | -0.016<br>(0.66)   | 0.003<br>(0.17)    | -0.004<br>(0.29)   |
| February           | -0.009<br>(0.53)   | -0.011<br>(0.47)   | -0.010<br>(0.44)   | -0.008<br>(0.35)   | -0.017<br>(0.91)    | -0.014<br>(0.61)   | -0.002<br>(0.12)   | -0.007<br>(0.51)   |
| March              | 0.004<br>(0.24)    | 0.002<br>(0.08)    | 0.004<br>(0.17)    | 0.002<br>(0.08)    | -0.002<br>(0.11)    | -0.003<br>(0.11)   | 0.004<br>(0.23)    | -0.003<br>(0.22)   |
| April              | 0.005<br>(0.30)    | 0.005<br>(0.20)    | 0.006<br>(0.27)    | 0.011<br>(0.51)    | 0.003<br>(0.18)     | 0.004<br>(0.17)    | 0.006<br>(0.31)    | 0.002<br>(0.17)    |
| May                | 0.001<br>(0.05)    | 0.001<br>(0.05)    | 0.002<br>(0.10)    | 0.005<br>(0.21)    | -0.004<br>(0.20)    | -0.009<br>(0.38)   | 0.002<br>(0.11)    | -0.006<br>(0.39)   |
| June               | 0.029<br>(1.66)    | 0.029<br>(1.24)    | 0.031<br>(1.37)    | 0.031<br>(1.41)    | 0.020<br>(1.07)     | 0.017<br>(0.67)    | 0.031<br>(1.62)    | 0.018<br>(1.18)    |
| July               | 0.008<br>(0.45)    | 0.010<br>(0.43)    | 0.010<br>(0.46)    | 0.013<br>(0.60)    | 0.003<br>(0.15)     | 0.008<br>(0.36)    | 0.011<br>(0.56)    | 0.005<br>(0.36)    |
| August             | -0.004<br>(0.24)   | -0.001<br>(0.05)   | -0.001<br>(0.07)   | 0.004<br>(0.17)    | -0.011<br>(0.60)    | -0.010<br>(0.44)   | -0.001<br>(0.08)   | -0.009<br>(0.58)   |
| September          | 0.005<br>(0.31)    | 0.008<br>(0.34)    | 0.007<br>(0.31)    | 0.010<br>(0.43)    | -0.004<br>(0.23)    | -0.002<br>(0.10)   | 0.007<br>(0.36)    | 0.000<br>(0.01)    |
| October            | -0.011<br>(0.61)   | -0.009<br>(0.39)   | -0.009<br>(0.39)   | -0.004<br>(0.18)   | -0.019<br>(1.04)    | -0.014<br>(0.61)   | -0.009<br>(0.48)   | -0.014<br>(0.95)   |
| November           | -0.011<br>(0.62)   | -0.009<br>(0.40)   | -0.010<br>(0.44)   | -0.008<br>(0.35)   | -0.015<br>(0.84)    | -0.011<br>(0.48)   | -0.010<br>(0.54)   | -0.011<br>(0.75)   |
| PPI Total - 7140A  | 0.005<br>(7.34)*** |                    |                    |                    |                     |                    |                    | 0.001<br>(1.01)    |
| PPIchange          |                    | 0.008<br>(1.71)*   |                    |                    |                     |                    |                    | 0.009<br>(2.09)**  |
| Repo Rate          |                    |                    | 0.005<br>(2.62)**  |                    |                     |                    |                    | 0.005<br>(1.43)    |
| Breakdummy         |                    |                    |                    |                    |                     |                    | 0.048<br>(5.54)*** | 0.038<br>(4.57)*** |
| Exchangeratechange |                    |                    |                    |                    |                     | -0.003<br>(1.70)*  |                    | -0.001<br>(0.94)   |
| Nominal Effective  |                    |                    |                    |                    | -0.002<br>(6.32)*** |                    |                    | -0.001<br>(0.77)   |
| Repochange         |                    |                    |                    | 0.032<br>(2.93)*** |                     |                    |                    | -0.002<br>(0.22)   |
| Constant           | 0.113<br>(8.65)*** | 0.150<br>(9.14)*** | 0.099<br>(3.97)*** | 0.147<br>(9.34)*** | 0.362<br>(10.04)*** | 0.156<br>(9.25)*** | 0.133<br>(9.59)*** | 0.150<br>(1.29)    |
| Observations       | 72                 | 72                 | 72                 | 72                 | 72                  | 72                 | 72                 | 72                 |
| R-squared          | 0.52               | 0.12               | 0.18               | 0.20               | 0.45                | 0.12               | 0.40               | 0.70               |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

## 10.14 Magnitude of price decreases (PPI)

|                                               | (1)                              | (2)                              | (3)                              | (4)                              | (5)                              | (6)                              | (7)                              | (8)                              |
|-----------------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
|                                               | PPI Size<br>of Price<br>Decrease | PPI Size<br>of Price<br>Decrease | PPI Size<br>of Price<br>Decrease | PPI Size<br>of Price<br>Decrease | PPI Size<br>of Price<br>Decrease | PPI Size<br>of Price<br>Decrease | PPI Size<br>of Price<br>Decrease | PPI Size<br>of Price<br>Decrease |
| January                                       | 9.277<br>(0.86)                  | 9.108<br>(0.82)                  | 9.419<br>(0.84)                  | 9.558<br>(0.83)                  | 6.269<br>(0.59)                  | 4.892<br>(0.42)                  | -21.185<br>(1.92)*               | 6.632<br>(0.63)                  |
| February                                      | 9.237<br>(0.86)                  | 8.988<br>(0.81)                  | 9.572<br>(0.85)                  | 10.187<br>(0.88)                 | 6.308<br>(0.60)                  | 6.764<br>(0.59)                  | -21.032<br>(1.91)*               | 6.281<br>(0.61)                  |
| March                                         | 8.967<br>(0.83)                  | 8.362<br>(0.75)                  | 9.411<br>(0.84)                  | 9.839<br>(0.85)                  | 5.925<br>(0.56)                  | 6.158<br>(0.53)                  | -24.161<br>(2.21)**              | 3.546<br>(0.34)                  |
| April                                         | 8.839<br>(0.82)                  | 9.034<br>(0.81)                  | 9.530<br>(0.85)                  | 10.434<br>(0.91)                 | 7.151<br>(0.68)                  | 9.266<br>(0.82)                  | -24.042<br>(2.20)**              | 5.104<br>(0.51)                  |
| May                                           | 8.138<br>(0.75)                  | 6.895<br>(0.62)                  | 9.710<br>(0.87)                  | 10.614<br>(0.92)                 | 6.700<br>(0.63)                  | 6.237<br>(0.54)                  | -23.862<br>(2.19)**              | 2.012<br>(0.19)                  |
| June                                          | 7.854<br>(0.72)                  | 8.786<br>(0.79)                  | 9.532<br>(0.85)                  | 10.249<br>(0.89)                 | 5.073<br>(0.48)                  | 4.301<br>(0.36)                  | -23.751<br>(2.18)**              | 3.073<br>(0.29)                  |
| July                                          | -1.179<br>(0.11)                 | -0.914<br>(0.08)                 | -0.597<br>(0.05)                 | -0.150<br>(0.01)                 | -2.901<br>(0.26)                 | -1.412<br>(0.12)                 | -32.455<br>(2.81)***             | -2.839<br>(0.27)                 |
| August                                        | -1.060<br>(0.09)                 | -0.253<br>(0.02)                 | -0.413<br>(0.04)                 | 0.143<br>(0.01)                  | -3.330<br>(0.30)                 | -4.169<br>(0.35)                 | -32.440<br>(2.81)***             | -3.377<br>(0.32)                 |
| September                                     | -0.858<br>(0.08)                 | 0.145<br>(0.01)                  | -0.425<br>(0.04)                 | -0.147<br>(0.01)                 | -3.888<br>(0.35)                 | -4.368<br>(0.36)                 | -32.452<br>(2.81)***             | -3.000<br>(0.28)                 |
| October                                       | -0.724<br>(0.06)                 | -0.180<br>(0.02)                 | -0.246<br>(0.02)                 | 0.141<br>(0.01)                  | -3.431<br>(0.31)                 | -2.526<br>(0.21)                 | -32.442<br>(2.81)***             | -2.879<br>(0.27)                 |
| November                                      | 0.159<br>(0.01)                  | 0.914<br>(0.08)                  | 0.387<br>(0.03)                  | 0.496<br>(0.04)                  | -1.370<br>(0.13)                 | -0.076<br>(0.01)                 | -31.808<br>(2.76)***             | -0.177<br>(0.02)                 |
| PPI Total - 7140A                             | 1.374<br>(3.02)***               |                                  |                                  |                                  |                                  |                                  |                                  | -0.690<br>(0.68)                 |
| PPIchange                                     |                                  | 5.026<br>(2.30)**                |                                  |                                  |                                  |                                  |                                  | 5.422<br>(2.10)**                |
| Repo Rate                                     |                                  |                                  | 2.023<br>(1.95)*                 |                                  |                                  |                                  |                                  | 2.445<br>(1.11)                  |
| Breakdummy                                    |                                  |                                  |                                  |                                  |                                  |                                  | 22.805<br>(4.37)***              | 14.838<br>(2.62)**               |
| Exchangeratechange                            |                                  |                                  |                                  |                                  |                                  | -1.416<br>(1.53)                 |                                  | -0.379<br>(0.39)                 |
| Nominal Effective<br>Exchange Rate -<br>5376M |                                  |                                  |                                  |                                  | -0.766                           |                                  |                                  | -0.430                           |
| Repochange                                    |                                  |                                  |                                  | 3.333<br>(0.59)                  | (3.59)***                        |                                  |                                  | (0.66)<br>-4.918<br>(0.83)       |
| Constant                                      | -8.775<br>(1.04)                 | 0.460<br>(0.06)                  | -18.643<br>(1.47)                | -0.035<br>(0.00)                 | 65.600<br>(3.32)***              | 3.178<br>(0.37)                  | 24.668<br>(3.31)***              | 15.088<br>(0.20)                 |
| Observations                                  | 78                               | 78                               | 78                               | 78                               | 78                               | 78                               | 84                               | 78                               |
| R-squared                                     | 0.18                             | 0.14                             | 0.12                             | 0.07                             | 0.22                             | 0.10                             | 0.39                             | 0.37                             |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

## 10.15 Magnitude of price changes (lagged) (PPI)

|                                       | (1)                | (2)                | (3)                | (4)                | (5)                 | (6)                | (7)                | (8)                |
|---------------------------------------|--------------------|--------------------|--------------------|--------------------|---------------------|--------------------|--------------------|--------------------|
|                                       | PPI Size           | PPI Size           | PPI Size           | PPI Size           | PPI Size            | PPI Size           | PPI Size           | PPI Size           |
| January                               | -0.003<br>(0.15)   | -0.006<br>(0.26)   | -0.004<br>(0.18)   | 0.001<br>(0.03)    | -0.004<br>(0.19)    | -0.005<br>(0.21)   | 0.003<br>(0.16)    | 0.003<br>(0.14)    |
| February                              | -0.009<br>(0.44)   | -0.011<br>(0.48)   | -0.010<br>(0.42)   | -0.010<br>(0.46)   | -0.007<br>(0.33)    | -0.004<br>(0.18)   | -0.002<br>(0.12)   | -0.001<br>(0.04)   |
| March                                 | 0.007<br>(0.34)    | 0.004<br>(0.17)    | 0.005<br>(0.21)    | 0.004<br>(0.20)    | 0.008<br>(0.38)     | 0.007<br>(0.30)    | 0.012<br>(0.61)    | 0.014<br>(0.75)    |
| April                                 | 0.009<br>(0.44)    | 0.005<br>(0.23)    | 0.006<br>(0.26)    | 0.001<br>(0.03)    | 0.008<br>(0.36)     | 0.005<br>(0.20)    | 0.014<br>(0.69)    | 0.012<br>(0.67)    |
| May                                   | 0.005<br>(0.23)    | 0.001<br>(0.04)    | 0.002<br>(0.10)    | 0.002<br>(0.10)    | 0.005<br>(0.26)     | 0.007<br>(0.28)    | 0.010<br>(0.50)    | 0.012<br>(0.64)    |
| June                                  | 0.033<br>(1.67)    | 0.029<br>(1.22)    | 0.031<br>(1.32)    | 0.026<br>(1.16)    | 0.035<br>(1.63)     | 0.033<br>(1.43)    | 0.031<br>(1.57)    | 0.033<br>(1.76)*   |
| July                                  | 0.012<br>(0.59)    | 0.009<br>(0.38)    | 0.011<br>(0.46)    | 0.013<br>(0.60)    | 0.017<br>(0.79)     | 0.017<br>(0.71)    | 0.011<br>(0.54)    | 0.016<br>(0.88)    |
| August                                | -0.001<br>(0.06)   | -0.003<br>(0.13)   | -0.001<br>(0.06)   | -0.001<br>(0.07)   | 0.002<br>(0.10)     | -0.003<br>(0.13)   | -0.001<br>(0.07)   | 0.000<br>(0.01)    |
| September                             | 0.006<br>(0.32)    | 0.004<br>(0.18)    | 0.007<br>(0.29)    | 0.004<br>(0.20)    | 0.007<br>(0.32)     | 0.003<br>(0.12)    | 0.007<br>(0.35)    | 0.004<br>(0.24)    |
| October                               | -0.010<br>(0.53)   | -0.011<br>(0.46)   | -0.009<br>(0.40)   | -0.009<br>(0.42)   | -0.007<br>(0.34)    | -0.004<br>(0.16)   | -0.009<br>(0.47)   | -0.007<br>(0.39)   |
| November                              | -0.011<br>(0.57)   | -0.011<br>(0.46)   | -0.010<br>(0.44)   | -0.008<br>(0.35)   | -0.009<br>(0.43)    | -0.010<br>(0.43)   | -0.010<br>(0.52)   | -0.009<br>(0.51)   |
| L3. PPI Total - 7140A                 | 0.005              |                    |                    |                    |                     |                    |                    | 0.001              |
| L3.PPIchange                          | (5.33)***          |                    |                    |                    |                     |                    |                    | (0.61)             |
| L3.Repochange                         |                    | 0.007<br>(1.35)    |                    | 0.032<br>(2.85)*** |                     |                    |                    | 0.002<br>(0.36)    |
| L3.Exchangerate change                |                    |                    |                    |                    |                     | -0.003             |                    | 0.006<br>(0.55)    |
| L3.Breakdummy                         |                    |                    |                    |                    |                     | (1.65)             |                    | -0.001<br>(0.40)   |
| L3. Repo Rate                         |                    |                    | 0.002<br>(0.91)    |                    |                     |                    | 0.047<br>(5.01)*** | 0.036<br>(3.23)*** |
| L3. Nominal Effective Exchange Rate - |                    |                    |                    |                    | -0.002<br>(3.90)*** |                    |                    | -0.001<br>(0.20)   |
| Constant                              | 0.118<br>(7.87)*** | 0.150<br>(9.09)*** | 0.131<br>(4.98)*** | 0.149<br>(9.49)*** | 0.288<br>(7.46)***  | 0.147<br>(8.96)*** | 0.134<br>(9.29)*** | 0.228<br>(1.69)*   |
| Observations                          | 72                 | 72                 | 72                 | 72                 | 72                  | 72                 | 72                 | 72                 |
| R-squared                             | 0.38               | 0.11               | 0.09               | 0.19               | 0.27                | 0.12               | 0.36               | 0.52               |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

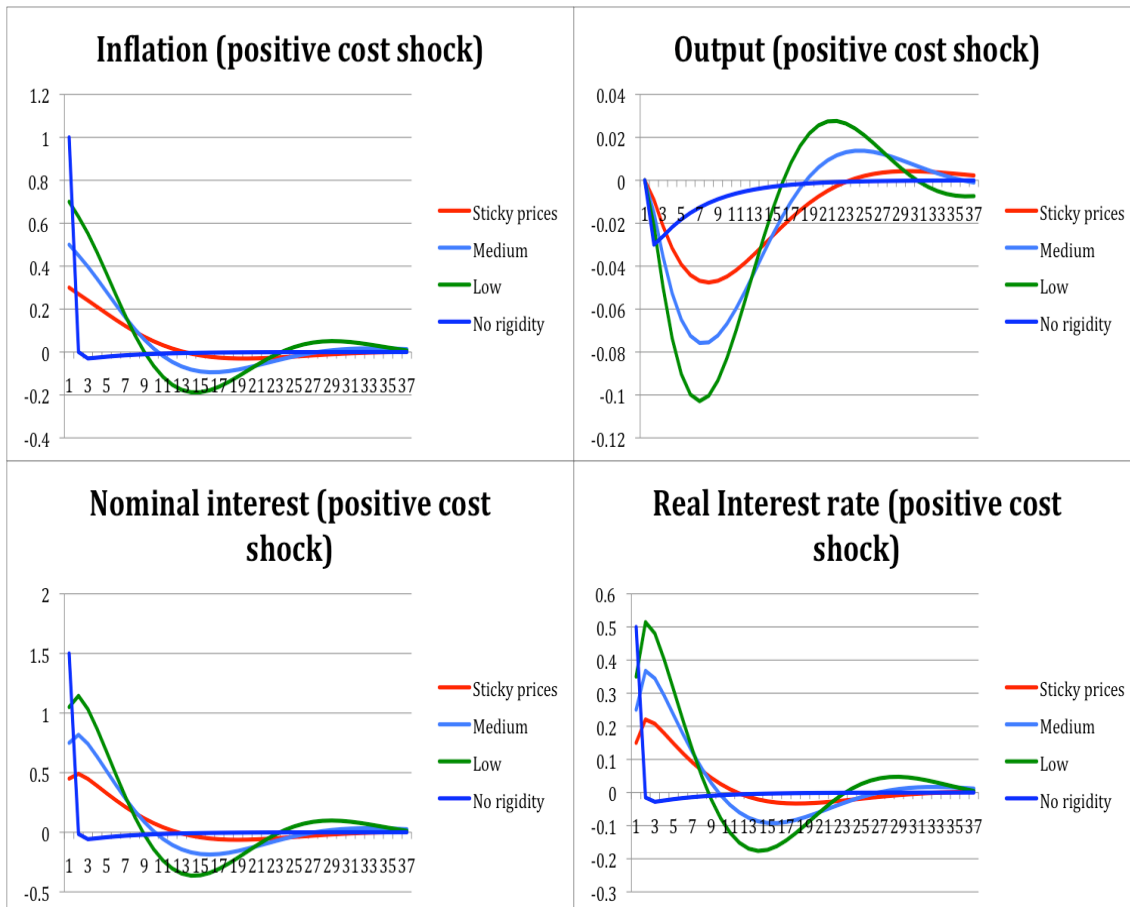
## 10.16 Magnitude of price decreases (lagged) (PPI)

|                                             | (1)              | (2)              | (3)               | (4)              | (5)               | (6)              | (7)                 | (8)                 |
|---------------------------------------------|------------------|------------------|-------------------|------------------|-------------------|------------------|---------------------|---------------------|
|                                             | PPI Size         | PPI Size         | PPI Size          | PPI Size         | PPI Size          | PPI Size         | PPI Size of         | PPI Size of         |
| January                                     | 9.717<br>(0.86)  | 9.314<br>(0.81)  | 9.838<br>(0.87)   | 10.048<br>(0.87) | 9.771<br>(0.87)   | 10.337<br>(0.91) | -17.710<br>(1.64)   | 10.561<br>(1.07)    |
| February                                    | 9.944<br>(0.88)  | 9.758<br>(0.85)  | 9.991<br>(0.88)   | 9.909<br>(0.86)  | 10.480<br>(0.94)  | 12.350<br>(1.08) | -17.557<br>(1.63)   | 12.188<br>(1.23)    |
| March                                       | 10.083<br>(0.90) | 9.742<br>(0.85)  | 9.997<br>(0.88)   | 9.746<br>(0.85)  | 10.658<br>(0.95)  | 11.088<br>(0.98) | -17.429<br>(1.61)   | 10.402<br>(1.06)    |
| April                                       | 10.126<br>(0.90) | 9.659<br>(0.84)  | 9.871<br>(0.87)   | 9.573<br>(0.83)  | 10.141<br>(0.91)  | 9.322<br>(0.82)  | -17.310<br>(1.60)   | 8.312<br>(0.84)     |
| May                                         | 10.182<br>(0.90) | 9.727<br>(0.85)  | 10.051<br>(0.89)  | 10.337<br>(0.90) | 10.252<br>(0.92)  | 11.059<br>(0.98) | -17.130<br>(1.59)   | 9.723<br>(0.99)     |
| June                                        | 10.035<br>(0.89) | 9.530<br>(0.83)  | 9.917<br>(0.88)   | 9.864<br>(0.86)  | 10.051<br>(0.90)  | 10.505<br>(0.93) | -20.599<br>(1.92)*  | 4.710<br>(0.47)     |
| July                                        | -0.279<br>(0.02) | -1.000<br>(0.08) | -0.428<br>(0.04)  | -0.088<br>(0.01) | 1.179<br>(0.10)   | 2.393<br>(0.20)  | -29.088<br>(2.58)** | -1.145<br>(0.11)    |
| August                                      | -0.340<br>(0.03) | -0.913<br>(0.08) | -0.413<br>(0.04)  | -0.413<br>(0.03) | 0.592<br>(0.05)   | -1.154<br>(0.10) | -29.072<br>(2.58)** | -3.059<br>(0.30)    |
| September                                   | -0.584<br>(0.05) | -1.281<br>(0.11) | -0.568<br>(0.05)  | -0.765<br>(0.06) | -0.466<br>(0.04)  | -2.385<br>(0.20) | -29.085<br>(2.58)** | -4.399<br>(0.42)    |
| October                                     | -0.620<br>(0.05) | -0.846<br>(0.07) | -0.557<br>(0.05)  | -0.415<br>(0.03) | 0.188<br>(0.02)   | 2.265<br>(0.19)  | -29.074<br>(2.58)** | -0.276<br>(0.03)    |
| November                                    | 0.079<br>(0.01)  | 0.051<br>(0.00)  | 0.219<br>(0.02)   | 0.559<br>(0.05)  | 0.551<br>(0.05)   | 0.387<br>(0.03)  | -28.441<br>(2.52)** | -0.041<br>(0.00)    |
| L3. PPI Total - 7140A                       | 0.889            |                  |                   |                  |                   |                  |                     | -1.123              |
|                                             | (1.78)*          |                  |                   |                  |                   |                  |                     | (1.09)              |
| L3.PPIchange                                |                  | 2.055<br>(0.84)  |                   |                  |                   |                  |                     | 5.339<br>(1.92)*    |
| L3.Repochange                               |                  |                  |                   | 4.084<br>(0.71)  |                   |                  |                     | 1.455<br>(0.25)     |
| L3.Exchangerate                             |                  |                  |                   |                  |                   | -1.282<br>(1.65) |                     | -0.910<br>(1.05)    |
| L3.Breakdummy                               |                  |                  |                   |                  |                   |                  | 25.059<br>(4.84)*** | 23.767<br>(4.37)*** |
| L3. Repo Rate                               |                  |                  | 1.713<br>(1.61)   |                  |                   |                  |                     | 5.590<br>(2.60)**   |
| L3. Nominal Effective Exchange Rate - 5376M |                  |                  |                   |                  | -0.467            |                  |                     | 0.339               |
|                                             |                  |                  |                   |                  | (2.02)**          |                  |                     | (0.54)              |
| Constant                                    | -5.871<br>(0.66) | 0.565<br>(0.07)  | -15.742<br>(1.22) | 0.243<br>(0.03)  | 37.945<br>(1.86)* | -0.670<br>(0.08) | 20.550<br>(2.77)*** | -79.297<br>(1.09)   |
| Observations                                | 78               | 78               | 78                | 78               | 78                | 78               | 83                  | 78                  |
| R-squared                                   | 0.11             | 0.08             | 0.11              | 0.08             | 0.12              | 0.11             | 0.39                | 0.39                |

Absolute value of t statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

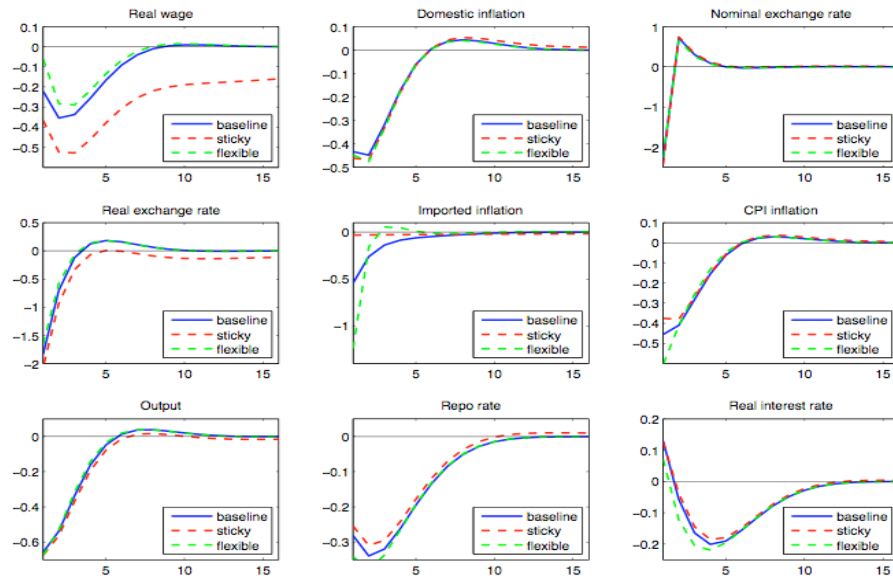
## Appendix 11: 'No price rigidity' scenario in basic closed economy model



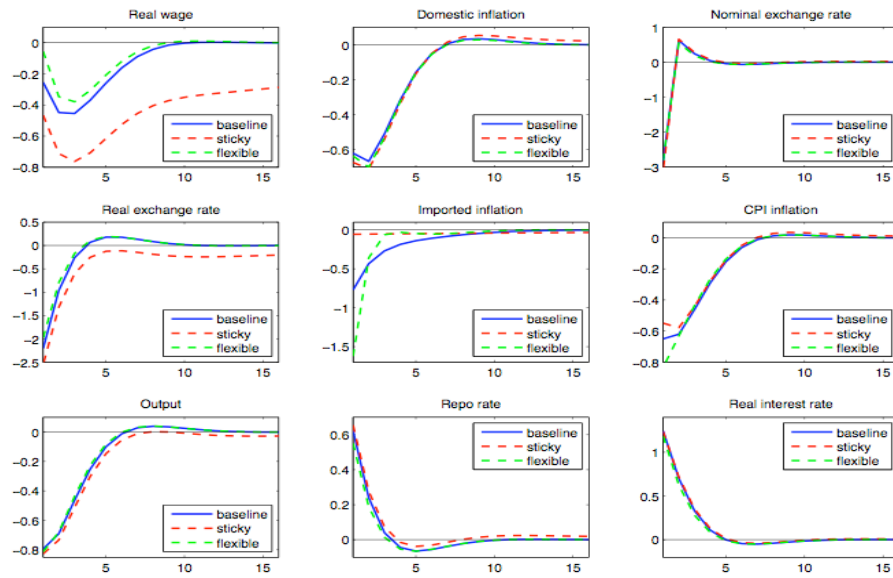
## Appendix 12: Comparison of degrees of importing firm stickiness

Where  $\theta_f = 0,672$  (baseline),  $\theta_f = 0,972$  (sticky) and  $\theta_f = 0,372$  (flexible)

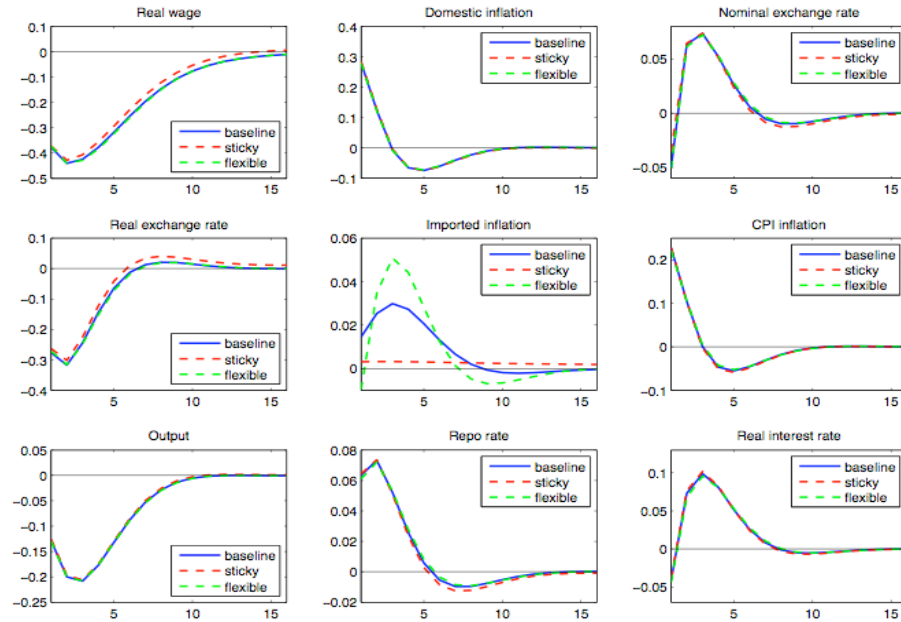
### Demand shock



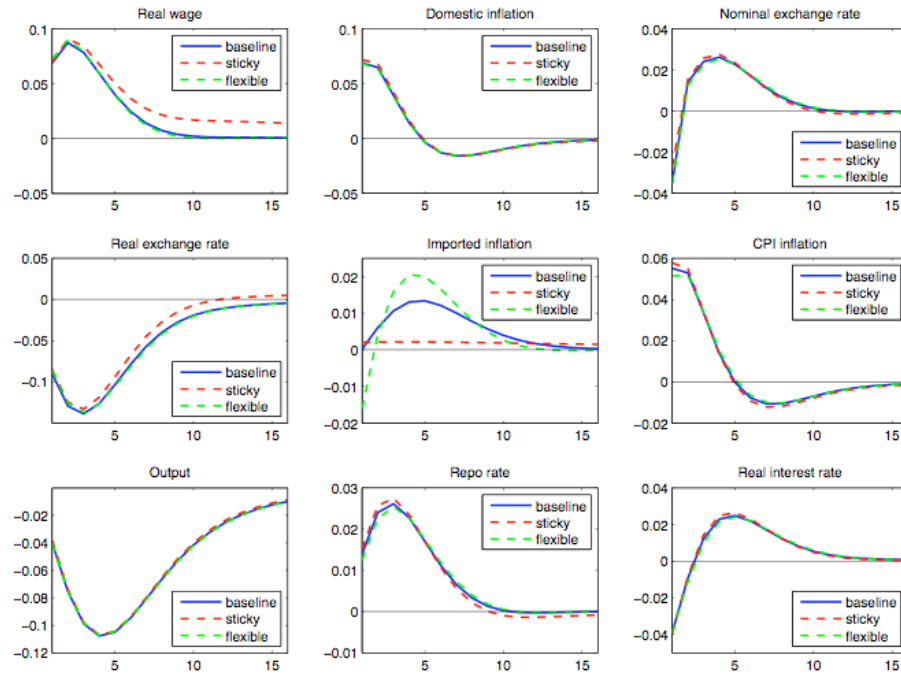
### Policy shock



## Price shock



## Wage shock

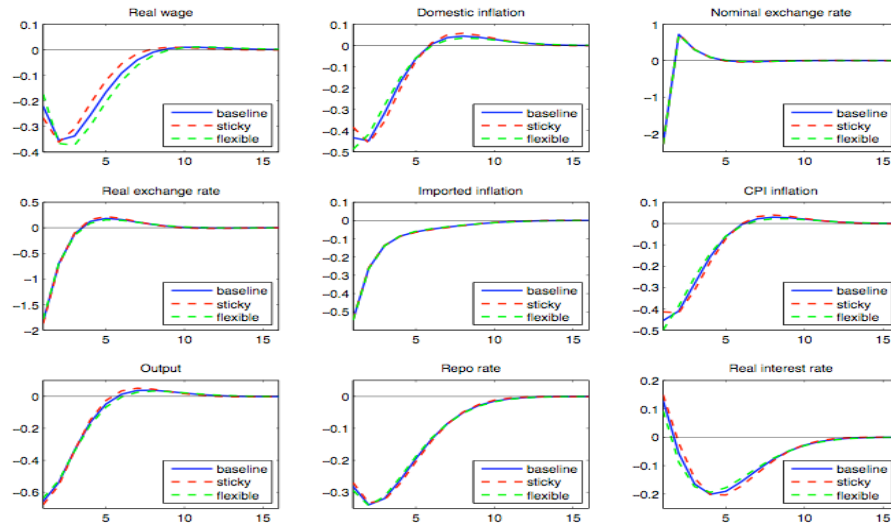




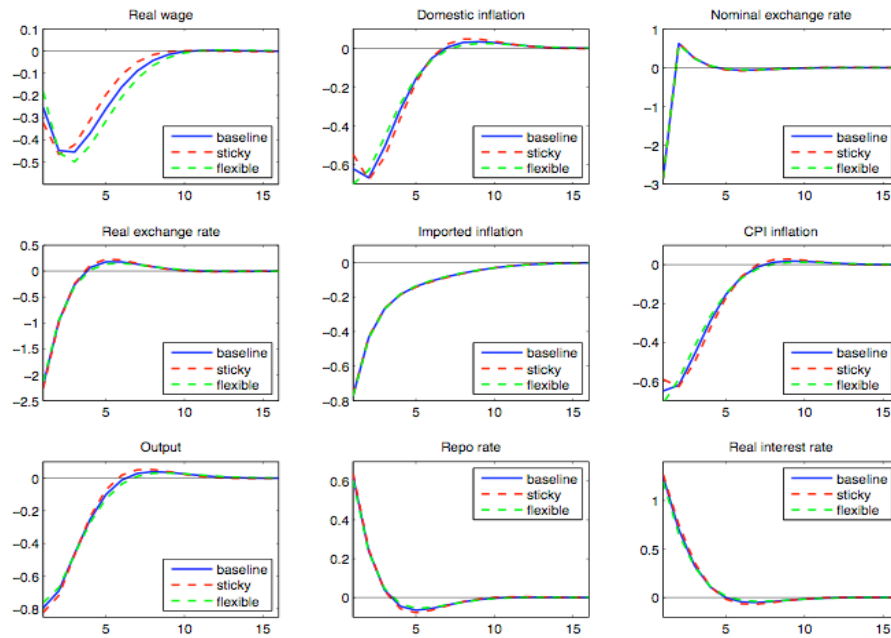
### Appendix 13: Comparison of degrees of backward price indexation

Where  $\delta = 0,25$  (baseline),  $\delta = 0,5$  (sticky) and  $\delta = 0,0$  (flexible)

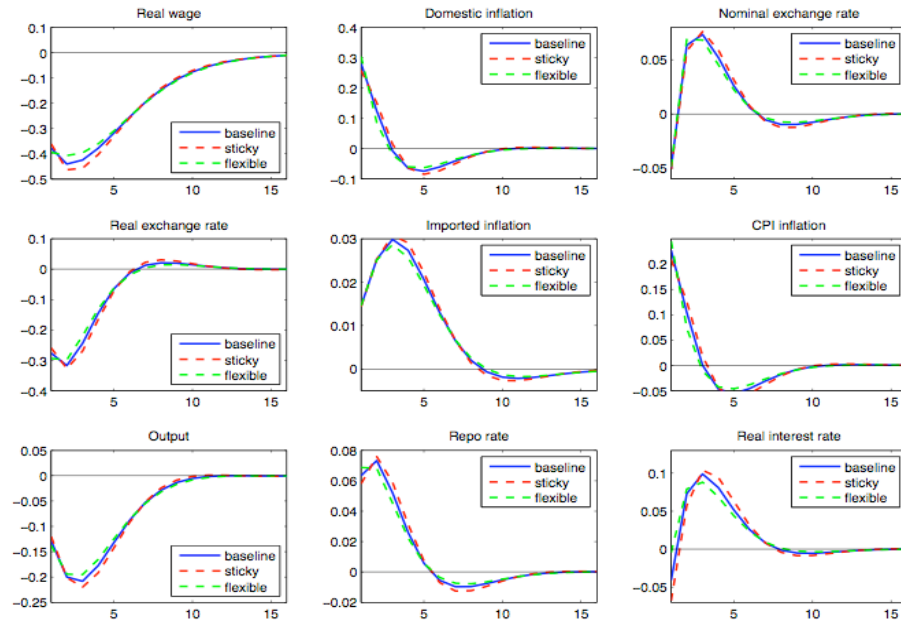
#### Demand shock



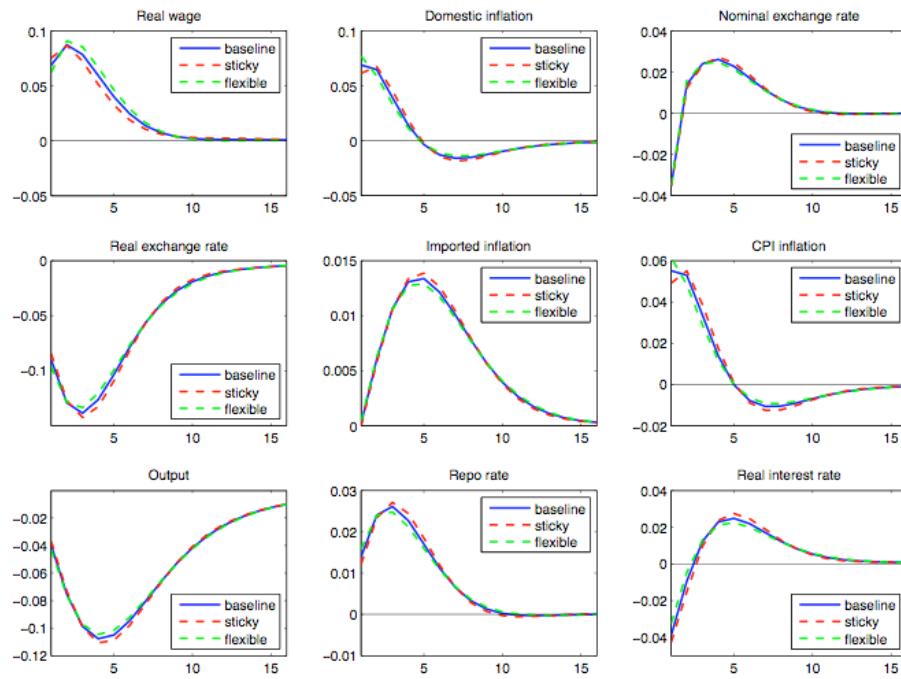
#### Policy shock



## Price shock



## Wage shock



## Appendix 14: Stata code for estimating indexation for DSGE model

```
insheet using "C:\Documents and Settings\Administrator\Desktop\DSGETest.csv"
*split date, p(-)
*destring date1 date2, replace
gen edate2=ym(date1, date2)
format edate2 %tm
tsset edate2
local k=1
while `k'<=12{
gen month`k'=0
replace month`k'=1 if date2==`k'
local k=`k'+1
}

/* save state file DSGETest.dta*/
/* Then Merge*/
clear
set mem 900m
use "C:\Documents and Settings\Administrator\Desktop\DSGETest.dta", clear
gen mergedate=edate2
sort mergedate
save "C:\Documents and Settings\Administrator\Desktop\DSGETest1.dta", replace
use "C:\CPI Unit Data\save_aggregate_joint.dta", clear

gen mergedate=edate2
sort mergedate
save "C:\CPI Unit Data\save_aggregate_joint1.dta", replace

/*here is where the merge actually happens*/
use "C:\Documents and Settings\Administrator\Desktop\DSGETest1.dta", clear

merge mergedate using "C:\CPI Unit Data\save_aggregate_joint1.dta"
tab _merge

/*Calculate price changes*/
sort id edate2
tsset id edate2
gen lnprice=log(price)
gen changelnprice=lnprice-1.lnprice

/*Calculate ratio of partial indexation with delta = 0.25 */
gen partialindexation25CPI=0 if changelnprice~=. & changelnprice~=0
if 12.cpi7032a/100>=0 replace partialindexation25CPI=1 if changelnprice~=. &
changelnprice~=0 & changelnprice<=0.25*(12.cpi7032a/100) & changelnprice>0
if 12.cpi7032a/100<0 append partialindexation25CPI=1 if changelnprice~=. &
changelnprice~=0 & changelnprice>=0.25*(12.cpi7032a/100) & changelnprice<0
tabstat partialindexation25CPI, stat(mean p50 n) by(edate2)

/*Robustness checks for delta 0.5 and 1.0*/

gen partialindexation50CPI=0 if changelnprice~=. & changelnprice~=0
if 12.cpi7032a/100>=0 replace partialindexation50CPI=1 if changelnprice~=. &
changelnprice~=0 & changelnprice<=0.5*(12.cpi7032a/100) & changelnprice>0
if 12.cpi7032a/100<0 append partialindexation50CPI=1 if changelnprice~=. &
changelnprice~=0 & changelnprice>=0.5*(12.cpi7032a/100) & changelnprice<0
tabstat partialindexation50CPI, stat(mean p50 n) by(edate2)
gen partialindexation100CPI=0 if changelnprice~=. & changelnprice~=0
if 12.cpi7032a/100>=0 replace partialindexation100CPI=1 if changelnprice~=. &
changelnprice~=0 & changelnprice<=1*(12.cpi7032a/100) & changelnprice>0
if 12.cpi7032a/100<0 append partialindexation100CPI=1 if changelnprice~=. &
```

```

changelnprice~=0 & changelnprice>=0.1*(12.cpi7032a/100) & changelnprice<0
tabstat partialindexation100CPI, stat(mean p50 n) by(edate2)

/*Overall pricing for Gali Gertler Phillips Curve - price optimisation, indexed
price and no change i.e. all prices = optimisation + indexation + no change*/
gen overallpricechange=0 if changelnprice~=.
replace overallpricechange=1 if changelnprice~=0 & changelnprice~=.
tabstat overallpricechange, stat(mean p50 n) by(edate2)
gen nopricechange=0 if changelnprice~=.
replace nopricechange=1 if changelnprice==0 & changelnprice~=.
tabstat nopricechange, stat(mean p50 n) by(edate2)
tabstat partialindexation25CPI, stat(mean p50 n) by(edate2)

/* PPI DATA SET */

clear

set mem 900m
use "C:\Documents and Settings\Administrator\Desktop\DSGETest.dta", clear

gen mergedate=edate2
sort mergedate
save "C:\Documents and Settings\Administrator\Desktop\DSGETest1.dta", replace
use "C:\Documents and
Settings\Administrator\Desktop\pricedata\PPIFINAL\save_ppi2_combined.dta", clear
gen mergedate=edate2

sort mergedate
save "C:\Documents and
Settings\Administrator\Desktop\pricedata\PPIFINAL\save_ppi3_combined.dta",
replace

/*here is where the merge actually happens*/

use "C:\Documents and Settings\Administrator\Desktop\DSGETest1.dta", clear
merge mergedate using "C:\Documents and
Settings\Administrator\Desktop\pricedata\PPIFINAL\save_ppi3_combined.dta"
tab _merge
destring capturecode, replace
keep if capturecode==0 | capturecode==1 | capturecode==4 | capturecode==5 |
capturecode==6
keep if questiontype_LIE==2
sort id edate2
tsset id edate2

/*Calculate price changes*/
sort id edate2
tsset id edate2
gen lnprice=log(price)
gen changelnprice=lnprice-1.lnprice

/*Calculate ratio of partial indexation with delta = 0.25 */
gen partialindexation25PPI=0 if changelnprice~=. & changelnprice~=0
if 12.ppiimported7141a/100>=0 replace partialindexation25PPI=1 if
changelnprice~=. & changelnprice~=0 &
changelnprice<=0.25*(12.ppiimported7141a/100) & changelnprice>0
if 12.ppiimported7141a/100<0 append partialindexation25PPI=1 if changelnprice~=.
& changelnprice~=0 & changelnprice>=0.25*(12.ppiimported7141a/100) &
changelnprice<0
tabstat partialindexation25PPI, stat(mean p50 n) by(edate2)

```

```

/*Robustness check for delta 0.5 and 1.0*/
gen partialindexation50PPI=0 if changelnprice~= . & changelnprice~=0
if l2.ppiimported7141a/100>=0 replace partialindexation50PPI=1 if
changelnprice~= . & changelnprice~=0 &
changelnprice<=0.5*(l2.ppiimported7141a/100) & changelnprice>0
if l2.ppiimported7141a/100<0 append partialindexation50PPI=1 if changelnprice~= .
& changelnprice~=0 & changelnprice>=0.5*(l2.ppiimported7141a/100) &
changelnprice<0
tabstat partialindexation50PPI, stat(mean p50 n) by(edate2)
gen partialindexation100PPI=0 if changelnprice~= . & changelnprice~=0
if l2.ppiimported7141a/100>=0 replace partialindexation100PPI=1 if
changelnprice~= . & changelnprice~=0 & changelnprice<=1*(l2.ppiimported7141a/100)
& changelnprice>0

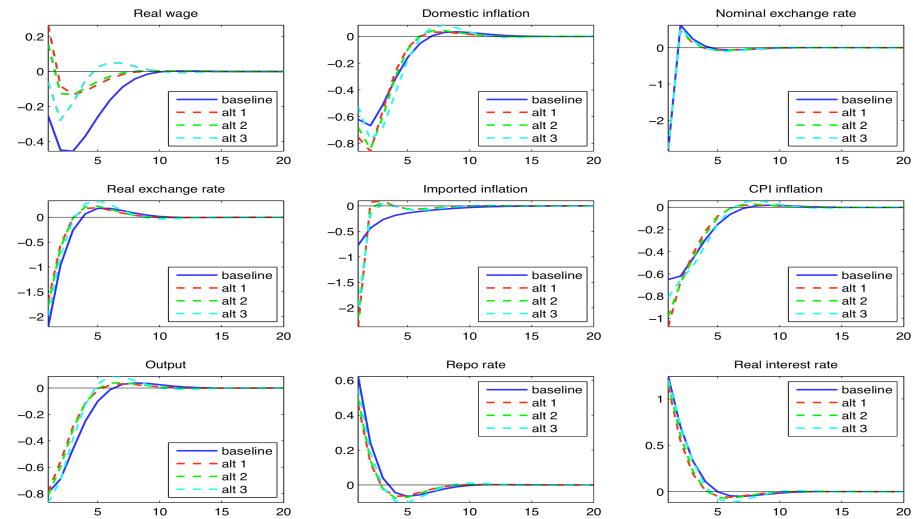
if l2.ppiimported7141a/100<0 append partialindexation100PPI=1 if
changelnprice~= . & changelnprice~=0 & changelnprice>=1*(l2.ppiimported7141a/100)
& changelnprice<0
tabstat partialindexation100PPI, stat(mean p50 n) by(edate2)

```

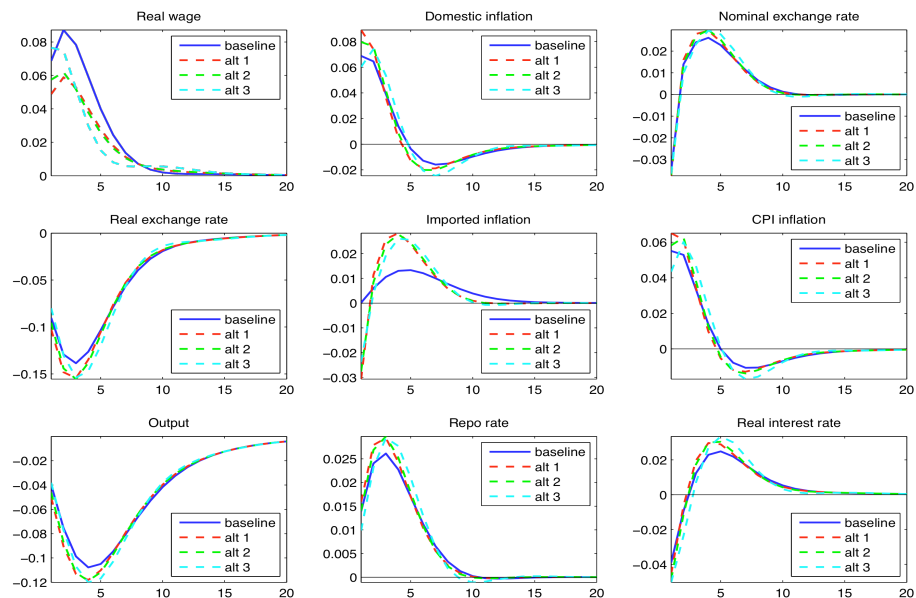
## Appendix 15: Comparing effects of shocks with decomposition of price changes into re-optimisations and indexations

For scenario 'alt 1' ( $\delta = 0,25$ ), for 'alt 2' ( $\delta = 0,5$ ) and for 'alt 3' ( $\delta = 1,0$ )

### Policy Shock



### Wage shock



## Appendix 16: Results by product

| CONSUMER PRICE INDEX                                           |  | Frequency of Price | Frequency of Price | Frequency of Price | N     |
|----------------------------------------------------------------|--|--------------------|--------------------|--------------------|-------|
| LIST OF PRODUCT CODES                                          |  | change             | Increase           | Decrease           |       |
|                                                                |  | mean               | mean               | mean               |       |
| 11 FOOD                                                        |  |                    |                    |                    |       |
| 110 CERAL PRODUCTS                                             |  |                    |                    |                    |       |
| 1101 BREAD                                                     |  |                    |                    |                    |       |
| 1101001 WHITE BREAD                                            |  | 0.1649612          | 0.1201482          | 0.044813           | 11336 |
| 1101002 BROWN BREAD                                            |  | 0.1879359          | 0.1307853          | 0.0571506          | 11041 |
| 1101003 WHOLEWHEAT BREAD                                       |  | 0.1577343          | 0.11833            | 0.0394042          | 8527  |
| 1101004 BREAD ROLLS - WHITE                                    |  | 0.1036269          | 0.0794866          | 0.0241404          | 8492  |
| 1102 MEAL                                                      |  |                    |                    |                    |       |
| 1102001 CAKE FLOUR                                             |  | 0.316226           | 0.1913945          | 0.1248315          | 9645  |
| 1102002 SELF-RAISING FLOUR                                     |  | 0.1917286          | 0.1261795          | 0.0655491          | 9962  |
| 1102003 BREAD FLOUR                                            |  | 0.2170132          | 0.1406441          | 0.0763691          | 7359  |
| 1102004 MEALIE MEAL/MAIZE FLOUR (SIFTED, GRANULATED)           |  | 0.2704548          | 0.1669993          | 0.1034555          | 9521  |
| 1102005 SORGHUM-MEAL                                           |  | 0.1399341          | 0.1032455          | 0.0366886          | 4252  |
| 1102006 CORN FLOUR                                             |  | 0.1241275          | 0.0910086          | 0.0331189          | 7307  |
| 1103 BREAKFAST CEREALS                                         |  |                    |                    |                    |       |
| 1103001 BREAKFAST OATS                                         |  | 0.2466098          | 0.1544182          | 0.0921916          | 9144  |
| 1103002 TAYSTEE WHEAT                                          |  | 0.1499827          | 0.1109769          | 0.0390059          | 5794  |
| 1103003 MABELLA                                                |  | 0.1623312          | 0.1210605          | 0.0412706          | 3998  |
| 1103004 CEREAL FLAKES (E.G. ALL-BRAN, CORN FLAKES)             |  | 0.2634783          | 0.1545652          | 0.108913           | 9200  |
| 1103005 PUFFED RICE (E.G. RICE CRISPIES, ETC.)                 |  | 0.1828687          | 0.1038837          | 0.078985           | 8394  |
| 1104 OTHER CEREAL PRODUCTS                                     |  |                    |                    |                    |       |
| 1104001 RICE                                                   |  | 0.1926984          | 0.1165644          | 0.076134           | 9943  |
| 1104002 MEALIE RICE                                            |  | 0.2078522          | 0.1350269          | 0.0728253          | 6495  |
| 1104003 SAMP                                                   |  | 0.2085326          | 0.1357916          | 0.072741           | 7946  |
| 1104004 SPAGHETTI                                              |  | 0.2288372          | 0.1496641          | 0.0791731          | 9675  |
| 1104005 MACARONI, PLAIN                                        |  | 0.2267211          | 0.1506374          | 0.0760836          | 9805  |
| 1104006 NOODLES                                                |  | 0.1641234          | 0.1092532          | 0.0548701          | 6160  |
| 1104007 MARIE BISCUITS                                         |  | 0.2350716          | 0.1420245          | 0.093047           | 9780  |
| 1104008 CRACKERS (PRO VITA'S, SNACKBREAD, CREAM CRACKERS, ETC) |  | 0.1686128          | 0.1084773          | 0.0601355          | 8564  |
| 1104009 RUSKS                                                  |  | 0.2336778          | 0.1465843          | 0.0870935          | 7934  |
| 1104011 CAKES                                                  |  | 0.1518434          | 0.1022191          | 0.0496243          | 5723  |
| 1104012 TARTS                                                  |  | 0.1560132          | 0.0996697          | 0.0563435          | 5147  |
| 1104013 BABY FOOD (CEREAL PRODUCTS ONLY)                       |  | 0.1515773          | 0.1090023          | 0.042575           | 7798  |
| 1104014 OTHER CEREAL PRODUCTS (SPECIFY)                        |  | 0.2476669          | 0.1568557          | 0.0908112          | 5572  |
| 111 MEAT                                                       |  |                    |                    |                    |       |
| 1111 BEEF AND VEAL<br>(SPECIFY GRADE)                          |  |                    |                    |                    |       |
| 1111001 RUMP STEAK                                             |  | 0.2572758          | 0.1708015          | 0.0864742          | 8384  |
| 1111002 SIRLOIN                                                |  | 0.246201           | 0.159824           | 0.086377           | 7502  |
| 1111003 FILLET                                                 |  | 0.2179017          | 0.1458792          | 0.0720225          | 8178  |
| 1111004 TOPSIDE (WITHOUT BONE)                                 |  | 0.2418679          | 0.1504436          | 0.0914243          | 8116  |
| 1111005 BRISKET (WITH BONE)                                    |  | 0.234192           | 0.1539504          | 0.0802416          | 8113  |
| 1111006 CHUCK (WITH BONE)                                      |  | 0.2318113          | 0.15429            | 0.0775213          | 7972  |
| 1111007 HIND QUARTER                                           |  | 0.2495183          | 0.1533719          | 0.0961464          | 5190  |
| 1111008 T-BONE                                                 |  | 0.2409361          | 0.1539954          | 0.0869407          | 8247  |
| 1111009 SHIN (WITH BONE)                                       |  | 0.2146649          | 0.1405999          | 0.0740649          | 8101  |
| 1111011 NECK                                                   |  | 0.195101           | 0.1244807          | 0.0706203          | 6981  |
| 1111012 THICK FLANK                                            |  | 0.2428926          | 0.1454596          | 0.0974331          | 7246  |
| 1112 MUTTON<br>(SPECIFY GRADE)                                 |  |                    |                    |                    |       |
| 1112001 LEG                                                    |  | 0.2035176          | 0.1404243          | 0.0630932          | 3582  |
| 1112002 CHOPS                                                  |  | 0.1815651          | 0.1203217          | 0.0612434          | 3233  |
| 1112003 SHOULDER                                               |  | 0.1975737          | 0.1322935          | 0.0652802          | 3462  |
| 1112004 RIB (SPECIFY "CHOPS" OR "ROAST")                       |  | 0.1805467          | 0.1166561          | 0.0638907          | 3146  |
| 1112005 NECK                                                   |  | 0.1781437          | 0.1167665          | 0.0613772          | 3340  |
| 1112006 HALF A SHEEP                                           |  | 0.2709734          | 0.1677872          | 0.1031862          | 3421  |
| 1112007 LOIN                                                   |  | 0.1696864          | 0.1090592          | 0.0606272          | 2870  |
| 1112008 FLANK                                                  |  | 0.1581332          | 0.1010421          | 0.0570911          | 2207  |
| 1113 LAMB<br>(SPECIFY GRADE)                                   |  |                    |                    |                    |       |
| 1113001 LEG                                                    |  | 0.2674346          | 0.1781645          | 0.0892701          | 7987  |
| 1113002 CHOPS                                                  |  | 0.2699239          | 0.1832487          | 0.0866751          | 7880  |
| 1113003 SHOULDER                                               |  | 0.2378334          | 0.1615342          | 0.0762991          | 7274  |
| 1113004 RIB (SPECIFY "CHOPS" OR "ROAST")                       |  | 0.2561054          | 0.1695309          | 0.0865745          | 7739  |
| 1113005 NECK                                                   |  | 0.2328042          | 0.158214           | 0.0745903          | 7749  |
| 1113006 HALF A LAMB                                            |  | 0.3439255          | 0.2199699          | 0.1239556          | 7301  |
| 1113007 LOIN                                                   |  | 0.2460019          | 0.1668753          | 0.0791267          | 7191  |
| 1113008 FLANK                                                  |  | 0.209744           | 0.1443022          | 0.0654418          | 4844  |
| 1114 PORK<br>(SPECIFY GRADE)                                   |  |                    |                    |                    |       |
| 1114001 CHOPS                                                  |  | 0.234998           | 0.1540601          | 0.0809379          | 7549  |
| 1114002 LEG                                                    |  | 0.2152537          | 0.1359573          | 0.0792964          | 6936  |
| 1114003 SHOULDER                                               |  | 0.2176507          | 0.1382686          | 0.0793821          | 6538  |

|                                                                                 |           |           |           |       |
|---------------------------------------------------------------------------------|-----------|-----------|-----------|-------|
| 1115 CHICKEN                                                                    |           |           |           |       |
| 1115001 CHICKEN, WHOLE, DRESSED                                                 | 0.2466446 | 0.1588505 | 0.0877941 | 6333  |
| 1115002 CHICKEN PORTIONS                                                        | 0.2251475 | 0.1414737 | 0.0836738 | 6609  |
| 1116                                                                            |           |           |           |       |
| 1116001 VENISON (SPECIFY)                                                       | 0.1163435 | 0.0789474 | 0.0373961 | 722   |
| 1117 OTHER MEAT                                                                 |           |           |           |       |
| 1117001 MINCED MEAT (SPECIFY TYPE)                                              | 0.2244265 | 0.1476751 | 0.0767514 | 8065  |
| 1117002 BOEREWORS (SPECIFY GRADE)                                               | 0.2181065 | 0.1445108 | 0.0735957 | 8207  |
| 1117003 PORK SAUSAGES                                                           | 0.2227237 | 0.135989  | 0.0867347 | 5096  |
| 1117004 VIENNA SAUSAGES (NOT TINNED)                                            | 0.2073864 | 0.1295702 | 0.0778162 | 8096  |
| 1117005 FRENCH POLONY                                                           | 0.1758482 | 0.106843  | 0.0690052 | 8695  |
| 1117006 COOKED HAM, SLICED (NOT SHOULDER)                                       | 0.1495251 | 0.0936228 | 0.0559023 | 3685  |
| 1117007 BILTONG, CUT                                                            | 0.1288929 | 0.0897035 | 0.0391894 | 6711  |
| 1117008 DRIED SAUSAGES                                                          | 0.1274661 | 0.0907531 | 0.036713  | 5829  |
| 1117009 BACON, MIDDLE CUT, SLICED                                               | 0.2133457 | 0.1326831 | 0.0806626 | 6459  |
| 1117011 MEAT SPREAD                                                             | 0.1472005 | 0.094534  | 0.0526666 | 6019  |
| 1117012 CORNED BEEF, S.A. - TINNED                                              | 0.2370939 | 0.1333417 | 0.1037522 | 7942  |
| 1117013 MEAT PATTIES                                                            | 0.1425912 | 0.0936337 | 0.0489576 | 5372  |
| 1117014 BABY FOOD CONTAINING MEAT<br>(E.G. MEAT AND VEGETABLES, MEAT AND PASTA) | 0.1935693 | 0.1276388 | 0.0659305 | 6158  |
| 112 FISH AND OTHER SEAFOOD                                                      |           |           |           |       |
| 1121 FRESH FISH                                                                 |           |           |           |       |
| 1121001 HAKE                                                                    | 0.1864746 | 0.1320528 | 0.0544218 | 2499  |
| 1121002 SNOEK                                                                   | 0.103207  | 0.0664723 | 0.0367347 | 1715  |
| 1122 FROZEN FISH AND FISH PRODUCTS                                              |           |           |           |       |
| 1122001 HAKE                                                                    | 0.2412068 | 0.155534  | 0.0856728 | 6198  |
| 1122002 HADDOCK                                                                 | 0.1919119 | 0.1337787 | 0.0581332 | 5539  |
| 1122003 FISH FINGERS                                                            | 0.2326853 | 0.1477825 | 0.0849028 | 6584  |
| 1122004 FISH CAKES                                                              | 0.2089224 | 0.1446748 | 0.0642476 | 6366  |
| 1123 CANNED FISH AND FISH PRODUCTS                                              |           |           |           |       |
| 1123001 TUNA, IN WATER                                                          | 0.2152728 | 0.1243767 | 0.0908961 | 7019  |
| 1123002 PILCHARDS IN TOMATO SAUCE                                               | 0.2067144 | 0.1410788 | 0.0656356 | 7953  |
| 1123003 PILCHARDS IN CHILLI SAUCE                                               | 0.205353  | 0.1370558 | 0.0682972 | 6501  |
| 1123004 SARDINES IN OIL                                                         | 0.1570231 | 0.0911812 | 0.065842  | 5012  |
| 1123005 FISH PASTE                                                              | 0.1141232 | 0.082654  | 0.0314692 | 5275  |
| 1124 OTHER FISH                                                                 |           |           |           |       |
| 1124001 FISH PORTIONS, IN CRUMBS                                                | 0.2243157 | 0.1422055 | 0.0821103 | 5042  |
| 1124002 FISH PORTIONS, IN BATTER                                                | 0.1864571 | 0.1303507 | 0.0561064 | 4135  |
| 1124003 SMOKED FISH                                                             | 0.1120201 | 0.0767778 | 0.0352423 | 1589  |
| 1124004 DRIED FISH                                                              | 0.055666  | 0.0397614 | 0.0159046 | 503   |
| 1125 OTHER SEAFOOD                                                              |           |           |           |       |
| 1125001 SEA FOOD MIXTURE, FROZEN                                                | 0.1649596 | 0.097035  | 0.0679245 | 1855  |
| 1125002 SHRIMPS, FROZEN                                                         | 0.1406351 | 0.0725859 | 0.0680493 | 1543  |
| 1125003 LOBSTER, FROZEN                                                         | 0.0824742 | 0.0541237 | 0.0283505 | 388   |
| 113 MILK, CHEESE AND EGGS                                                       |           |           |           |       |
| 1131 MILK AND MILK PRODUCTS                                                     |           |           |           |       |
| 1131001 FRESH MILK                                                              | 0.1954992 | 0.1449342 | 0.0505649 | 10798 |
| 1131002 MAAS (AMASI)                                                            | 0.1695328 | 0.116725  | 0.0528078 | 6571  |
| 1131003 BUTTER MILK                                                             | 0.1631483 | 0.1167579 | 0.0463904 | 7674  |
| 1131004 SOUR MILK                                                               |           |           |           | 0     |
| 1131005 CREAM                                                                   | 0.2382521 | 0.1459151 | 0.0923369 | 7895  |
| 1131006 YOGHURT, PLAIN                                                          | 0.2223461 | 0.1419615 | 0.0803845 | 7178  |
| 1131007 YOGHURT, FLAVOURED                                                      | 0.221008  | 0.1409103 | 0.0800977 | 7778  |
| 1132 ICE CREAM AND RELATED PRODUCTS                                             |           |           |           |       |
| 1132001 SORBET (SPECIFY FLAVOUR)                                                | 0.1806629 | 0.1121415 | 0.0685214 | 5823  |
| 1132002 FULL CREAM ICE CREAM (SPECIFY FLAVOUR)                                  | 0.2814059 | 0.1672026 | 0.1142033 | 9019  |
| 1132003 FROZEN YOGHURT                                                          | 0.1303993 | 0.0904645 | 0.0399348 | 1227  |
| 1133 MILK POWDERS AND WHITENERS                                                 |           |           |           |       |
| 1133001 SKIMMED MILK POWDER                                                     | 0.1206858 | 0.0913603 | 0.0293255 | 4433  |
| 1133002 WHITENERS, CREAMERS                                                     | 0.218982  | 0.1427028 | 0.0762792 | 7407  |
| 1134 OTHER MILK PRODUCTS                                                        |           |           |           |       |
| 1134001 CONDENSED MILK, SWEETENED                                               | 0.2029733 | 0.1415858 | 0.0613875 | 9888  |
| 1134002 EVAPORATED MILK                                                         | 0.1910976 | 0.1390244 | 0.0520732 | 8200  |
| 1134003 LONGLIFE MILK, FULL CREAM                                               | 0.228435  | 0.1599045 | 0.0685305 | 8799  |
| 1134004 MILK FORMULAS FOR BABIES                                                | 0.1650128 | 0.118089  | 0.0469237 | 7054  |
| 1134005 SOYA MILK                                                               | 0.150286  | 0.0933437 | 0.0569423 | 3846  |
| 1135 CHEESE                                                                     |           |           |           |       |
| 1135001 CHEDDAR CHEESE, FIRST GRADE                                             | 0.2266025 | 0.1441875 | 0.082415  | 6443  |
| 1135002 GOUDA CHEESE, FIRST GRADE                                               | 0.218683  | 0.1434916 | 0.0751914 | 6530  |
| 1135003 WHITE CHEESE, FIRST GRADE                                               | 0.2101363 | 0.1390041 | 0.0711322 | 3374  |
| 1135004 COTTAGE CHEESE                                                          | 0.2392638 | 0.1455089 | 0.0937549 | 6357  |
| 1136 EGGS, FIRST GRADE                                                          |           |           |           |       |



|                                              |           |           |           |      |
|----------------------------------------------|-----------|-----------|-----------|------|
| 1136001 JUMBO                                | 0.1650586 | 0.1266368 | 0.0384218 | 5804 |
| 1136002 EXTRA LARGE                          | 0.1659689 | 0.1251495 | 0.0408194 | 6688 |
| 1136003 LARGE                                | 0.1837634 | 0.1313978 | 0.0523656 | 9300 |
| 1136004 MEDIUM                               | 0.1250499 | 0.0890931 | 0.0359569 | 2503 |
| 114 FATS AND OILS                            |           |           |           |      |
| 1141 BUTTER                                  |           |           |           |      |
| 1141001 BUTTER, CREAMERY, CHOICE             | 0.2272468 | 0.1416548 | 0.085592  | 7010 |
| 1142 MARGARINE                               |           |           |           |      |
| 1142001 MEDIUM FAT SPREAD, TUB               | 0.2193449 | 0.1363382 | 0.0830067 | 7144 |
| 1142002 LOW FAT SPREAD, TUB                  | 0.1801907 | 0.1132516 | 0.0669391 | 5139 |
| 1142003 YELLOW MARGARINE, BLOCK              | 0.2121697 | 0.1297038 | 0.082466  | 8743 |
| 1143 OTHER FATS AND OILS                     |           |           |           |      |
| 1143001 COOKING OIL                          | 0.2709664 | 0.1737146 | 0.0972518 | 9861 |
| 1143002 PEANUT BUTTER                        | 0.2337048 | 0.1547519 | 0.0789529 | 9512 |
| 1143003 COOKING FAT, VEGETABLE               | 0.0901192 | 0.0618173 | 0.0283019 | 4028 |
| 1143004 LARD                                 | 0.0742129 | 0.0607196 | 0.0134933 | 1334 |
| 115 FRUIT AND NUTS                           |           |           |           |      |
| 1151 DECIDUOUS FRUIT, FRESH                  |           |           |           |      |
| 1151001 APPLES                               | 0.3753748 | 0.227377  | 0.1479979 | 5669 |
| 1151002 GRAPES                               | 0.3659727 | 0.1646064 | 0.2013663 | 3074 |
| 1151003 APRICOTS                             | 0.1550132 | 0.0831135 | 0.0718997 | 1516 |
| 1151004 PEACHES                              | 0.3283804 | 0.1575037 | 0.1708767 | 2019 |
| 1151005 PLUMS                                | 0.3339815 | 0.147788  | 0.1861935 | 2057 |
| 1151006 PEARS                                | 0.3695185 | 0.2100172 | 0.1595013 | 4652 |
| 1152 SUBTROPICAL FRUIT, FRESH                |           |           |           |      |
| 1152001 BANANAS                              | 0.472011  | 0.2630058 | 0.2090052 | 6574 |
| 1152002 PAWPAWS                              | 0.3524173 | 0.1949109 | 0.1575064 | 3930 |
| 1152003 PINEAPPLES                           | 0.359043  | 0.196572  | 0.162471  | 5601 |
| 1152004 MANGOES                              | 0.2881183 | 0.1295258 | 0.1585926 | 1961 |
| 1152005 AVOCADO'S                            | 0.4       | 0.2320778 | 0.1679222 | 4115 |
| 1152006 GUAVAS                               | 0.2475884 | 0.1534221 | 0.0941663 | 2177 |
| 1153 CITRUS FRUIT, FRESH                     |           |           |           |      |
| 1153001 ORANGES                              | 0.3242938 | 0.1853107 | 0.1389831 | 4425 |
| 1153002 NAARTJIES                            | 0.2954473 | 0.179879  | 0.1155683 | 3141 |
| 1153003 GRAPEFRUIT                           | 0.2926209 | 0.1456743 | 0.1469466 | 3144 |
| 1153004 LEMONS                               | 0.3263753 | 0.1800624 | 0.1463129 | 5126 |
| 1154 OTHER FRUIT, FRESH                      |           |           |           |      |
| 1154001 WATERMELON                           | 0.3738739 | 0.1707617 | 0.2031122 | 2442 |
| 1154002 STRAWBERRIES                         | 0.3051282 | 0.1533333 | 0.1517949 | 1950 |
| 1154003 MELON                                | 0.3633654 | 0.1931103 | 0.1702551 | 3019 |
| 1155 CANNED FRUIT                            |           |           |           |      |
| 1155001 PEARS, CHOICE GRADE, CANNED          | 0.162644  | 0.1201317 | 0.0425123 | 7292 |
| 1155002 PEACHES, CHOICE GRADE, CANNED        | 0.1914451 | 0.1219653 | 0.0694798 | 8650 |
| 1155003 GUAVAS, CHOICE GRADE, CANNED         | 0.1564413 | 0.1159026 | 0.0405387 | 7351 |
| 1155004 FRUIT COCKTAIL, CHOICE GRADE, CANNED | 0.1740572 | 0.119887  | 0.0541702 | 8141 |
| 1156 DRIED FRUIT                             |           |           |           |      |
| 1156001 PEACHES, DRIED                       | 0.0927288 | 0.066585  | 0.0261438 | 2448 |
| 1156002 PRUNES                               | 0.1146744 | 0.0840622 | 0.0306122 | 4116 |
| 1156003 RAISINS (STALKLESS, SEEDLESS)        | 0.1542543 | 0.1000197 | 0.0542346 | 5089 |
| 1157 FRUIT JUICE                             |           |           |           |      |
| 1157001 FRUIT JUICE, 100% (SPECIFY)          | 0.2414217 | 0.1503297 | 0.091092  | 8947 |
| 1157002 FRUIT JUICE CONCENTRATES (SPECIFY)   | 0.2257885 | 0.1428373 | 0.0829512 | 7197 |
| 1157003 DAIRY MIXTURES                       | 0.1862976 | 0.128708  | 0.0575897 | 8057 |
| 1158 NUTS                                    |           |           |           |      |
| 11581 DRIED COCOANUT                         |           |           |           |      |
| 1158101 NOT ROASTED                          | 0.1294304 | 0.0897549 | 0.0396755 | 5671 |
| 1158102 ROASTED                              | 0.3333333 | 0.2083333 | 0.125     | 24   |
| 11582 OTHER NUTS                             |           |           |           |      |
| 1158201 ALMONDS                              | 0.1274487 | 0.0828416 | 0.044607  | 4237 |
| 1158202 PECAN-NUTS                           | 0.1066218 | 0.0707071 | 0.0359147 | 3564 |
| 1158203 WALNUTS                              | 0.1032753 | 0.0634405 | 0.0398348 | 3389 |
| 1158204 PEANUTS, BAKED, SALTED               | 0.1138579 | 0.0763014 | 0.0375565 | 4207 |
| 1159 OTHER FRUIT PRODUCTS                    |           |           |           |      |
| 1159001 BABY FOOD (FRUIT PRODUCTS ONLY)      | 0.2209884 | 0.138133  | 0.0828554 | 8195 |
| 1159002 GRENADILLA PULP                      | 0.1107857 | 0.0768436 | 0.0339421 | 5804 |
| 1159003 DATES, MASHED, COMPRESSED            | 0.1450146 | 0.0858806 | 0.0591339 | 5496 |
| 116 VEGETABLES                               |           |           |           |      |
| 1161 FRESH VEGETABLES                        |           |           |           |      |
| 1161001 POTATOES                             | 0.3518827 | 0.1940118 | 0.1578709 | 6613 |
| 1161002 SWEET POTATOES                       | 0.3040186 | 0.1774413 | 0.1265774 | 5151 |
| 1161003 GREEN MEALIES (SWEETCORN)            | 0.2872291 | 0.1488294 | 0.1384615 | 2990 |

|                                      |                                        |           |           |           |       |
|--------------------------------------|----------------------------------------|-----------|-----------|-----------|-------|
| 1161004                              | ONIONS                                 | 0.3402842 | 0.1813407 | 0.1589435 | 6474  |
| 1161005                              | TOMATOES                               | 0.4181326 | 0.1975643 | 0.2205683 | 6651  |
| 1161006                              | GREEN BEANS                            | 0.3481114 | 0.1811798 | 0.1669342 | 4984  |
| 1161007                              | CABBAGE                                | 0.3925725 | 0.2183615 | 0.174211  | 6274  |
| 1161008                              | CAULIFLOWER                            | 0.3804159 | 0.1993068 | 0.1811092 | 4616  |
| 1161009                              | CARROTS                                | 0.3317141 | 0.1773074 | 0.1544067 | 5764  |
| 1161011                              | PUMPKIN                                | 0.3351739 | 0.1847966 | 0.1503773 | 5433  |
| 1161012                              | VEGETABLE MARROW                       | 0.3384971 | 0.1852023 | 0.1532948 | 4325  |
| 1161013                              | GEM SQUASH                             | 0.3397193 | 0.167868  | 0.1718513 | 5272  |
| 1161014                              | BEETROOT                               | 0.3305172 | 0.1813311 | 0.1491861 | 4853  |
| 1161015                              | LETTUCE                                | 0.3854981 | 0.2077166 | 0.1777815 | 6013  |
| 1161016                              | MAROGO                                 | 0.2774025 | 0.1568969 | 0.1205056 | 4589  |
| 1161017                              | OTHER FRESH VEGETABLES (SPECIFY)       | 0.3321719 | 0.1656988 | 0.1664731 | 2583  |
| 1162 FROZEN VEGETABLES               |                                        |           |           |           |       |
| 1162001                              | GREEN BEANS, FROZEN                    | 0.1820988 | 0.1230453 | 0.0590535 | 4860  |
| 1162002                              | PEAS, FROZEN                           | 0.2221374 | 0.1381679 | 0.0836995 | 6550  |
| 1162003                              | CARROTS, FROZEN                        | 0.1924966 | 0.117855  | 0.0746415 | 5091  |
| 1162004                              | MIXED VEGETABLES, FROZEN               | 0.2390415 | 0.1415839 | 0.0974576 | 6844  |
| 1162005                              | CAULIFLOWER, FROZEN                    | 0.1619747 | 0.1089351 | 0.0530396 | 4902  |
| 1162006                              | CORN KERNELS, FROZEN                   | 0.1716789 | 0.1109341 | 0.0607449 | 5021  |
| 1162007                              | POTATO CHIPS, FROZEN                   | 0.2282519 | 0.1458642 | 0.0823878 | 6081  |
| 1162008                              | PUMPKIN                                | 0.1366436 | 0.0981524 | 0.0384911 | 2598  |
| 1163 CANNED VEGETABLES               |                                        |           |           |           |       |
| 1163001                              | CORN, KERNELS, CANNED                  | 0.1597876 | 0.1099445 | 0.0498431 | 8286  |
| 1163002                              | SWEETCORN, CREAM STYLE, CANNED         | 0.1983141 | 0.1234472 | 0.0748669 | 9016  |
| 1163003                              | BAKED BEANS IN TOMATO SAUCE            | 0.227092  | 0.1354602 | 0.0916318 | 9811  |
| 1163004                              | PEAS, CANNED (CHOICE GRADE)            | 0.2034443 | 0.1302002 | 0.0732441 | 9639  |
| 1163005                              | BUTTER BEANS, CANNED                   | 0.1602579 | 0.1158265 | 0.0444314 | 8530  |
| 1163006                              | GREEN BEANS, CANNED                    | 0.1557387 | 0.1188349 | 0.0369038 | 8617  |
| 1164 DRIED VEGETABLES                |                                        |           |           |           |       |
| 1164001                              | PEAS, DRIED                            | 0.1619572 | 0.1035098 | 0.0584474 | 6724  |
| 1164002                              | BEANS, DRIED                           | 0.1890159 | 0.1258712 | 0.0631447 | 7174  |
| 1164003                              | LENTILS, DRIED                         | 0.1540848 | 0.0933668 | 0.060718  | 6769  |
| 1165 OTHER VEGETABLE PRODUCTS        |                                        |           |           |           |       |
| 1165001                              | BABY FOOD (VEGETABLE PRODUCTS ONLY)    | 0.2202028 | 0.1415778 | 0.078625  | 7593  |
| 1165002                              | OTHER VEGETABLE PRODUCTS (SPECIFY)     | 0.1949807 | 0.127027  | 0.0679537 | 2590  |
| 1165003                              | PREPARED SALADS                        | 0.0941434 | 0.0684182 | 0.0257252 | 1827  |
| 117 SUGAR AND RELATED PRODUCTS       |                                        |           |           |           |       |
| 1170001                              | WHITE SUGAR                            | 0.2324702 | 0.1509068 | 0.0815634 | 10311 |
| 1170002                              | BROWN SUGAR                            | 0.1584392 | 0.1107613 | 0.0476779 | 8893  |
| 1170003                              | ARTIFICIAL SWEETENERS                  | 0.1107948 | 0.0790453 | 0.0317495 | 4567  |
| 1170004                              | ICING SUGAR                            | 0.1417451 | 0.0974159 | 0.0443291 | 9249  |
| 1170005                              | CASTOR SUGAR                           | 0.148073  | 0.0989407 | 0.0491323 | 8874  |
| 118 COFFEE, TEA AND COCOA            |                                        |           |           |           |       |
| 1181 COFFEE                          |                                        |           |           |           |       |
| 1181001                              | INSTANT COFFEE                         | 0.2164761 | 0.1338933 | 0.0825827 | 9881  |
| 1181002                              | GROUND COFFEE, 75% COFFEE, 25% CHICORY | 0.1406708 | 0.0978509 | 0.0428199 | 6142  |
| 1181003                              | COFFEE BEANS                           | 0.1637286 | 0.1084402 | 0.0552885 | 3744  |
| 1182 TEA                             |                                        |           |           |           |       |
| 11821 TEA, CEYLON                    |                                        |           |           |           |       |
| 1182101                              | TEA LEAVES                             | 0.1459708 | 0.0885649 | 0.057406  | 6515  |
| 1182102                              | TEA BAGS, TAGGED                       | 0.123848  | 0.0831043 | 0.0407437 | 6185  |
| 1182103                              | TEA BAGS, TAGLESS                      | 0.2232324 | 0.1183156 | 0.1049169 | 8359  |
| 11822 TEA, TIPS, CEYLON              |                                        |           |           |           |       |
| 1182201                              | TEA LEAVES                             |           |           |           |       |
| 1182202                              | TEA BAGS, TAGGED                       |           |           |           |       |
| 1182203                              | TEA BAGS, TAGLESS                      |           |           |           |       |
| 11823 ROOIBOS                        |                                        |           |           |           |       |
| 1182301                              | TEA LEAVES                             | 0.1237959 | 0.0883378 | 0.0354581 | 4879  |
| 1182302                              | TEA BAGS, TAGLESS                      | 0.1579407 | 0.0993518 | 0.0585889 | 8022  |
| 11824 HERBAL TEA                     |                                        |           |           |           |       |
| 1182401                              | TEA LEAVES                             | 0         | 0         | 0         | 3     |
| 1182402                              | TEA BAGS, TAGLESS                      | 0.0625    | 0.03125   | 0.03125   | 32    |
| 1183 OTHER WARM DRINKS               |                                        |           |           |           |       |
| 1183001                              | COCOA                                  | 0.1229718 | 0.087105  | 0.0358668 | 7026  |
| 1183002                              | HOT CHOCOLATE (SPECIFY)                | 0.1601803 | 0.1028267 | 0.0573535 | 7323  |
| 1183003                              | MALT DRINKS                            | 0.1402633 | 0.0894235 | 0.0508398 | 2203  |
| 119 OTHER FOOD PRODUCTS              |                                        |           |           |           |       |
| 1191 SYRUP, JAM AND RELATED PRODUCTS |                                        |           |           |           |       |
| 1191001                              | GOLDEN SYRUP                           | 0.1649318 | 0.1172797 | 0.0476521 | 8646  |
| 1191002                              | HONEY                                  | 0.129458  | 0.0972506 | 0.0322074 | 6365  |
| 1191003                              | APRICOT JAM, SMOOTH                    | 0.1885994 | 0.1160098 | 0.0725896 | 8982  |

|                                                               |           |           |           |       |
|---------------------------------------------------------------|-----------|-----------|-----------|-------|
| 1191004 PEACH JAM, SMOOTH                                     | 0.1593807 | 0.116272  | 0.0431087 | 6588  |
| 1191005 MELON AND GINGER JAM                                  | 0.1538868 | 0.1188084 | 0.0350784 | 5673  |
| 1191006 STRAWBERRY JAM                                        | 0.1603404 | 0.1131974 | 0.0471431 | 7403  |
| 1191007 MARMELADE, S.A.                                       | 0.159372  | 0.1214716 | 0.0379004 | 6306  |
| 1191008 JELLY POWDER                                          | 0.1832981 | 0.1217759 | 0.0615222 | 9460  |
| 1191009 CHOCOLATE, SLAB, MILK, PLAIN                          | 0.2898627 | 0.1629823 | 0.1268803 | 7645  |
| 1191011 CHOCOLATE, SLAB, MILK, WHOLE NUT                      | 0.2946944 | 0.1640027 | 0.1306917 | 7445  |
| 1191012 CHOCOLATE BAR, WITH FILLING                           | 0.2080451 | 0.1312953 | 0.0767498 | 6215  |
| 1191013 TOFFEES, EACH, WRAPPED (E.G. "WILSON")                | 0.0753729 | 0.0578383 | 0.0175347 | 3821  |
| 1191014 GLUCOSE SWEETS, WRAPPED (E.G. "SUPER C")              | 0.1271743 | 0.0848473 | 0.042327  | 5174  |
| 1191015 HEALTH BARS                                           | 0.1297826 | 0.0893478 | 0.0404348 | 4600  |
| 1191016 OTHER RELATED SUGAR PRODUCTS (SPECIFY)                | 0.1137917 | 0.0743868 | 0.0394049 | 2487  |
| 1192 OTHER FOOD PRODUCTS                                      |           |           |           |       |
| 1192001 OVEN-READY DISHES MAINLY MEAT, FISH, POULTRY(SPECIFY) | 0.1581709 | 0.1026987 | 0.0554723 | 1334  |
| 1192002 OVEN-READY DISHES MAINLY VEGETABLES(SPECIFY)          | 0.127321  | 0.0857648 | 0.0415561 | 1131  |
| 1192003 CUSTARD POWDER                                        | 0.1702283 | 0.1163186 | 0.0539097 | 8236  |
| 1192004 INSTANT PUDDINGS                                      | 0.1652902 | 0.1168684 | 0.0484218 | 8839  |
| 1192005 YEAST, INSTANT                                        | 0.1350884 | 0.0940232 | 0.0410653 | 9838  |
| 1192006 BAKING POWDER                                         | 0.1309025 | 0.0885517 | 0.0423508 | 8831  |
| 1192007 BICARBONATE OF SODA                                   | 0.0910382 | 0.0703771 | 0.0206612 | 7744  |
| 1192008 SALT, FINE, HOUSEHOLD, BAG                            | 0.1281287 | 0.0966428 | 0.0314859 | 10068 |
| 1192009 PEPPER, WHITE                                         | 0.1306701 | 0.0929124 | 0.0377577 | 7760  |
| 1192011 PEPPER, CORNS, BLACK                                  | 0.1266759 | 0.090769  | 0.0359069 | 6489  |
| 1192012 VINEGAR                                               | 0.1281818 | 0.0914141 | 0.0367677 | 9900  |
| 1192013 CHICKEN SPICES                                        | 0.1405811 | 0.1034442 | 0.0371368 | 8536  |
| 1192014 STEAK AND CHOPS SPICES                                | 0.1442549 | 0.1086982 | 0.0355566 | 8381  |
| 1192015 CLOVES                                                | 0.1096391 | 0.0925841 | 0.017055  | 6567  |
| 1192016 CINNAMON                                              | 0.1253862 | 0.1010556 | 0.0243306 | 7768  |
| 1192017 CURRY POWDER                                          | 0.1655798 | 0.1144026 | 0.0511772 | 9047  |
| 1192018 CHUTNEY                                               | 0.2535359 | 0.1523311 | 0.1012048 | 9545  |
| 1192019 PICKLES                                               | 0.1436415 | 0.101842  | 0.0417995 | 5646  |
| 1192021 MUSTARD                                               | 0.1741631 | 0.111488  | 0.0626751 | 6781  |
| 1192022 TOMATO SAUCE                                          | 0.2665327 | 0.1540704 | 0.1124623 | 9950  |
| 1192023 MAYONNAISE                                            | 0.2614561 | 0.1442694 | 0.1171867 | 9711  |
| 1192024 SALAD DRESSING                                        | 0.2292345 | 0.1369747 | 0.0922598 | 7067  |
| 1192025 CANNED SOUP                                           | 0.1698777 | 0.1146789 | 0.0551988 | 6540  |
| 1192026 SOUP POWDER not instant                               | 0.1991677 | 0.1137931 | 0.0853746 | 8410  |
| 1192027 MEAT EXTRACT CUBES: BEEF                              | 0.1787114 | 0.1196717 | 0.0590397 | 8164  |
| 1192028 MEAT EXTRACT CUBES: CHICKEN                           | 0.1770335 | 0.1201209 | 0.0569126 | 7942  |
| 1192029 POTATO CRISPS                                         | 0.1952923 | 0.1124    | 0.0828922 | 8879  |
| 1192031 CHEESE CURLS                                          | 0.1931387 | 0.1128715 | 0.0802671 | 7637  |
| 1192032 CORN CHIPS                                            | 0.1486903 | 0.0858243 | 0.0628659 | 6490  |
| 1192033 POP CORN, ALREADY PREPARED                            | 0.093708  | 0.0696458 | 0.0240622 | 6691  |
| 1192034 POP CORN, KERNELS                                     | 0.1334709 | 0.0887161 | 0.0447548 | 6301  |
| 1192035 OTHER FOOD PRODUCTS (SPECIFY)                         | 0.1440907 | 0.0825688 | 0.0615219 | 1853  |
| 12 NON-ALCOHOLIC BEVERAGES                                    |           |           |           |       |
| 120 AERATED COOL DRINKS (SOFT DRINKS)                         |           |           |           |       |
| 1201 ORANGE                                                   |           |           |           |       |
| 1201001 340 ML CAN                                            | 0.0966762 | 0.0818525 | 0.0148237 | 10861 |
| 1201002 LITRE BOTTLE (EXCLUDING DEPOSIT)                      | 0.1321251 | 0.0960818 | 0.0360433 | 9877  |
| 1202 COCA-COLA                                                |           |           |           |       |
| 1202001 340 ML CAN                                            | 0.1002016 | 0.0824055 | 0.0177961 | 11407 |
| 1202002 LITRE BOTTLE (EXCLUDING DEPOSIT)                      | 0.1591445 | 0.1076672 | 0.0514773 | 11034 |
| 121 MINERAL WATER                                             |           |           |           |       |
| 1210001 500 ML BOTTLE                                         | 0.1119376 | 0.0770638 | 0.0348738 | 8201  |
| 1210002 LITRE BOTTLE                                          | 0.1208173 | 0.0821735 | 0.0386438 | 6754  |
| 122 FRUIT SQUASHES                                            |           |           |           |       |
| 1220001 ORANGE SQUASH                                         | 0.1820598 | 0.1094684 | 0.0725914 | 6020  |
| 1220002 OTHER FLAVOURS                                        | 0.1289564 | 0.0871767 | 0.0417797 | 5529  |
| 123 OTHER COOL DRINKS                                         |           |           |           |       |
| 1230001 FLAVOURED COOL DRINK SYRUPS (SPECIFY)                 | 0.1855386 | 0.1198385 | 0.0657001 | 5449  |
| 13 ALCOHOLIC BEVERAGES                                        |           |           |           |       |
| 130 SPIRITS                                                   |           |           |           |       |
| 1301 SOUTH AFRICAN                                            |           |           |           |       |
| 1301001 BRANDY                                                | 0.144554  | 0.112101  | 0.0324531 | 9429  |
| 1301002 WHISKY                                                | 0.1379106 | 0.1019803 | 0.0359303 | 8433  |
| 1301003 GIN                                                   | 0.1352177 | 0.1067336 | 0.0284841 | 9163  |
| 1301004 VODKA                                                 | 0.1369196 | 0.105098  | 0.0318216 | 9239  |
| 1301005 CANE SPIRITS                                          | 0.130897  | 0.1024363 | 0.0284607 | 9030  |
| 1301006 LIQUEUR                                               | 0.1349768 | 0.104245  | 0.0307318 | 9046  |
| 1302 IMPORTED                                                 |           |           |           |       |
| 1302001 WHISKY                                                | 0.1604898 | 0.1110747 | 0.0494151 | 9147  |
| 131 BEER                                                      |           |           |           |       |

|                                        |           |           |           |       |
|----------------------------------------|-----------|-----------|-----------|-------|
| 1310001 LAGER (SOUTH AFRICAN)          | 0.1226415 | 0.1054454 | 0.0171961 | 8374  |
| 1310002 DARK (ENGLISH) BEER            | 0.095422  | 0.0777716 | 0.0176503 | 3626  |
| 1310003 APPLE CIDER                    | 0.1147074 | 0.092957  | 0.0217504 | 7724  |
| 1310004 SORGHUM BEER - PREPACKED       | 0.0912596 | 0.0809769 | 0.0102828 | 1556  |
| 1310005 SORGHUM BEER - OWN CONTAINER   | 0.099631  | 0.0922509 | 0.0073801 | 271   |
| 132 WINE, SOUTH AFRICAN                |           |           |           |       |
| 1320001 NATURAL, DRY RED WINE          | 0.1177035 | 0.0825842 | 0.0351193 | 8343  |
| 1320002 SEMI-SWEET WHITE WINE          | 0.1093323 | 0.0837677 | 0.0255647 | 8058  |
| 1320003 SPARKLING WINE                 | 0.1215338 | 0.092396  | 0.0291378 | 9232  |
| 1320004 COOKING WINE                   | 0.1373039 | 0.0987874 | 0.0385164 | 2804  |
| 1320005 SHERRY, MEDIUM CREAM           | 0.0971233 | 0.0798918 | 0.0172316 | 7022  |
| 1320006 SHERRY, OTHER                  | 0.1151772 | 0.0934955 | 0.0216818 | 8717  |
| 1320007 PORT                           | 0.0944214 | 0.0723438 | 0.0220777 | 5073  |
| 133 OTHER ALCOHOLIC BEVERAGES          |           |           |           |       |
| 1330001 ALCOHOLIC FRUIT BEVERAGES      | 0.10703   | 0.0774092 | 0.0296209 | 2532  |
| 14 CIGARETTES, CIGARS AND TOBACCO      |           |           |           |       |
| 140 CIGARETTES                         |           |           |           |       |
| 1401 CARTON OF 200 CIGARETTES          |           |           |           |       |
| 1401001 VIRGINIA TYPE (SPECIFY)        | 0.201503  | 0.1774296 | 0.0240734 | 7851  |
| 1401002 AMERICAN TYPE (SPECIFY)        | 0.1960045 | 0.173093  | 0.0229114 | 7158  |
| 1402 PACKET OF 30 CIGARETTES           |           |           |           |       |
| 1402001 VIRGINIA TYPE (SPECIFY)        | 0.1799232 | 0.1673066 | 0.0126166 | 7292  |
| 1402002 AMERICAN TYPE (SPECIFY)        | 0.1957399 | 0.1800448 | 0.0156951 | 4460  |
| 1403 PACKET OF 20 CIGARETTES           |           |           |           |       |
| 1403001 VIRGINIA TYPE (SPECIFY)        | 0.1848554 | 0.1691602 | 0.0156953 | 10895 |
| 1403002 AMERICAN TYPE (SPECIFY)        | 0.1949346 | 0.1783268 | 0.0166078 | 9634  |
| 1410001 CIGARS, EACH                   | 0.1068912 | 0.0783085 | 0.0285826 | 2554  |
| 1420001 PIPE TOBACCO                   | 0.1110447 | 0.0898221 | 0.0212225 | 6691  |
| 2 CLOTHING AND FOOTWEAR                |           |           |           |       |
| 21 CLOTHING                            |           |           |           |       |
| 210 WOMEN'S CLOTHING, MEDIUM SIZE      |           |           |           |       |
| 2101 DRESS FOR DAY WEAR, ONE PIECE     |           |           |           |       |
| 2101001 PURE WOOL OR WOOL MIXTURE      | 0.2363636 | 0.1454545 | 0.0909091 | 275   |
| 2101002                                | 0         | 0         | 0         | 6     |
| 2101003 SYNTHETIC                      | 0.1124339 | 0.0634921 | 0.0489418 | 756   |
| 2101004 COTTON MIXTURES                | 0.1209331 | 0.0399018 | 0.0810313 | 1629  |
| 2101005 SYNTHETIC                      | 0.1158576 | 0.0530744 | 0.0627832 | 1545  |
| 2102 SKIRT                             |           |           |           |       |
| 2102001 WINTER, PURE WOOL              | 0.0795262 | 0.0490694 | 0.0304569 | 591   |
| 2102002                                | 0.0408163 | 0         | 0.0408163 | 49    |
| 2102003 SUMMER, (SYNTHETIC FIBRE)      | 0.0795328 | 0.0372636 | 0.0422692 | 1798  |
| 2102004 COTTON MIXTURES                | 0.1284314 | 0.0490196 | 0.0794118 | 2040  |
| 2102005 SYNTHETIC                      | 0.0993314 | 0.0439351 | 0.0553964 | 2094  |
| 2103 BLOUSE                            |           |           |           |       |
| 2103001 WINTER WEIGHT, LONG SLEEVES    | 0.1547042 | 0.0591659 | 0.0955383 | 2062  |
| 2103002 COTTON MIXTURES                | 0.1314535 | 0.0615568 | 0.0698967 | 2518  |
| 2103003 SYNTHETIC                      | 0.0965233 | 0.0480329 | 0.0484904 | 2186  |
| 2104 LADIES' SLACK SUIT                |           |           |           |       |
| 2104001 PURE WOOL                      | 0.1187648 | 0.0486936 | 0.0700713 | 842   |
| 2104002                                | 0.1707317 | 0.0243902 | 0.1463415 | 41    |
| 2104003 SYNTHETIC                      | 0.0944947 | 0.0460148 | 0.0484799 | 1217  |
| 2104004 SLACKS SYNTHETIC               | 0.1240987 | 0.058444  | 0.0656546 | 2635  |
| 2104005 SLACKS COTTON (DENIM)          | 0.0826577 | 0.0398649 | 0.0427928 | 4440  |
| 2105 JERSEYS                           |           |           |           |       |
| 2105001 WINTER, LONG SLEEVES, CARDIGAN | 0.1198872 | 0.0416079 | 0.0782793 | 1418  |
| 2105002                                | 0.0921053 | 0.0263158 | 0.0657895 | 76    |
| 2105003 CARDIGAN (SUMMER)              | 0.0910698 | 0.0477454 | 0.0433245 | 1131  |
| 2105004 PULL-OVER LONG SLEEVE          | 0.0684932 | 0.0298147 | 0.0386785 | 1241  |
| 2105005 PULL-OVER SHORT SLEEVE         | 0.0967413 | 0.0529532 | 0.0437882 | 982   |
| 2105006                                | 0.125     | 0         | 0.125     | 8     |
| 2106 TRACK SUIT                        |           |           |           |       |
| 2106001 BOTTOM                         | 0.0866575 | 0.0288858 | 0.0577717 | 727   |
| 2106002 TOP                            | 0.1100917 | 0.0321101 | 0.0779817 | 436   |
| 2107 SLEEPWEAR                         |           |           |           |       |
| 2107001 PYJAMAS, WINTER,               | 0.129055  | 0.0592384 | 0.0698166 | 1418  |
| 2107002                                | 0.03125   | 0         | 0.03125   | 64    |
| 2107003 DRESSING GOWN WINTER           | 0.1199718 | 0.0494001 | 0.0705716 | 1417  |

|                                              |           |           |           |      |
|----------------------------------------------|-----------|-----------|-----------|------|
| 2107004 SUMMER COTTON, RAYON OR NYLON        | 0.1695226 | 0.0746634 | 0.0948592 | 1634 |
| 2107005                                      | 0.0638298 | 0.0212766 | 0.0425532 | 47   |
| 2107006 DRESSING GOWN SUMMER                 | 0.1188119 | 0.0500874 | 0.0687245 | 1717 |
| 2108000 COAT FULL LENGTH, FULLY LINED        |           |           |           |      |
| 2108001 PURE WOOL                            | 0.0433735 | 0.0168675 | 0.026506  | 415  |
| 2108002 WOOL MIXTURE                         |           |           |           |      |
| 2108003 SYNTHETIC                            | 0.0661939 | 0.0283688 | 0.0378251 | 423  |
| 2108 UNDERWEAR                               |           |           |           |      |
| 2109001 SLIP, FULL-LENGTH                    | 0.0449568 | 0.0282421 | 0.0167147 | 1735 |
| 2109002 SLIP, HALF-LENGTH                    | 0.0454697 | 0.0297559 | 0.0157138 | 2991 |
| 2109003 STEP-IN GIRDLE                       | 0.0630312 | 0.0424929 | 0.0205382 | 2824 |
| 2109004 BRASSIERS                            | 0.0975751 | 0.0557159 | 0.0418591 | 3464 |
| 2109005 PANTY                                | 0.0883041 | 0.0482456 | 0.0400585 | 3420 |
| 2109006 PANTHOSE, NYLON, SHEER, SINGLE PACK  | 0.0991272 | 0.0642145 | 0.0349127 | 1604 |
| 2109007 PANTHOSE, NYLON, SHEER, TRIPPLE PACK | 0.1260924 | 0.0724095 | 0.0536829 | 801  |
| 211 MEN'S CLOTHING                           |           |           |           |      |
| 2111 TROUSERS                                |           |           |           |      |
| 2111001 LONG, WINTER PURE WOOL               | 0.0773399 | 0.0423645 | 0.0349754 | 2030 |
| 2111002 LONG, WOOL MIXTURE                   | 0.0719318 | 0.0415276 | 0.0304042 | 2697 |
| 2111003 LONG, COTTON DENIM                   | 0.0771161 | 0.0485969 | 0.0285193 | 4383 |
| 211004                                       | 0.1529412 | 0.0470588 | 0.1058824 | 85   |
| 2111005 SHORTS, SYNTHETIC FIBRE              | 0.0780347 | 0.0380539 | 0.0399807 | 2076 |
| 2112 SHIRTS                                  |           |           |           |      |
| 2112001 LOUNGE, LONG SLEEVES                 | 0.0775901 | 0.0403925 | 0.0371976 | 4382 |
| 2112002 SPORTS, SHORT SLEEVES COTTON         | 0.0726858 | 0.0309648 | 0.041721  | 3068 |
| 2112003 SPORTS SYNTHETIC                     | 0.0787671 | 0.0359589 | 0.0428082 | 2336 |
| 2113 SUITS                                   |           |           |           |      |
| 2113001 PURE WOOL                            | 0.078905  | 0.0499195 | 0.0289855 | 1242 |
| 2113002 SUMMER                               | 0.0883106 | 0.0499147 | 0.0383959 | 2344 |
| 2114 SPORT JACKETS                           |           |           |           |      |
| 2114001 WINTER PURE WOOL                     | 0.0774908 | 0.0424354 | 0.0350554 | 1084 |
| 2114002 WINTER WOOL MIXTURE                  | 0.0752773 | 0.0427892 | 0.0324881 | 1262 |
| 2114003 SYNTHETIC                            | 0.0709516 | 0.0275459 | 0.0434057 | 1198 |
| 2115 TRACK SUITS                             |           |           |           |      |
| 2115001 BOTTOM                               | 0.0659841 | 0.0284414 | 0.0375427 | 879  |
| 2115002 TOP                                  | 0.0762987 | 0.0243506 | 0.0519481 | 616  |
| 2116 JERSEYS                                 |           |           |           |      |
| 2116001 WINTER, LONG SLEEVES, CARDIGAN       | 0.110957  | 0.0312067 | 0.0797503 | 1442 |
| 2116002                                      | 0.0352941 | 0.0117647 | 0.0235294 | 85   |
| 2117 PYJAMAS                                 |           |           |           |      |
| 2117001 WINTER PYJAMAS                       | 0.0644783 | 0.0345838 | 0.0298945 | 1706 |
| 2117002 SUMMER PYJAMAS                       | 0.0670588 | 0.0341176 | 0.0329412 | 1700 |
| 2118 UNDERWEAR AND SOCKS                     |           |           |           |      |
| 2118001 VESTS                                | 0.0703078 | 0.0473748 | 0.022933  | 3314 |
| 2118002 UNDERPANTS, SHORT                    | 0.0530635 | 0.0322757 | 0.0207877 | 3656 |
| 2118003 SOCKS, WOOL MIXTURE                  | 0.0746528 | 0.0503472 | 0.0243056 | 1728 |
| 2118004 SOCKS, NYLON                         | 0.0495868 | 0.030303  | 0.0192837 | 1815 |
| 2118005                                      |           |           |           | 0    |
| 212 GIRLS' CLOTHING (GIRL AGED 8 YEARS)      |           |           |           |      |
| 21201 DRESS                                  |           |           |           |      |
| 2120101 WINTER                               | 0         | 0         | 0         | 3    |
| 2120103 SUMMER COTTON MIXTURES               | 0.1052632 | 0.0299278 | 0.0753354 | 969  |
| 2120104 SUMMER SYNTHETIC                     | 0.0594059 | 0.0240453 | 0.0353607 | 707  |
| 2120105 WINTER SYNTHETIC                     | 0         | 0         | 0         | 18   |
| 21202 SCHOOL CLOTHING                        |           |           |           |      |
| PRIMARY SCHOOL                               |           |           |           |      |
| 2120201 SCHOOL DRESS                         | 0.0748915 | 0.04233   | 0.0325615 | 2764 |
| 2120202 CULOTTE (SKIRT DRESS)                | 0.0452418 | 0.0280811 | 0.0171607 | 641  |
| 2120203 SCHOOL BLOUSE, SHORT SLEEVES         | 0.0716685 | 0.0386338 | 0.0330347 | 1786 |
| 2120204 POLO COLLAR SHIRT                    | 0.0401891 | 0.0307329 | 0.0094563 | 1269 |
| 2120205 SCHOOL JERSEY, CARDIGAN              | 0.0532514 | 0.0363543 | 0.0168971 | 1953 |
| 2120206 RAIN JACKET (DRI MAC)                | 0.0364512 | 0.0206327 | 0.0158184 | 1454 |
| 2120207 TRACKSUIT                            | 0.0630324 | 0.0468484 | 0.016184  | 1174 |
| 2120208 SCHOOL PANTIE                        | 0.0233161 | 0.0146805 | 0.0086356 | 1158 |
| 2120209 SCHOOL SOCKS                         | 0.0381264 | 0.0239651 | 0.0141612 | 918  |
| HIGH SCHOOL                                  |           |           |           |      |
| 2120211 SCHOOL DRESS                         | 0.0599455 | 0.0408719 | 0.0190736 | 1101 |
| 2120212 SCHOOL SKIRT                         | 0.0579524 | 0.0347714 | 0.0231809 | 1553 |
| 2120213 CULOTTE (SKIRT TROUSER)              | 0.0406852 | 0.0299786 | 0.0107066 | 467  |
| 2120214 SCHOOL BLOUSE, SHORT SLEEVES         | 0.0590143 | 0.0311284 | 0.0278859 | 1542 |
| 2120215 BLAZER                               | 0.0473083 | 0.0367047 | 0.0106036 | 1226 |
| 2120216 SCHOOL JERSEY, CARDIGAN              | 0.069031  | 0.0474984 | 0.0215326 | 1579 |
| 2120217 RAIN JACKET (DRI MAC)                | 0.0437158 | 0.0264117 | 0.0173042 | 1098 |

|                                                 |           |           |           |      |
|-------------------------------------------------|-----------|-----------|-----------|------|
| 2120218 SLACKS                                  | 0.0498409 | 0.0339343 | 0.0159067 | 943  |
| 2120219 SCHOOL SOCKS                            | 0.0513158 | 0.0328947 | 0.0184211 | 1520 |
| 2120221 SCHOOL TIE                              | 0.0433071 | 0.0299213 | 0.0133858 | 1270 |
| 2120222 PT PANTS                                | 0.057971  | 0.0366581 | 0.0213129 | 1173 |
| 2120301                                         | 0.0888889 | 0         | 0.0888889 | 45   |
|                                                 | 0.1551724 | 0.0344828 | 0.1206897 | 58   |
|                                                 | 0.1142857 | 0         | 0.1142857 | 35   |
| 2120401 T-SHIRTS                                | 0.0721649 | 0.0226804 | 0.0494845 | 485  |
|                                                 | 0.1875    | 0         | 0.1875    | 16   |
|                                                 | 0.2352941 | 0         | 0.2352941 | 34   |
|                                                 | 0.1875    | 0.0625    | 0.125     | 16   |
| 21205 PANTS                                     | 0         | 0         | 0         | 33   |
|                                                 | 0.084507  | 0.0140845 | 0.0704225 | 71   |
| 2120503 SHORT, SYNTHETIC FIBRE                  | 0.0996251 | 0.0444563 | 0.0551687 | 1867 |
|                                                 | 0.25      | 0         | 0.25      | 12   |
|                                                 | 0         | 0         | 0         | 19   |
| 21206 JERSEYS                                   |           |           |           |      |
| 2120601 JERSEY, SUMMER, CARDIGAN                | 0         | 0         | 0         | 4    |
| 2120602 JERSEY, WINTER, CARDIGAN, LONG SLEEVES  | 0.1304348 | 0         | 0.1304348 | 23   |
| 2120603 JERSEY, WINTER, PULL-OVER, LONG SLEEVES | 0.1129032 | 0.0322581 | 0.0806452 | 62   |
| 2120701 WINDBREAKER, LONG SLEEVES               | 0.0812558 | 0.0277008 | 0.0535549 | 1083 |
| 21208 TRACK SUIT                                |           |           |           |      |
| 2120801 BOTTOM                                  | 0.0672269 | 0.0294118 | 0.0378151 | 476  |
| 2120802 TOP                                     | 0.0594901 | 0.0141643 | 0.0453258 | 353  |
| 21209 PYJAMAS                                   |           |           |           |      |
| 2120901 SLEEPSHIRTS WINTER                      | 0.0545455 | 0.0363636 | 0.0181818 | 55   |
| 2120902 SLEEPSHIRTS SUMMER                      | 0.0758808 | 0.0379404 | 0.0379404 | 369  |
| 2120903                                         | 0.0363636 | 0         | 0.0363636 | 55   |
|                                                 | 0.24      | 0         | 0.24      | 25   |
|                                                 | 0.1333333 | 0.0666667 | 0.0666667 | 15   |
| 21210 UNDERWEAR                                 |           |           |           |      |
| 2121001 VEST, SHORT SLEEVES                     | 0.0927835 | 0.0475372 | 0.0452463 | 1746 |
| 2121002 PANTY                                   | 0.0634058 | 0.0307971 | 0.0326087 | 552  |
| 2121003 TIGHTS                                  | 0.0583596 | 0.0362776 | 0.022082  | 634  |
| 2121004 ANKLE SOCKS                             | 0.0557078 | 0.0356164 | 0.0200913 | 1095 |
| 213 BOYS' CLOTHING                              |           |           |           |      |
| 21301 TROUSERS                                  | 0.0852341 | 0.0508203 | 0.0344138 | 2499 |
| 2130101 LONG,(DENIM)                            | 0.1045328 | 0.0471785 | 0.0573543 | 1081 |
| 2130102 SHORTS, SYNTHETIC FIBRE                 | 0.16      | 0         | 0.16      | 25   |
| 21302 SHIRTS                                    |           |           |           |      |
| 2130201 LONG SLEEVES,                           | 0.1180604 | 0.0365425 | 0.0815179 | 1423 |
| 2130202 T-SHIRTS, SHORT SLEEVES                 | 0.1003322 | 0.0438538 | 0.0564784 | 1505 |
| 2130203                                         | 0.0985915 | 0.0140845 | 0.084507  | 71   |
| 21303 SUITS                                     |           |           |           |      |
| 2130301 WOOL MIXTURE                            | 0.0967742 | 0.0752688 | 0.0215054 | 93   |
| 2130302 SYNTHETIC                               | 0.059322  | 0.0423729 | 0.0169492 | 236  |
| 2130401                                         | 0.0909091 | 0         | 0.0909091 | 55   |
| 2130402                                         | 0.0645161 | 0.0322581 | 0.0322581 | 31   |
| 2130501                                         | 0.0652174 | 0         | 0.0652174 | 46   |
| 21306 TRACK SUITS                               |           |           |           |      |
| 2130601 BOTTOM                                  | 0.094518  | 0.0396975 | 0.0548204 | 529  |
| 2130602 TOP                                     | 0.074928  | 0.0201729 | 0.054755  | 347  |
| 21307 PYJAMAS                                   |           |           |           |      |
| 2130701 WINTER PYJAMAS, LONG PANTS AND SHIRT    | 0.0451866 | 0.0166994 | 0.0284872 | 1018 |
| 2130702 SUMMER PYJAMAS, SHORT PANTS AND SHIRT,  | 0.0983412 | 0.035545  | 0.0627962 | 844  |
| 21308 UNDERWEAR                                 |           |           |           |      |
| 2130801 VESTS                                   | 0.0823188 | 0.0469565 | 0.0353623 | 1725 |
| 2130802 UNDERPANTS                              | 0.0761575 | 0.0402423 | 0.0359152 | 2311 |
| 2130803 SOCKS, NYLON                            | 0.0679178 | 0.0437891 | 0.0241287 | 1119 |
| 2130804                                         |           |           |           | 0    |
| 21309 SCHOOLWEAR                                |           |           |           |      |
| 2130901 PRIMARY SCHOOL                          |           |           |           |      |
| 2130901 GREY SHIRT                              | 0.0608604 | 0.0335782 | 0.0272823 | 953  |
| 2130902 WHITE SHIRT                             | 0.0631229 | 0.0348837 | 0.0282392 | 1806 |
| 2130903 POLO COLLAR SHIRT                       | 0.043346  | 0.0281369 | 0.0152091 | 1315 |
| 2130904 GREY TROUSERS                           | 0.0511182 | 0.027689  | 0.0234292 | 1878 |
| 2130905 OTHER TROUSERS                          | 0.0471698 | 0.0216981 | 0.0254717 | 1060 |
| 2130906 JERSEY                                  | 0.0488323 | 0.0313163 | 0.0175159 | 1884 |
| 2130907 RAIN COAT (DRI MAC)                     | 0.0416667 | 0.0228175 | 0.0188492 | 2016 |
| 2130908 TRACKSUIT                               | 0.0506003 | 0.0385935 | 0.0120069 | 1166 |
| 2130909 SCHOOL SOCKS                            | 0.0488889 | 0.0377778 | 0.0111111 | 900  |
| HIGH SCHOOL                                     |           |           |           |      |
| 2130911 SHORTS                                  | 0.0464135 | 0.0274262 | 0.0189873 | 1422 |
| 2130912 LONG TROUSERS                           | 0.0535918 | 0.0353478 | 0.018244  | 1754 |
| 2130913 SHIRT - SHORT SLEEVE                    | 0.0606742 | 0.0370787 | 0.0235955 | 1780 |

|                                                                 |           |           |           |      |
|-----------------------------------------------------------------|-----------|-----------|-----------|------|
| 2130914 SHIRT - LONG SLEEVE                                     | 0.0656627 | 0.0361446 | 0.0295181 | 1660 |
| 2130915 POLO COLLAR SHIRT                                       | 0.0473083 | 0.0318108 | 0.0154976 | 1226 |
| 2130916 JERSEY                                                  | 0.0552307 | 0.0422352 | 0.0129955 | 1539 |
| 2130917 RAIN COAT (DRI MAC)                                     | 0.0457686 | 0.0276339 | 0.0181347 | 1158 |
| 2130918 BLAZER                                                  | 0.0542169 | 0.0361446 | 0.0180723 | 1162 |
| 2130919 PT SHORTS                                               | 0.0500385 | 0.0277136 | 0.0223249 | 1299 |
| 2130921 SCHOOL SOCKS                                            | 0.0538147 | 0.0313351 | 0.0224796 | 1468 |
| 2130922 SCHOOL TIE                                              | 0.049728  | 0.035742  | 0.013986  | 1287 |
| 214 INFANTS' CLOTHING                                           |           |           |           |      |
| 2141 DIAPERS (NON-DISPOSABLE)                                   |           |           |           |      |
| 2141001 TERRY, 70 CM X 70 CM                                    | 0.0639013 | 0.0403587 | 0.0235426 | 2676 |
| 2142 BABY-GROWS                                                 |           |           |           |      |
| 2142001 SHORT SLEEVES                                           | 0.0791789 | 0.0351906 | 0.0439883 | 341  |
| 2142002 LONG SLEEVES                                            | 0.0865385 | 0.0320513 | 0.0544872 | 624  |
| 2143 OTHER INFANTS' CLOTHING                                    |           |           |           |      |
| 2143001 WATER-PROOF                                             | 0.0318021 | 0.0176678 | 0.0141343 | 849  |
| 2143002 FEEDER BIB                                              | 0.0501319 | 0.0316623 | 0.0184697 | 379  |
| 2143003 VEST                                                    | 0.0859799 | 0.0503486 | 0.0356313 | 1291 |
| 2143004 BOOTIES                                                 | 0.0478469 | 0.0271132 | 0.0207337 | 627  |
| 215 MATERIAL, KNITTING WOOL, COST OF HIRE AND MAKING OF CLOTHES |           |           |           |      |
| 2151 MATERIAL FOR CLOTHING                                      |           |           |           |      |
| 2151001 CRIMPED MATERIAL                                        | 0.0811856 | 0.0412371 | 0.0399485 | 776  |
| 2151002 SATIN                                                   | 0.0700809 | 0.0368374 | 0.0332435 | 1113 |
| 2151003 COTTON                                                  | 0.0572034 | 0.0275424 | 0.029661  | 472  |
| 2151004 COTTON - 100%                                           | 0.0668842 | 0.045677  | 0.0212072 | 613  |
| 2151005 COTTON MIXTURE                                          | 0.0693694 | 0.0387387 | 0.0306306 | 1110 |
| 2151006 FLANNELETTE                                             | 0.059633  | 0.029052  | 0.030581  | 654  |
| 2151007 JERSEY KNIT                                             | 0.0662393 | 0.0277778 | 0.0384615 | 468  |
| 2151008 POLYSTER CREPE                                          | 0.0681818 | 0.034632  | 0.0335498 | 924  |
| 2151009 WOOLLEN MATERIALS, WOOL                                 | 0.0563847 | 0.0215589 | 0.0348259 | 603  |
| 2151011 COTTON CHILDREN                                         | 0.0510397 | 0.0236295 | 0.0274102 | 1058 |
| 2152 KNITTING WOOL AND YARNS                                    |           |           |           |      |
| 2152001 BABY WOOL, SYNTHETIC (SPECIFY)                          | 0.0909091 | 0.0669856 | 0.0239234 | 209  |
| 2152002 DOUBLE KNITTING, SYNTHETIC (SPECIFY)                    | 0.0622837 | 0.0449827 | 0.017301  | 289  |
| 2152003 CROCHET COTTON                                          | 0.0367347 | 0.0163265 | 0.0204082 | 245  |
| 2153 YARN                                                       |           |           |           |      |
| 2153001 SEWING COTTON, BLACK OR WHITE                           | 0.0344828 | 0.023988  | 0.0104948 | 667  |
| 2153002 SHEEN                                                   | 0.0682353 | 0.04      | 0.0282353 | 425  |
| 2154 PATTERNS                                                   |           |           |           |      |
| 2154001 DRESS, WOMEN, ONE PIECE, SUMMER, NO. 8 - 18             | 0.0658199 | 0.0496536 | 0.0161663 | 866  |
| 2154002 SKIRT, WOMEN, NO. 8 - 18                                | 0.0658602 | 0.0497312 | 0.016129  | 744  |
| 2154003 BLOUSE, WOMEN, SHORT SLEEVES, NO. 8 - 18                | 0.0626058 | 0.0473773 | 0.0152284 | 591  |
| 2154004 BLOUSE, WOMEN, LONG SLEEVES, NO. 8 - 18                 | 0.0716667 | 0.05      | 0.0216667 | 600  |
| 2154005 DRESS, GIRLS, SHORT SLEEVES, SUMMER, NO. 6 - 16         | 0.0686901 | 0.0511182 | 0.0175719 | 626  |
| 2154006 JACKET, WOMEN, LONG SLEEVES, NO. 8 - 18                 | 0.0617284 | 0.0462963 | 0.0154321 | 648  |
| 2155 LACE                                                       |           |           |           |      |
| 2155001 COTTON, 20 - 30 MM WIDE                                 | 0.0297324 | 0.0198216 | 0.0099108 | 1009 |
| 2155002 COTTON, 40 - 50 MM WIDE                                 | 0.0308325 | 0.0215827 | 0.0092497 | 973  |
| 2155003 SYNTHETIC, 20 - 30 MM WIDE                              | 0.0346232 | 0.0264766 | 0.0081466 | 982  |
| 2155004 SYNTHETIC, 40 - 50 MM WIDE                              | 0.0332295 | 0.0218069 | 0.0114226 | 963  |
| 2156001 WAGES FOR MAKING OF CLOTHING                            | 0.92      | 0.74      | 0.18      | 1100 |
| 2157001 REPAIRS TO CLOTHING                                     | 0.92      | 0.74      | 0.18      | 1100 |
| 2158001 COST FOR THE HIRE OF CLOTHING                           | 0.92      | 0.74      | 0.18      | 1100 |
| 2159 ACCESSORIES                                                |           |           |           |      |
| 2159001 SCISSORS                                                | 0.0505376 | 0.0290323 | 0.0215054 | 930  |
| 2159002 NEEDLES                                                 | 0.05613   | 0.0369276 | 0.0192024 | 677  |
| 2159003 PINS                                                    | 0.0590717 | 0.0323488 | 0.0267229 | 711  |
| 22 FOOTWEAR                                                     |           |           |           |      |
| 220 WOMEN'S FOOTWEAR                                            |           |           |           |      |
| 2201 BOOTS AND HALF-BOOTS                                       |           |           |           |      |
| 2201001 GENUINE LEATHER BOOTS                                   | 0.0706861 | 0.0301455 | 0.0405405 | 962  |
| 2201002 ARTIFICIAL LEATHER BOOTS                                | 0.084885  | 0.024644  | 0.060241  | 1826 |
| 2202 SHOES AND SANDALS                                          |           |           |           |      |
| 2202001 PLAIN COURT, 40 - 60 MM HIGH, GENUINE LEATHER           | 0.071223  | 0.0309353 | 0.0402878 | 1390 |
| 2202002 PLAIN COURT, 40 - 60 MM HIGH, ARTIFICIAL LEATHER        | 0.0741252 | 0.0313076 | 0.0428177 | 2172 |
| 2202003 FANCY BARS, 40-60 MM GENUINE LEATHER                    | 0.1259151 | 0.0585652 | 0.0673499 | 683  |
| 2202004 FANCY BARS, 40-60 MM ARTIFICIAL LEATHER                 | 0.0808941 | 0.0250133 | 0.0558808 | 1879 |

|         |                                                |           |           |           |      |
|---------|------------------------------------------------|-----------|-----------|-----------|------|
| 2202005 | FLAT OR WALKING SHOES, GENUINE LEATHER         | 0.1041545 | 0.0485664 | 0.0555881 | 1709 |
| 2202006 | FLAT OR WALKING SHOES, ARTIFICIAL LEATHER      | 0.073882  | 0.0265716 | 0.0473104 | 3086 |
| 2202007 | SANDALS, GENUINE LEATHER                       | 0.057971  | 0.0357488 | 0.0222222 | 1035 |
| 2202008 | SANDALS, ARTIFICIAL LEATHER                    | 0.0632287 | 0.0255605 | 0.0376682 | 2230 |
| 2203001 | TACKIES                                        | 0.0714533 | 0.0322581 | 0.0391953 | 2883 |
| 2204001 | RUNNING SHOES                                  | 0.0759615 | 0.0331731 | 0.0427885 | 2080 |
| 2205001 | SLIPPERS                                       | 0.0849273 | 0.0390207 | 0.0459067 | 2614 |
| 221     | MEN'S FOOTWEAR                                 |           |           |           |      |
| 2211    | BOOTS AND HALF-BOOTS                           |           |           |           |      |
| 2211001 | GENUINE LEATHER BOOTS                          | 0.0694957 | 0.0319803 | 0.0375154 | 1626 |
| 2211002 | ARTIFICIAL LEATHER BOOTS                       | 0.0617284 | 0.026455  | 0.0352734 | 567  |
| 2212    |                                                |           |           |           |      |
| 2212001 | WELTED, LEATHER SOLES                          | 0.0732436 | 0.0426009 | 0.0306428 | 1338 |
| 2212002 | WELTED, RUBBER SOLES                           | 0.0808511 | 0.0425532 | 0.0382979 | 1880 |
| 2212003 | STUCK-ON SOLES, LEATHER                        | 0.0946633 | 0.0552732 | 0.0393901 | 1574 |
| 2212004 | STUCK-ON SOLES, RUBBER                         | 0.0849772 | 0.0440061 | 0.0409712 | 1977 |
| 2213    | SHOES OTHER                                    |           |           |           |      |
| 2213001 | WELTED, RUBBER SOLES                           | 0.0694215 | 0.0305785 | 0.038843  | 1210 |
| 2213002 | STUCK-ON SOLES RUBBER                          | 0.0629454 | 0.0243468 | 0.0385986 | 1684 |
| 2214001 | TACKIES                                        | 0.0727723 | 0.0326733 | 0.040099  | 2020 |
| 2215001 | RUNNING SHOES                                  | 0.0708004 | 0.0277045 | 0.0430959 | 2274 |
| 2216001 | GHOLF SHOES                                    | 0.0566038 | 0.0377358 | 0.0188679 | 106  |
| 2217001 | SLIPPERS, LEATHER UPPER, SOFT SOLES            | 0.047234  | 0.0302128 | 0.0170213 | 2350 |
| 2218001 | SLIP-ON'S RUBBER                               | 0.0496795 | 0.0272436 | 0.0224359 | 624  |
| 222     | GIRLS' FOOTWEAR (GIRL OF 8 YEARS)              |           |           |           |      |
| 2221    | BOOTS AND HALF-BOOTS                           |           |           |           |      |
| 2221001 | GENUINE LEATHER BOOTS                          | 0.0484848 | 0.0181818 | 0.030303  | 165  |
| 2221002 | ARTIFICIAL LEATHER BOOTS                       | 0.0784133 | 0.0221402 | 0.0562731 | 1084 |
| 2222    | SHOES AND SANDALS                              |           |           |           |      |
| 2222001 | SANDALS, FLAT, GENUINE LEATHER                 | 0.0258993 | 0.0172662 | 0.0086331 | 695  |
| 2222002 | SANDALS, FLAT, ARTIFICIAL LEATHER              | 0.0661376 | 0.0285714 | 0.0375661 | 1890 |
| 2222003 | FANCY SHOES, FLAT, GENUINE LEATHER             | 0.0503597 | 0.0251799 | 0.0251799 | 556  |
| 2222004 | FANCY SHOES, FLAT, OTHER (NOT GENUINE LEATHER) | 0.0795848 | 0.0297578 | 0.049827  | 1445 |
| 2222005 | SCHOOLGIRLS' SHOES, SIZE 2-8                   | 0.0773282 | 0.0465632 | 0.030765  | 3608 |
| 2223001 | TACKIES                                        | 0.0663573 | 0.0315545 | 0.0348028 | 2155 |
| 2224001 | SLIPPERS                                       | 0.0476545 | 0.0178704 | 0.0297841 | 1343 |
| 2225001 | SLIP-ON'S, RUBBER                              | 0.0610169 | 0.0146893 | 0.0463277 | 885  |
| 223     | BOYS' FOOTWEAR (BOY OF 8 YEARS)                |           |           |           |      |
| 2231    | BOOTS AND HALF-BOOTS                           |           |           |           |      |
| 2231001 | GENUINE LEATHER BOOTS                          | 0.044     | 0.022     | 0.022     | 500  |
| 2231002 | ARTIFICIAL LEATHER BOOTS                       | 0.0747664 | 0.021028  | 0.0537383 | 428  |
| 2232    | SHOES AND SANDALS                              |           |           |           |      |
| 2232001 | SANDALS, LEATHER                               | 0.0605643 | 0.0220234 | 0.0385409 | 1453 |
| 2232002 | SANDALS, OTHER (NOT GENUINE LEATHER)           | 0.066628  | 0.0243337 | 0.0422943 | 1726 |
| 2232003 | SCHOOLBOYS' SHOES, SIZE 2-8                    | 0.0809194 | 0.050063  | 0.0308564 | 3176 |
| 2233001 | TACKIES                                        | 0.0730731 | 0.032032  | 0.041041  | 1998 |
| 2234001 | SLIPPERS                                       | 0.0562806 | 0.0236542 | 0.0326264 | 1226 |
| 2235001 | SLIP-ON'S, RUBBER                              | 0.0551876 | 0.0264901 | 0.0286976 | 453  |
| 224     | INFANT SHOES                                   |           |           |           |      |
| 2240001 | SHOES                                          | 0.0509209 | 0.0200433 | 0.0308776 | 1846 |
| 2240002 | SANDALS                                        | 0.0492826 | 0.0237056 | 0.025577  | 1603 |
| 2240003 | SLIPPERS                                       | 0.0613393 | 0.0253236 | 0.0360158 | 1777 |
| 225     | FOOTWEAR REPAIRS                               |           |           |           |      |
| 2251    | WOMEN'S FOOTWEAR                               |           |           |           |      |
| 2251001 | WOMEN'S STICK-ON SOLES (NYLON)                 | 0.0716981 | 0.0679245 | 0.0037736 | 265  |
| 2251002 | WOMEN'S HEELING (RUBBER TWIN TOPS)             | 0.05      | 0.0470588 | 0.0029412 | 340  |
| 2252    | MEN'S FOOTWEAR                                 |           |           |           |      |
| 2252001 | MEN'S STICK-ON SOLES (NYLON)                   | 0.0714286 | 0.0616883 | 0.0097403 | 308  |
| 2252002 | MEN'S HEELING (RUBBER TWIN TOPS)               | 0.056338  | 0.056338  | 0         | 355  |



|                                                                                                                       |           |           |           |      |
|-----------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|------|
| 2253 GIRLS' FOOTWEAR                                                                                                  |           |           |           |      |
| 2253001 STICK-ON SOLES                                                                                                | 0.0478469 | 0.0478469 | 0         | 209  |
| 2254 BOYS' FOOTWEAR                                                                                                   |           |           |           |      |
| 2254001 STICK-ON SOLES                                                                                                | 0.0574163 | 0.0478469 | 0.0095694 | 209  |
| 31 HOUSING                                                                                                            |           |           |           |      |
| 310 RENT                                                                                                              |           |           |           |      |
| 3100001 RENT PAID FOR A HOUSE                                                                                         |           |           |           |      |
| 3100002 RENT PAID FOR A FLAT                                                                                          |           |           |           |      |
| 3100003 RENT PAID FOR A TOWNHOUSE                                                                                     |           |           |           |      |
| 311 HOME-OWNER'S COSTS                                                                                                |           |           |           |      |
| 3111 INTEREST                                                                                                         |           |           |           |      |
| 3111001 INTEREST RATES ON MORTGAGE BONDS                                                                              |           |           |           |      |
| 3112001 ASSESSMENT RATES                                                                                              |           |           |           |      |
| 3113001 SANITATION FEES                                                                                               |           |           |           |      |
| 3114001 REFUSE REMOVAL                                                                                                |           |           |           |      |
| 3115 INSURANCE                                                                                                        |           |           |           |      |
| 3115001 INSURANCE OF BUILDINGS                                                                                        |           |           |           |      |
| 3115002 INSURANCE COVERING MORTGAGE DEBT                                                                              |           |           |           |      |
| 3116001 REPAIRS, MAINTENANCE AND ADDITIONS                                                                            |           |           |           |      |
| 3117001 COST OF OWNERSHIP                                                                                             |           |           |           |      |
| 3118001 LEVY - TOWN HOUSES                                                                                            |           |           |           |      |
| 312 OTHER HOUSING                                                                                                     |           |           |           |      |
| 3121001 WATER                                                                                                         |           |           |           |      |
| 3122 BOARDING FEES                                                                                                    |           |           |           |      |
| 3122101 HOSTELS (SCHOOLS, TEACHERS' TRAINING AND<br>TECHNICAL COLLEGES, TECHNICONs, UNIVERSITIES, ETC.)               |           |           |           |      |
| 31222 HOLIDAYS                                                                                                        |           |           |           |      |
| 3122201 HOTEL/MOTEL AND/OR BOARDING FEES                                                                              |           |           |           |      |
| 3122202 HOLIDAY FLAT OR HOUSE, CARAVAN (RENT)                                                                         |           |           |           |      |
| 3122203 EXPENSES INCURRED AS OWNER OF A HOLIDAY HOME                                                                  |           |           |           |      |
| 32 FUEL AND POWER                                                                                                     |           |           |           |      |
| 3200001 ELECTRICITY                                                                                                   |           |           |           |      |
| 321 GAS                                                                                                               |           |           |           |      |
| 3210001 GAS SUPPLIED BY PUBLIC NETWORKS                                                                               |           |           |           |      |
| 3210002 GAS IN CYLINDERS                                                                                              |           |           |           |      |
| 322 PRODUCTS OF PETROLEUM                                                                                             |           |           |           |      |
| 3220001 PARAFFIN                                                                                                      | 0.2244824 | 0.1512895 | 0.0731929 | 5506 |
| 3230001 FIREWOOD, PER BAG                                                                                             | 0.0986111 | 0.0819444 | 0.0166667 | 720  |
| 3240001 CHARCOAL                                                                                                      | 0.155303  | 0.0909091 | 0.0643939 | 264  |
| 3250001 COAL, FOR DOMESTIC USE                                                                                        | 0.1155378 | 0.1065737 | 0.0089641 | 1004 |
| 3260001 METHYLATED SPIRITS                                                                                            | 0.1018716 | 0.0758699 | 0.0260018 | 7961 |
| 327 OTHER                                                                                                             |           |           |           |      |
| 3270001 RE-CHARGING OF WET-CELLS                                                                                      |           |           |           |      |
| 3270002 DRY-CELLS                                                                                                     |           |           |           |      |
| 3270003 DUNG                                                                                                          |           |           |           |      |
| 3270004 CROP WASTE                                                                                                    |           |           |           |      |
| 3270005 OTHER                                                                                                         |           |           |           |      |
| 41 FURNITURE AND EQUIPMENT                                                                                            |           |           |           |      |
| 410 FURNITURE                                                                                                         |           |           |           |      |
| 4101 BEDROOM                                                                                                          |           |           |           |      |
| 41011 BEDROOM SUITE                                                                                                   |           |           |           |      |
| 4101101 3-PIECE, SOLID OR UPHOLSTERED HEADBOARD WITH<br>PEDESTALS, 137 CM, DRESSING TABLE AND STOOL<br>(SPECIFY WOOD) | 0.1381285 | 0.0769368 | 0.0611916 | 5589 |
| 4101102 3-PIECE, VENEERED OR DUOED, HEADBOARD WITH<br>PEDESTALS, 137 CM, DRESSING TABLE AND STOOL                     | 0.1443341 | 0.0802757 | 0.0640584 | 4933 |
| 41012 OTHER BEDROOM FURNITURE                                                                                         |           |           |           |      |

|         |                                                                                                                    |           |           |           |      |
|---------|--------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|------|
| 4101201 | WARDROBE OR MULTI-ROBE, SOLID WOOD OR VENEERED WITH DRAWERS                                                        | 0.1435022 | 0.0895171 | 0.0539851 | 5094 |
| 4101202 | DRESSING TABLE, 1,4 M (SPECIFY WOOD)                                                                               | 0.0708861 | 0.0565401 | 0.014346  | 1185 |
| 4101203 | BABY'S COT, DROPSIDE, WOODEN (EXCLUDING MATTRESS)                                                                  | 0.0462633 | 0.0391459 | 0.0071174 | 281  |
| 4102    | DINING-ROOM                                                                                                        |           |           |           |      |
| 4102001 | DINING-ROOM SUITE, 8 PIECE (TABLE, SIDEBOARD AND 6 CHAIRS)                                                         | 0.1133054 | 0.0644325 | 0.0488729 | 5013 |
| 4103    | LOUNGE                                                                                                             |           |           |           |      |
| 4103001 | LOUNGE SUITE, 3 OR 4 PIECE, FULLY UPHOLSTERED OR SHOW-WOOD FRAME (SPECIFY WOOD)                                    | 0.1417742 | 0.0758065 | 0.0659677 | 6200 |
| 4104    | KITCHEN                                                                                                            |           |           |           |      |
| 4104001 | PANELYTE KITCHEN TABLE WITH 4 CHAIRS                                                                               | 0.0972222 | 0.0680556 | 0.0291667 | 2880 |
| 4104002 | CABINET UNIT, STEEL, WITH SHELVES                                                                                  | 0.0985099 | 0.0645695 | 0.0339404 | 1208 |
| 4105    | GARDEN AND PATIO FURNITURE                                                                                         |           |           |           |      |
| 4105001 | GARDEN FURNITURE, TABLE WITH 6 CHAIRS, PLASTIC                                                                     | 0.0791191 | 0.0522023 | 0.0269168 | 1226 |
| 4106    | OTHER FURNITURE                                                                                                    |           |           |           |      |
| 4106001 | LOOSE CHAIRS, WOOD (SPECIFY)                                                                                       | 0.0818414 | 0.0549872 | 0.0268542 | 782  |
| 4106002 | WALL-UNIT, WOOD                                                                                                    | 0.1112035 | 0.0737659 | 0.0374376 | 3606 |
| 4106003 | DISPLAY CABINET                                                                                                    | 0.0735502 | 0.0438472 | 0.029703  | 1414 |
| 4106004 | COFFEE TABLE                                                                                                       | 0.0857569 | 0.0516406 | 0.0341163 | 5364 |
| 4106005 | DESK                                                                                                               | 0.0706522 | 0.0398551 | 0.0307971 | 1104 |
| 4107    | FLOOR COVERINGS                                                                                                    |           |           |           |      |
| 41071   | CARPETS                                                                                                            |           |           |           |      |
| 4107101 | 2,7 M WIDE (NOT A COMPLETE CARPET)                                                                                 | 0.0697987 | 0.0416107 | 0.0281879 | 745  |
| 4107102 | 275 X 365 CM                                                                                                       | 0.0652452 | 0.0426439 | 0.0226013 | 2345 |
| 41072   | OTHER FLOOR COVERINGS                                                                                              |           |           |           |      |
| 4107201 | RUNNER, 0,7 M WIDE, PER METRE                                                                                      | 0.0857843 | 0.0563725 | 0.0294118 | 408  |
| 4107202 | FLOOR TILES, PLASTIC                                                                                               | 0.0907643 | 0.044586  | 0.0461783 | 628  |
| 4108    | REPAIR COSTS (FURNITURE)                                                                                           |           |           |           |      |
| 4108001 | UPHOLSTERING                                                                                                       | 0.92      | 0.74      | 0.18      | 1100 |
| 4108002 | OTHER REPAIR COSTS TO FURNITURE                                                                                    | 0.92      | 0.74      | 0.18      | 1100 |
| 411     | EQUIPMENT AND APPLIANCES                                                                                           |           |           |           |      |
| 41101   | REFRIGERATOR, ELECTRIC, STEEL CABINET, WHITE BAKED ENAMEL FINISH, STANDARD MODEL                                   |           |           |           |      |
| 4110101 | 200 - 249 LITRE                                                                                                    | 0.1325121 | 0.0712953 | 0.0612169 | 2679 |
| 4110102 | 250 - 299 LITRE                                                                                                    | 0.1170303 | 0.0708416 | 0.0461887 | 3529 |
| 4110103 | 300 - 400 LITRE                                                                                                    | 0.1248991 | 0.0756393 | 0.0492598 | 3715 |
| 41102   | DEEFPREEZER AND REFRIGERATOR COMBINATION, ELECTRIC, STEEL CABINET, WHITE BAKED ENAMEL FINISH, STANDARD MODEL       |           |           |           |      |
| 4110201 | 300 - 399 LITRE                                                                                                    | 0.1628753 | 0.0987261 | 0.0641492 | 4396 |
| 4110202 | 400 - 500 LITRE                                                                                                    | 0.1170682 | 0.068205  | 0.0488633 | 2947 |
| 41103   | CHEST FREEZER, ELECTRIC, WHITE BAKED ENAMEL FINISH                                                                 |           |           |           |      |
| 4110301 | 200 - 299 LITRE                                                                                                    | 0.1382368 | 0.0864198 | 0.0518171 | 5751 |
| 4110302 | 300 - 400 LITRE                                                                                                    | 0.105198  | 0.0726073 | 0.0325908 | 2424 |
| 41104   | STOVES AND OVENS                                                                                                   |           |           |           |      |
| 4110401 | STOVE, ELECTRIC COOKING, STANDARD MODEL, WHITE VITREOUS ENAMEL FINISH, FOUR PLATES (TUBULER OR FLAT TYPE) AND OVEN | 0.1579842 | 0.0995517 | 0.0584325 | 6469 |
| 4110402 | MICROWAVE OVEN, WITH TURN-TABLE, STANDARD MODEL (SPECIFY SIZE)                                                     | 0.1603323 | 0.0783101 | 0.0820223 | 5657 |
| 4110403 | STOVE, 2 PLATES (TUBULER OR FLAT TYPE), WHITE VITREOUS ENAMEL FINISH, ELECTRIC, PORTABLE                           | 0.1263916 | 0.0694172 | 0.0569745 | 3054 |
| 4110404 | HOTPLATES                                                                                                          | 0.1363926 | 0.0780752 | 0.0583174 | 3138 |
| 41105   | WASHING MACHINE, ELECTRIC, WITH WHITE BAKED ENAMEL FINISH                                                          |           |           |           |      |
| 4110501 | TWIN TUB, 2,7 KG - 3,6 KG CAPACITY                                                                                 | 0.122288  | 0.0591716 | 0.0631164 | 1014 |
| 4110502 | TWIN TUB, 3,6 KG AND MORE                                                                                          | 0.1431106 | 0.0715553 | 0.0715553 | 5073 |
| 4110503 | FULLY AUTOMATIC, 5 KG - 7,5 KG CAPACITY                                                                            | 0.148721  | 0.0751537 | 0.0735673 | 5043 |
| 41106   | DISH WASHER                                                                                                        |           |           |           |      |
| 4110601 | ELECTRICAL, WHITE BAKED ENAMEL FINISH, 4,5 KG - 6 KG CAPACITY                                                      | 0.1328395 | 0.0740741 | 0.0587654 | 2025 |
| 41107   | TUMBLE DRIER, ELECTRICAL, WHITE BAKED ENAMEL FINISH                                                                |           |           |           |      |
| 4110701 | 3 KG - 5 KG CAPACITY                                                                                               | 0.1267352 | 0.0863753 | 0.0403599 | 3890 |
| 4110702 | MORE THAN 5 KG CAPACITY                                                                                            | 0.1237113 | 0.0654639 | 0.0582474 | 1940 |
| 41108   | VACUUM CLEANERS, POLISHERS AND CARPET CLEANERS                                                                     |           |           |           |      |

|                                                                                                              |           |           |           |      |
|--------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|------|
| 4110801 VACUUM CLEANER, ELECTRICAL, STANDARD SIZE, INCLUDING STANDARD ATTACHMENTS (SPECIFY NUMBER OF PIECES) | 0.1243082 | 0.0708812 | 0.053427  | 4698 |
| 4110802 FLOOR POLISHERS, ELECTRICAL, STANDARD MODEL                                                          | 0.1218774 | 0.0775927 | 0.0442846 | 2642 |
| 4110803 CARPET CLEANERS, ELECTRICAL, STANDARD MODEL                                                          | 0.1081446 | 0.0692802 | 0.0388645 | 2959 |
| 41109 IRONS                                                                                                  |           |           |           |      |
| 4110901 ELECTRICAL, STANDARD SIZE, NON-AUTOMATIC, 400 - 600 WATT (SPECIFY)                                   | 0.1172386 | 0.0678105 | 0.0494281 | 4896 |
| 41110 KETTLES AND PERCOLATORS                                                                                |           |           |           |      |
| 4111001 KETTLE, ELECTRICAL, SEAMLESS, 2,2 LITRE                                                              | 0.1115908 | 0.0641053 | 0.0474854 | 4633 |
| 4111002 PERCOLATOR, STANDARD, ELECTRICAL                                                                     | 0.1252588 | 0.0771222 | 0.0481366 | 1932 |
| 41111 SEWING MACHINE                                                                                         |           |           |           |      |
| 4111101 SEWING MACHINE, DOMESTIC, ELECTRICAL, TABLE MODEL, AUTOMATIC                                         | 0.1222571 | 0.0679206 | 0.0543365 | 2871 |
| 41112 OVERLOCKER                                                                                             |           |           |           |      |
| 4111201 3 - THREAD, ELECTRICAL                                                                               | 0.0864362 | 0.0545213 | 0.0319149 | 752  |
| 4111202 4 - THREAD, ELECTRICAL                                                                               | 0.1108742 | 0.0591684 | 0.0517058 | 1876 |
| 4111301 KNITTING MACHINE, ELECTRICAL (SPECIFY)                                                               | 0.2758621 | 0.2068966 | 0.0689655 | 29   |
| 41114 FOOD MIXERS AND PROCESSORS                                                                             |           |           |           |      |
| 4111401 ELECTRICAL BEATER                                                                                    | 0.0993542 | 0.0640835 | 0.0352707 | 2013 |
| 4111402 FOOD PROCESSOR, LIQUIDIZE, CHOP, MIX, ELECTRICAL                                                     | 0.1248869 | 0.0669683 | 0.0579186 | 2210 |
| 4111501 ELECTRICAL FRYING PAN                                                                                | 0.1073755 | 0.0682917 | 0.0390838 | 4759 |
| 4111601 TOASTER, ELECTRICAL, 2 SLICES, POP-UP                                                                | 0.1030146 | 0.0604911 | 0.0425235 | 5009 |
| 4111701 WAFFLE PAN, ELECTRICAL, 2 WAFFLES                                                                    | 0.0944882 | 0.0575409 | 0.0369473 | 1651 |
| 4111801 SANDWICH-MAKER, ELECTRICAL, ("SNACKWICH"), 2 SANDWICHES                                              | 0.1152841 | 0.068695  | 0.046589  | 4207 |
| 41119 ELECTRICALLY OPERATED LAWN-MOWERS AND EDGE-TRIMMERS                                                    |           |           |           |      |
| 4111901 LAWN-MOWER, ELECTRICAL                                                                               | 0.1605351 | 0.0981048 | 0.0624303 | 897  |
| 4111902 EDGE-TRIMMER, ELECTRICAL                                                                             | 0.1154791 | 0.0651106 | 0.0503686 | 814  |
| 41120 OTHER ELECTRICAL APPLIANCES                                                                            |           |           |           |      |
| 4112001 HEATER, ELECTRICAL, CAPIL ASBESTOS                                                                   | 0.0584577 | 0.039801  | 0.0186567 | 804  |
| 4112002 OIL HEATER, ELECTRICAL, 7 - RIB, 1500 W                                                              | 0.1013597 | 0.0543881 | 0.0469716 | 2427 |
| 4112003 ELECTRICAL BLANKET, 137 CM, WITH HEAT REGULATOR                                                      | 0.1040268 | 0.0657718 | 0.038255  | 1490 |
| 4112004 PEDESTAL LAMP, ELECTRICAL, WITH SHADE                                                                | 0.0674518 | 0.0401499 | 0.0273019 | 1868 |
| 4112005 FAN, STANDING TYPE, ELECTRICAL                                                                       | 0.0912433 | 0.0578209 | 0.0334225 | 2992 |
| 4112006 CEILING FAN                                                                                          | 0.1050157 | 0.0646552 | 0.0403605 | 2552 |
| 41121 NON-ELECTRICAL EQUIPMENT AND APPLIANCES                                                                |           |           |           |      |
| 4112101 GAS STOVE                                                                                            |           |           |           |      |
| 4112102 HEATER, WORK WITH GAS                                                                                |           |           |           |      |
| 4112103 COAL/WOOD STOVE                                                                                      |           |           |           |      |
| 4112104 ANTHRACITE STOVE                                                                                     |           |           |           |      |
| 4112105 PARAFFIN STOVE                                                                                       |           |           |           |      |
| 4112106 PARAFFIN HEATER                                                                                      |           |           |           |      |
| 4112107 SEWING AND KNITTING MACHINES, NON-ELECTRICAL                                                         |           |           |           |      |
| 4112108 LAWNMOWER, MANUAL, 350 MM, BALL BEARINGS                                                             | 0.0710227 | 0.0426136 | 0.0284091 | 352  |
| 4112109 LAWNMOWER, PETROL DRIVEN, 125 CC, 48 CM, 3,5 HP, ROTARY CUT                                          | 0.1505882 | 0.0847059 | 0.0658824 | 425  |
| 4112111 OTHER NON-ELECTRICAL APPLIANCES (SPECIFY)                                                            |           |           |           |      |
| 41122 REPAIRS                                                                                                |           |           |           |      |
| 4112201 REPAIRS OF ELECTRICAL AND NON-ELECTRICAL APPLIANCES                                                  |           |           |           |      |
| 412 OTHER HOUSEHOLD EQUIPMENT AND TEXTILES                                                                   |           |           |           |      |
| 4120 KITCHEN AND TABLEWARE                                                                                   |           |           |           |      |
| 41201 GLASSWARE                                                                                              |           |           |           |      |
| 4120101 PIE DISH (SPECIFY SIZE)                                                                              | 0.0519337 | 0.0370166 | 0.0149171 | 1810 |
| 4120102 CASSEROLE, COVERED (SPECIFY SIZE)                                                                    | 0.079929  | 0.0414446 | 0.0384843 | 1689 |
| 41202 ENAMELWARE                                                                                             |           |           |           |      |
| 4120201 SAUCEPAN, MEDIUM, 203 MM                                                                             | 0.0935673 | 0.0526316 | 0.0409357 | 171  |
| 4120202 KETTLE, SEAMLESS, 2,3 LITRE                                                                          | 0.122449  | 0.0561224 | 0.0663265 | 196  |
| 4120203 COFFEE POT, 1,1 LITRE                                                                                | 0.106383  | 0.0531915 | 0.0531915 | 188  |
| 4120204 TEA POT, 1,1 LITRE                                                                                   | 0.08      | 0.0470588 | 0.0329412 | 425  |
| 41203 ALUMINIUMWARE                                                                                          |           |           |           |      |
| 4120301 SAUCEPAN, COVERED, MEDIUM, 2,3 LITRE                                                                 | 0.0871935 | 0.0544959 | 0.0326975 | 367  |
| 4120302 FRYING PAN (NON-ELECTRICAL), MEDIUM, 229 MM                                                          | 0.1002621 | 0.0576671 | 0.042595  | 1526 |

|                                                                             |           |           |           |      |
|-----------------------------------------------------------------------------|-----------|-----------|-----------|------|
| 41204 CROCKERY (EARTHENWARE)                                                |           |           |           |      |
| 4120401 DINNER PLATES                                                       | 0.0752941 | 0.0423529 | 0.0329412 | 1275 |
| 4120402 SOUP PLATES                                                         | 0.0615819 | 0.0316384 | 0.0299435 | 1770 |
| 4120403 PUDDING PLATES                                                      | 0.0460993 | 0.0236407 | 0.0224586 | 846  |
| 4120404 SIDE PLATES                                                         | 0.0806794 | 0.0414013 | 0.0392781 | 1884 |
| 4120405 CUPS AND SAUCERS - BREAKFAST                                        | 0.0870902 | 0.045082  | 0.0420082 | 976  |
| 4120406 CUPS AND SAUCERS - TEA                                              | 0.0711078 | 0.0471557 | 0.0239521 | 1336 |
| 41205 CUTLERY, STAINLESS STEEL                                              |           |           |           |      |
| 4120501 KNIFE                                                               | 0.0704307 | 0.0389988 | 0.0314319 | 1718 |
| 4120502 FORK                                                                | 0.0762998 | 0.043214  | 0.0330858 | 1481 |
| 4120503 TEASPOON                                                            | 0.09258   | 0.0578625 | 0.0347175 | 1469 |
| 4120504 DESSERTSPOON                                                        | 0.0863363 | 0.0570571 | 0.0292793 | 1332 |
| 4120505 VEGETABLE KNIFE                                                     | 0.0509259 | 0.0305556 | 0.0203704 | 1080 |
| 41206 PLASTIC KITCHEN AND TABLEWARE                                         |           |           |           |      |
| 4120601 MIXING-BOWL                                                         | 0.0782609 | 0.0507246 | 0.0275362 | 690  |
| 4120602 BOWL WITH PLASTIC LID                                               | 0.05939   | 0.0417335 | 0.0176565 | 623  |
| 4121 HOUSEHOLD TEXTILES                                                     |           |           |           |      |
| 41211 BLANKETS, SOUTH AFRICAN                                               |           |           |           |      |
| 4121101 PURE WOOL, 152 X 203 CM                                             | 0.0441989 | 0.038674  | 0.0055249 | 181  |
| 4121102 WOOL MIXTURE (SPECIFY), 152 X 203 CM                                | 0.0488889 | 0.0355556 | 0.0133333 | 225  |
| 4121103 COTTON AND RAYON MIXTURE (SPECIFY), 152 X 203 CM                    | 0.1229508 | 0.057377  | 0.0655738 | 366  |
| 41212 SHEETS AND PILLOWCASES                                                |           |           |           |      |
| 4121201 READY-MADE SHEETS, FLAT SHEET, 160 X 229 CM                         | 0.0745501 | 0.0418656 | 0.0326845 | 2723 |
| 4121202 FITTED SHEET, DOUBLE BED (137 CM)                                   | 0.0957153 | 0.0542502 | 0.0414651 | 2894 |
| 4121203 PILLOWCASE, COTTON, 46 X 71 CM                                      | 0.0673469 | 0.0440233 | 0.0233236 | 3430 |
| 41213 DUVETS AND DUVET COVERS                                               |           |           |           |      |
| 4121301 DUVET INNER (DOUBLE BED)                                            | 0.0617683 | 0.0383528 | 0.0234154 | 2477 |
| 4121302 DUVET COVER, COTTON, DOUBLE BED                                     | 0.0751634 | 0.0347222 | 0.0404412 | 2448 |
| 4121303 DUVET COVER, COTTON, SINGLE BED                                     | 0.0939992 | 0.0377675 | 0.0562316 | 2383 |
| 41214 TABLE CLOTHS                                                          |           |           |           |      |
| 4121401 BREAKFAST, COTTON, 137 X 137 CM                                     | 0.0570776 | 0.0410959 | 0.0159817 | 438  |
| 4121402 DINNER, 137 X 183 CM                                                | 0.0873672 | 0.0413223 | 0.0460449 | 847  |
| 41215 TOWELS AND FACE-CLOTHS                                                |           |           |           |      |
| 4121501 HAND TOWEL, 56 X 112 CM                                             | 0.0516681 | 0.0277532 | 0.023915  | 3387 |
| 4121502 BATH TOWEL, 70 X 130 CM                                             | 0.0512087 | 0.0295802 | 0.0216285 | 3144 |
| 4121503 BATH SHEET, 90 X 150 CM                                             | 0.0508726 | 0.024508  | 0.0263646 | 2693 |
| 4121504 FACE-CLOTH                                                          | 0.0592379 | 0.0333013 | 0.0259366 | 3123 |
| 41216 CURTAINS, LACE CURTAINING, ETC.                                       |           |           |           |      |
| 4121601 COTTON, 122 CM                                                      | 0.0694143 | 0.0477223 | 0.021692  | 461  |
| 4121602 COTTON MIXTURE, 122 CM                                              | 0.08125   | 0.0416667 | 0.0395833 | 480  |
| 4121603 SUNFILTER, 122 CM                                                   | 0.0465116 | 0.0232558 | 0.0232558 | 344  |
| 4121604 LACE CURTAINING, POLYESTER, 122 CM                                  | 0.0998553 | 0.065123  | 0.0347323 | 691  |
| 4121605 CURTAIN LINING, COTTON, 122 CM                                      | 0.0546358 | 0.0380795 | 0.0165563 | 604  |
| 4121606 CALICO, 91 CM                                                       | 0.0501672 | 0.0301003 | 0.0200669 | 598  |
| 41217 PILLOWS AND CUSHIONS                                                  |           |           |           |      |
| 4121701 PILLOW, STANDARD SIZE, FEATHER, 1,4 KG                              | 0.0731707 | 0.0413895 | 0.0317812 | 1353 |
| 4121702 PILLOW, STANDARD SIZE, FOAMRUBBER/<br>FOAM PLASTIC, 1,4 KG          | 0.0478011 | 0.0258126 | 0.0219885 | 1046 |
| 4121703 PILLOW, CONTINENTAL, FEATHER                                        | 0.0228758 | 0.0163399 | 0.0065359 | 306  |
| 4121704 PILLOW, CONTINENTAL, FOAMRUBBER/<br>FOAM PLASTIC                    | 0.0463862 | 0.0237325 | 0.0226537 | 927  |
| 41218 MATTRESSES                                                            |           |           |           |      |
| 4121801 BED BASE WITH MATTRESS, INNER-SPRING MATTRESS,<br>137 CM            | 0.1353578 | 0.0794702 | 0.0558876 | 6191 |
| 4121802 BED BASE WITH MATTRESS, FOAMRUBBER/FOAM PLASTIC<br>MATTRESS, 137 CM | 0.1135721 | 0.0749293 | 0.0386428 | 2122 |
| 4121803 BED BASE WITH MATTRESS, INNER-SPRING MATTRESS,<br>92 CM             | 0.1163592 | 0.0731806 | 0.0431786 | 4933 |
| 4121804 BED BASE WITH MATTRESS, FOAMRUBBER/FOAM PLASTIC<br>MATTRESS, 92 CM  | 0.0821429 | 0.0577381 | 0.0244048 | 1680 |
| 4121805 MATTRESS, INNER-SPRING, 92 CM                                       | 0.071775  | 0.0562561 | 0.0155189 | 2062 |
| 4121806 MATTRESS, FOAMRUBBER/FOAM PLASTIC, 92 CM                            | 0.0862697 | 0.0615634 | 0.0247064 | 2469 |
| 41219 OTHER                                                                 |           |           |           |      |
| 4121901 REPAIRS TO HOUSEHOLD TEXTILES                                       | 0.9047619 | 0.6904762 | 0.2142857 | 924  |
| 4121902 BLINDS                                                              | 0.9047619 | 0.6904762 | 0.2142857 | 924  |
| 4122 GARDENING EQUIPMENT                                                    |           |           |           |      |
| 41221 SPADE                                                                 |           |           |           |      |
| 4122101 ALL STEEL                                                           | 0.1451204 | 0.1115336 | 0.0335868 | 1578 |
| 4122102 WITH WOODEN HANDLE                                                  | 0.1       | 0.0814815 | 0.0185185 | 270  |
| 41222 GARDEN FORK                                                           |           |           |           |      |

|                                                                            |           |           |           |      |
|----------------------------------------------------------------------------|-----------|-----------|-----------|------|
| 4122201 ALL STEEL                                                          | 0.1197411 | 0.0899676 | 0.0297735 | 1545 |
| 4122202 WITH WOODEN HANDLE                                                 | 0.0873016 | 0.0793651 | 0.0079365 | 252  |
| 4122301 GARDEN RAKE, 14-TOOTH, INCLUDING WOODEN HANDLE                     | 0.1135822 | 0.0754567 | 0.0381255 | 1259 |
| 4122401 GARDEN HOSE, 12,5 MM, PLASTIC                                      | 0.1251981 | 0.0855784 | 0.0396197 | 1262 |
| 4122501 PRUNING SHEARS                                                     | 0.0865079 | 0.05      | 0.0365079 | 1260 |
| 4122601 HEDGE CLIPPER, 300 MM BLADE, STRAIGHT EDGE                         | 0.0915371 | 0.0630397 | 0.0284974 | 1158 |
| 4122701 WATERING-CAN, PLASTIC                                              | 0.0894737 | 0.062406  | 0.0270677 | 1330 |
| 4123 OTHER HOUSEHOLD EQUIPMENT                                             |           |           |           |      |
| 41231 LIGHT BULBS AND SOCKETS                                              |           |           |           |      |
| 4123101 LIGHT BULB, NOT FROSTED OR COLOURED,<br>220 TO 250 VOLTS, 100 WATT | 0.1027721 | 0.0601758 | 0.0425963 | 1479 |
| 4123102 PLUG                                                               | 0.1272727 | 0.1181818 | 0.0090909 | 110  |
| 4123103 FUSE                                                               | 0.3548387 | 0.2580645 | 0.0967742 | 31   |
| 4123104 ELECTRIC WIRE                                                      | 0.2       | 0.1428571 | 0.0571429 | 35   |
| 41232 OTHER EQUIPMENT                                                      |           |           |           |      |
| 4123201 IRONING BOARD, OF WOOD                                             | 0.1702128 | 0.1489362 | 0.0212766 | 47   |
| 4123202 LAUNDRY BASKET, PLASTIC                                            | 0.1492537 | 0.1343284 | 0.0149254 | 67   |
| 4123203 LADDER, STEEL FRAME                                                | 0.0384615 | 0.0384615 | 0         | 26   |
| 4123204 BATHROOM SCALE, NOT ELECTRONIC                                     | 0.1458333 | 0.0625    | 0.0833333 | 48   |
| 4123205 ORNAMENTS, PAINTINGS AND OTHER WORKS OF ART                        |           |           |           |      |
| 42 HOUSEHOLD OPERATION                                                     |           |           |           |      |
| 420 HOUSEHOLD CONSUMABLES                                                  |           |           |           |      |
| 42001 SOAP, BARS AND CAKES                                                 |           |           |           |      |
| 4200101 FOR HOUSEHOLD USE (NOT TOILET SOAP)                                | 0.2169179 | 0.1436348 | 0.0732831 | 7164 |
| 42002 WASHING POWDER                                                       |           |           |           |      |
| 4200201 FOR HAND WASH AND TWIN TUBS                                        | 0.1689498 | 0.1085616 | 0.0603881 | 8760 |
| 4200202 FOR AUTOMATIC WASHING MACHINES                                     | 0.2091775 | 0.1361868 | 0.0729907 | 7453 |
| 42003 LIQUID DETERGENTS AND BLEACHES                                       |           |           |           |      |
| 4200301 MULTIPURPOSE HOUSEHOLD CLEANER ("HANDY ANDY")                      | 0.2688226 | 0.1571501 | 0.1116726 | 9895 |
| 4200302 DISH-WASHING LIQUID                                                | 0.2530728 | 0.1510663 | 0.1020065 | 9519 |
| 4200303 CLEANING DETERGENTS FOR FLOORS                                     | 0.1547451 | 0.099831  | 0.0549141 | 7102 |
| 4200304 CLEANING DETERGENTS FOR WINDOWS<br>(WINDOW-CLEANERS)               | 0.1449201 | 0.1008252 | 0.0440949 | 7756 |
| 4200305 BLEACH                                                             | 0.1833261 | 0.1385858 | 0.0447403 | 9164 |
| 42004 BRUSHES AND BROOMS                                                   |           |           |           |      |
| 4200401 SCRUBBING BRUSH                                                    | 0.0778186 | 0.0594363 | 0.0183824 | 1632 |
| 4200402 BROOM, CORN, 4-TIE                                                 | 0.0863724 | 0.0556622 | 0.0307102 | 1042 |
| 4200403 SWEEPING BROOM, HAIR, INCLUDING WOODEN HANDLE                      | 0.0917355 | 0.0603306 | 0.0314405 | 1210 |
| 4200404 BROOM AND DUST-PAN SET, PLASTIC                                    | 0.0819462 | 0.0550576 | 0.0268886 | 781  |
| 4200405 MOP                                                                | 0.1275441 | 0.0820896 | 0.0454545 | 1474 |
| 4200406 FEATHER DUSTER (SPECIFY)                                           | 0.0726306 | 0.0558016 | 0.0168291 | 1129 |
| 42005 POLISH                                                               |           |           |           |      |
| 4200501 FLOOR POLISH, WAX                                                  | 0.1541485 | 0.1006055 | 0.053543  | 9413 |
| 4200502 SHOE POLISH, WAX                                                   | 0.157802  | 0.1106273 | 0.0471747 | 9645 |
| 4200503 FURNITURE POLISH                                                   | 0.1877338 | 0.1144995 | 0.0732343 | 8821 |
| 4200504 METAL POLISH                                                       | 0.139631  | 0.1096117 | 0.0300193 | 7262 |
| 42006 SCOURING AGENTS                                                      |           |           |           |      |
| 4200601 SCOURING POWDER                                                    | 0.113833  | 0.0918653 | 0.0219678 | 7511 |
| 4200602 POT SCOURERS                                                       | 0.1064828 | 0.0693793 | 0.0371034 | 7250 |
| 4200603 STEEL WIRE                                                         | 0.0969076 | 0.0685444 | 0.0283632 | 5077 |
| 42007 MATCHES AND CANDLES                                                  |           |           |           |      |
| 4200701 MATCHES                                                            | 0.1115201 | 0.0847989 | 0.0267212 | 7335 |
| 4200702 CANDLES, WAX, PACKET OF 6 (NOT COLOURED)                           | 0.1022541 | 0.0728467 | 0.0294074 | 6699 |
| 42008 FERTILIZER AND LIME                                                  |           |           |           |      |
| 4200801 MIXED GENERAL FERTILIZER                                           | 0.1035032 | 0.0796178 | 0.0238854 | 1256 |
| 4200802 SUPERPHOSPHATE                                                     | 0.0801762 | 0.0590308 | 0.0211454 | 1135 |
| 4200803 AGRICULTURAL LIME                                                  | 0.0638554 | 0.0481928 | 0.0156627 | 830  |
| 42009 DISINFECTANTS AND SWIMMING-POOL CHEMICALS                            |           |           |           |      |
| 4200901 CHLORINE                                                           | 0.177453  | 0.1210856 | 0.0563674 | 479  |
| 4200902 ACID                                                               | 0.1272085 | 0.0795053 | 0.0477032 | 566  |
| 42010 OTHER CLEANERS                                                       |           |           |           |      |
| 4201001 OVEN-CLEANER                                                       | 0.113721  | 0.0859353 | 0.0277857 | 6982 |
| 4201002 DRAIN AND TOILET CLEANERS                                          | 0.1734709 | 0.1198605 | 0.0536103 | 6883 |
| 4201003 AIR FRESHENERS                                                     | 0.1926093 | 0.1147814 | 0.0778279 | 8416 |
| 42011 OTHER                                                                |           |           |           |      |
| 4201101 INSECTICIDES (INDOOR)                                              | 0.2220536 | 0.1264542 | 0.0955994 | 7908 |

|                                                                                        |           |           |           |      |
|----------------------------------------------------------------------------------------|-----------|-----------|-----------|------|
| 4201102 PLASTIC BAGS AND SACHETS - SANDWICH BAGS                                       | 0.1379859 | 0.0966129 | 0.041373  | 4399 |
| 4201103 PLASTIC BAGS AND SACHETS - FREEZER BAGS                                        | 0.1502224 | 0.1073595 | 0.0428629 | 4946 |
| 4201104 PLASTIC BAGS AND SACHETS - FOR DUST BINS                                       | 0.1436204 | 0.1021586 | 0.0414619 | 4679 |
| 4201105 FOIL                                                                           | 0.1271478 | 0.085747  | 0.0414008 | 6111 |
| 4201106 WAXPAPER                                                                       | 0.0918105 | 0.0655527 | 0.0262578 | 5446 |
| 4201107 PAPER SERVIETTES                                                               | 0.1046341 | 0.0665686 | 0.0380655 | 5438 |
| 4201108 PAPER PLATES                                                                   | 0.1613982 | 0.1010202 | 0.060378  | 5979 |
| 4201109 PLASTIC TUMBLERS, DISPOSABLE                                                   | 0.0779967 | 0.0533662 | 0.0246305 | 3654 |
| 4201111 NAILS                                                                          | 0.0835322 | 0.0787589 | 0.0047733 | 419  |
| 4201112 CLOTHES-PEGS                                                                   | 0.0931857 | 0.0575809 | 0.0356048 | 5870 |
| 4201113 PINS                                                                           |           |           |           |      |
| 4201114 DISHCLOTHS (WASH)                                                              | 0.0781206 | 0.0486838 | 0.0294367 | 3533 |
| 4201115 DISHCLOTHS (DRY)                                                               | 0.0805541 | 0.0469472 | 0.033607  | 3898 |
| 421 DOMESTIC WORKERS                                                                   |           |           |           |      |
| 4211001 WAGES FOR DOMESTIC WORKERS                                                     |           |           |           |      |
| 422 HOUSEHOLD SERVICES                                                                 |           |           |           |      |
| 4221 LAUNDRETTE                                                                        |           |           |           |      |
| 4221001 WASHING (PER LOAD)                                                             | 0.053125  | 0.04375   | 0.009375  | 640  |
| 4221002 TUMBLE DRYING (PER LOAD)                                                       | 0.0510204 | 0.047619  | 0.0034014 | 588  |
| 4222 DRY CLEANING SERVICES                                                             |           |           |           |      |
| 42221 MEN                                                                              |           |           |           |      |
| 4222101 SUIT                                                                           | 0.0840183 | 0.0812785 | 0.0027397 | 3285 |
| 4222102 TROUSERS                                                                       | 0.0818624 | 0.0785149 | 0.0033475 | 3286 |
| 42222 WOMEN                                                                            |           |           |           |      |
| 4222201 SLACK SUIT                                                                     | 0.0821406 | 0.0774736 | 0.0046671 | 3214 |
| 4222202 DRESS                                                                          | 0.0747693 | 0.0680878 | 0.0066815 | 3143 |
| 4222203 SKIRT                                                                          | 0.0761437 | 0.069696  | 0.0064477 | 3257 |
| 4223 WASHING AND IRONING SERVICES                                                      |           |           |           |      |
| 42231 10 - 20 ITEMS                                                                    |           |           |           |      |
| 4223101 WASH AND IRON                                                                  | 0.0557325 | 0.0509554 | 0.0047771 | 628  |
| 4223102 WASH ONLY                                                                      | 0.0517241 | 0.0440613 | 0.0076628 | 522  |
| 4223103 IRON ONLY                                                                      | 0.0613497 | 0.0511247 | 0.0102249 | 489  |
| 42232 21 - 30 ITEMS                                                                    |           |           |           |      |
| 4223201 WASH AND IRON                                                                  | 0.0605096 | 0.0573248 | 0.0031847 | 314  |
| 4223202 WASH ONLY                                                                      | 0.0540541 | 0.0432432 | 0.0108108 | 185  |
| 4223203 IRON ONLY                                                                      | 0.0347826 | 0.0304348 | 0.0043478 | 230  |
| 42233 31 - 40 ITEMS                                                                    |           |           |           |      |
| 4223301 WASH AND IRON                                                                  | 0.0568182 | 0.0530303 | 0.0037879 | 264  |
| 4223302 WASH ONLY                                                                      | 0.0482759 | 0.0413793 | 0.0068966 | 145  |
| 4223303 IRON ONLY                                                                      | 0.0404624 | 0.0346821 | 0.0057803 | 173  |
| 4224001 CLEANING SERVICES FOR CARPETS, UPHOLSTERY                                      |           |           |           |      |
| 4225001 FUMIGATION SERVICES                                                            |           |           |           |      |
| 4226001 HIRE OF FURNITURE AND EQUIPMENT<br>(EXCLUDING TELEVISION SETS, TAPE RECORDERS) |           |           |           |      |
| 4227001 GRINDING/GRISTING OF MAIZE/WHEAT                                               |           |           |           |      |
| 4228001 OTHER HOUSEHOLD SERVICES (SPECIFY)                                             |           |           |           |      |
| 5 MEDICAL CARE AND HEALTH EXPENSES                                                     |           |           |           |      |
| 501 MEDICAL SERVICES                                                                   |           |           |           |      |
| 5011 DOCTOR'S FEES                                                                     |           |           |           |      |
| 5011001 FOR MEMBERS OF MEDICAL AID SCHEMES                                             | 0.1       | 0.1       | 0         | 1100 |
| 5011002 FOR PRIVATE PATIENTS                                                           | 0.1       | 0.1       | 0         | 1100 |
| 5012 DENTISTS' FEES                                                                    |           |           |           |      |
| 5012001 FOR MEMBERS OF MEDICAL AID SCHEMES                                             | 0.0992714 | 0.0992714 | 0         | 1098 |
| 5012002 FOR PRIVATE PATIENTS                                                           | 0.1       | 0.1       | 0         | 1100 |
| 5013 PHYSIOTHERAPISTS                                                                  |           |           |           |      |
| 5013001 FOR MEMBERS OF MEDICAL AID SCHEMES                                             | 0.1       | 0.08      | 0.02      | 1100 |
| 5013002 FOR PRIVATE PATIENTS                                                           | 0.1       | 0.08      | 0.02      | 1100 |
| 5014 OCCUPATIONAL THERAPISTS                                                           |           |           |           |      |
| 5014001 FOR MEMBERS OF MEDICAL AID SCHEMES                                             | 0.1       | 0.1       | 0         | 1100 |
| 5014002 FOR PRIVATE PATIENTS                                                           | 0.1       | 0.1       | 0         | 1100 |
| 5015 OPTICIANS                                                                         |           |           |           |      |
| 5015001 FOR MEMBERS OF MEDICAL AID SCHEMES                                             | 0.1       | 0.1       | 0         | 1100 |
| 5015002 FOR PRIVATE PATIENTS                                                           | 0.1       | 0.1       | 0         | 1100 |
| 5016 TRADITIONAL DOCTORS                                                               |           |           |           |      |

|         |                                                        |           |           |           |      |
|---------|--------------------------------------------------------|-----------|-----------|-----------|------|
| 5016001 | FOR MEMBERS OF MEDICAL AID SCHEMES                     |           |           |           |      |
| 5016002 | FOR PRIVATE PATIENTS                                   |           |           |           |      |
| 502     | HOSPITALISING                                          |           |           |           |      |
| 5021    | HOSPITALS, NURSING-HOMES, CLINICS AND RELATED SERVICES |           |           |           |      |
| 5021001 | FOR MEMBERS OF MEDICAL-AID SCHEMES                     |           |           |           |      |
| 5021002 | FOR PRIVATE PATIENTS                                   |           |           |           |      |
| 503     | MEDICAL AND PHARMACEUTICAL PRODUCTS                    |           |           |           |      |
| 5031    | PRESCRIPTION MEDICINES                                 |           |           |           |      |
| 50311   | ETHNIC MEDICINE                                        |           |           |           |      |
| 5031101 | FOR MEMBERS OF MEDICAL-AID SCHEMES                     | 0.5       | 0.14      | 0.36      | 1100 |
| 5031102 | FOR PRIVATE PATIENTS                                   | 0.5       | 0.14      | 0.36      | 1100 |
| 50312   | PRESCRIPTION FEES                                      |           |           |           |      |
| 5031201 | FOR MEMBERS OF MEDICAL-AID SCHEMES                     | 0.5       | 0.14      | 0.36      | 1100 |
| 5031202 | FOR PRIVATE PATIENTS                                   | 0.5       | 0.14      | 0.36      | 1100 |
| 5032    | OTHER MEDICINE AND PHARMACEUTICAL PRODUCTS             |           |           |           |      |
| 5032001 | ASPIRIN                                                | 0.2014776 | 0.1258452 | 0.0756324 | 7986 |
| 5032002 | COUGH MIXTURE                                          | 0.1635609 | 0.0983921 | 0.0651688 | 9391 |
| 5032003 | MILK OF MAGNESIA                                       | 0.1886308 | 0.1296435 | 0.0589873 | 9341 |
| 5032004 | FRUIT SALTS                                            | 0.2073048 | 0.1283369 | 0.0789679 | 8953 |
| 5032005 | PETROLEUM JELLY, WHITE                                 | 0.1558473 | 0.098926  | 0.0569212 | 8380 |
| 5032006 | BANDAGES, 25 MM X 5 M                                  | 0.1093248 | 0.0693615 | 0.0399633 | 4354 |
| 5032007 | COTTON WOOL, B.P.C.                                    | 0.1357143 | 0.0846753 | 0.051039  | 7700 |
| 5032008 | ELASTIC ADHESIVE PLASTER, 25MM X 1M                    | 0.1434402 | 0.0940719 | 0.0493683 | 5145 |
| 5032009 | ANTISEPTIC FLUID                                       | 0.1772797 | 0.1171588 | 0.060121  | 8433 |
| 5032011 | PAIN KILLERS                                           | 0.1894228 | 0.1170862 | 0.0723366 | 7866 |
| 504     | THERAPEUTIC APPLIANCES AND EQUIPMENT                   |           |           |           |      |
| 5041001 | SPECTACLES                                             | 0.1       | 0.1       | 0         | 1100 |
| 5041002 | CONTACT LENSES                                         | 0.1       | 0.08      | 0.02      | 1100 |
| 5041003 | DENTURES                                               | 0         | 0         | 0         | 1100 |
| 5041004 | CRUTCHES                                               | 0.06      | 0.04      | 0.02      | 1100 |
| 5041005 | WHEEL CHAIR                                            | 0.06      | 0.04      | 0.02      | 1100 |
| 505     | CONTRIBUTIONS TO MEDICAL-AID SCHEMES                   |           |           |           |      |
| 5051001 | MEDICAL-AID FUND TARIFFS                               |           |           |           |      |
| 5061001 | MEDICAL INSURANCE                                      |           |           |           |      |
| 61      | TRANSPORT                                              |           |           |           |      |
| 610     | VEHICLES                                               |           |           |           |      |
| 6101    | NEW VEHICLES                                           |           |           |           |      |
| 61011   | MOTOR CARS, SEDAN, STANDARD MODEL                      |           |           |           |      |
| 6101101 | UP TO 1499 CC                                          | 0.1673947 | 0.1500961 | 0.0172986 | 5723 |
| 6101102 | 1500 TO 1999 CC                                        | 0.169372  | 0.1491485 | 0.0202235 | 7516 |
| 6101103 | 2000 TO 2499 CC                                        | 0.1468785 | 0.123269  | 0.0236095 | 4405 |
| 6101104 | 2500 TO 2999 CC                                        | 0.1280314 | 0.1052068 | 0.0228245 | 2804 |
| 6101105 | 3000 CC AND ABOVE                                      | 0.1475783 | 0.1236467 | 0.0239316 | 1755 |
| 61012   | STATION WAGONS                                         |           |           |           |      |
| 6101201 | 1600 TO 2499 CC                                        | 0.1545741 | 0.1297882 | 0.0247859 | 2219 |
| 6101202 | 2500 TO 3000 CC                                        | 0.1409091 | 0.1204545 | 0.0204545 | 880  |
| 61013   | MINI-BUSES                                             |           |           |           |      |
| 6101301 | 2000 TO 3000 CC                                        | 0.1696021 | 0.1542727 | 0.0153294 | 3066 |
| 61014   | BAKKIES                                                |           |           |           |      |
| 6101401 | UP TO 1999 CC                                          | 0.1549089 | 0.1404647 | 0.0144442 | 4777 |
| 6101402 | 2000 TO 3000 CC                                        | 0.1575053 | 0.1346723 | 0.022833  | 4730 |
| 61015   | FOUR-WHEEL DRIVE VEHICLES                              |           |           |           |      |
| 6101501 | UP TO 2999 CC                                          | 0.1619197 | 0.1372505 | 0.0246692 | 4459 |
| 6101502 | 3000 CC AND ABOVE                                      | 0.1351931 | 0.1134273 | 0.0217658 | 3262 |
| 61016   | MOTOR CYCLES                                           |           |           |           |      |
| 6101601 | 50 CC                                                  | 0.1210191 | 0.044586  | 0.0764331 | 157  |
| 6101602 | 750 CC                                                 | 0.1025641 | 0.0626781 | 0.039886  | 351  |
| 6101701 | SCOOTERS                                               | 0.08      | 0.0133333 | 0.0666667 | 150  |
|         |                                                        | 0.1184211 | 0.0328947 | 0.0855263 | 152  |
| 61018   | BICYCLES                                               |           |           |           |      |
| 6101801 | RACING BICYCLE                                         | 0.1233422 | 0.0517241 | 0.071618  | 754  |
| 6101802 | MOUNTAIN BICYCLE                                       | 0.1298569 | 0.0695297 | 0.0603272 | 978  |
| 6101803 | TRICYCLE                                               | 0.1189591 | 0.070632  | 0.0483271 | 269  |
| 61019   | CARAVAN, 4-BED MODEL                                   |           |           |           |      |

|                                                                                                       |           |           |           |      |
|-------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|------|
| 6101901 STANDARD, SOLID TYPE CARAVAN                                                                  | 0.2230483 | 0.2081784 | 0.0148699 | 269  |
| 6101902 SOLID TYPE CARAVAN (WITH ELEVATING ROOM)                                                      | 0.2395833 | 0.2291667 | 0.0104167 | 288  |
| 6101903 COLLAPSIBLE TYPE CARAVAN                                                                      | 0         | 0         | 0         | 8    |
| 6102 USED (SECOND HAND) VEHICLES                                                                      |           |           |           |      |
| 61021 MOTOR CARS, SEDAN, STANDARD MODEL                                                               |           |           |           |      |
| 6102101 UP TO 1499 CC                                                                                 | 0.3665534 | 0.1204228 | 0.2461306 | 2649 |
| 6102102 1500 TO 1999 CC                                                                               | 0.4099067 | 0.1048098 | 0.3050969 | 2786 |
| 6102103 2000 TO 2499 CC                                                                               | 0.4574183 | 0.0830209 | 0.3743974 | 1867 |
| 6102104 2500 TO 2999 CC                                                                               | 0.7745337 | 0.081914  | 0.6926196 | 1233 |
| 6102105 3000 CC AND ABOVE                                                                             | 0.725058  | 0.0197216 | 0.7053364 | 862  |
| 61022 STATION WAGONS                                                                                  |           |           |           |      |
| 6102201 1600 TO 2499 CC                                                                               | 0.5354478 | 0.0718284 | 0.4636194 | 1072 |
| 6102202 2500 TO 3000 CC                                                                               | 0.7005348 | 0.0677362 | 0.6327986 | 561  |
| 61023 MINI-BUSES                                                                                      |           |           |           |      |
| 6102301 2000 TO 3000 CC                                                                               | 0.3491756 | 0.0649855 | 0.2841901 | 1031 |
| 61024 BAKKIES                                                                                         |           |           |           |      |
| 6102401 UP TO 1999 CC                                                                                 | 0.3909465 | 0.0875955 | 0.303351  | 1701 |
| 6102402 2000 TO 3000 CC                                                                               | 0.4082418 | 0.1142857 | 0.293956  | 1820 |
| 61025 FOUR-WHEEL DRIVE VEHICLES                                                                       |           |           |           |      |
| 6102501 UP TO 2999 CC                                                                                 | 0.4939541 | 0.0822249 | 0.4117291 | 1654 |
| 6102502 3000 CC AND ABOVE                                                                             | 0.625731  | 0.051462  | 0.574269  | 855  |
| 61026 MOTOR CYCLES                                                                                    |           |           |           |      |
| 6102601 50 CC                                                                                         | 0.3894737 | 0.0578947 | 0.3315789 | 190  |
| 6102602 750 CC                                                                                        | 0.3770492 | 0.0614754 | 0.3155738 | 244  |
| 6102701 SCOOTERS                                                                                      |           |           |           |      |
|                                                                                                       | 0.4214876 | 0.0495868 | 0.3719008 | 121  |
| 61028 BICYCLES                                                                                        |           |           |           |      |
| 6102801 RACING BICYCLE                                                                                | 0.1136364 | 0.0681818 | 0.0454545 | 44   |
| 6102802 MOUNTAIN BICYCLE                                                                              | 0.225     | 0.1375    | 0.0875    | 80   |
| 6102803 TRICYCLE                                                                                      | 0         | 0         | 0         | 2    |
| 61029 CARAVANS, 4-BED MODEL                                                                           |           |           |           |      |
| 6102901 STANDARD, SOLID TYPE CARAVAN                                                                  | 0.1545455 | 0.1060606 | 0.0484848 | 330  |
| 6102902 SOLID TYPE CARAVAN (WITH ELEVATING ROOM)                                                      | 0.1948882 | 0.14377   | 0.0511182 | 313  |
| 6102903 COLLAPSIBLE TYPE CARAVAN                                                                      | 0.047619  | 0.0357143 | 0.0119048 | 84   |
| 611 RUNNING COSTS                                                                                     |           |           |           |      |
| 61101 FUEL                                                                                            |           |           |           |      |
| 6110102 PETROL, 93 OCTANE                                                                             | 0.94      | 0.58      | 0.36      | 1100 |
| 6110103 PETROL, 97 OCTANE                                                                             | 0.94      | 0.58      | 0.36      | 250  |
| 6110104 UNLEADED PETROL, 93 OCTANE                                                                    | 0.94      | 0.58      | 0.36      | 1100 |
| 6110105 UNLEADED PETROL, 95 OCTANE                                                                    | 0.94      | 0.58      | 0.36      | 250  |
| 6110106 DIESEL                                                                                        | 0.893186  | 0.5709024 | 0.3222836 | 5430 |
| 61102 OIL AND GHRIES                                                                                  |           |           |           |      |
| 6110201 LUBRICATING OIL, SAE 30                                                                       | 0.1268748 | 0.0981067 | 0.0287681 | 4067 |
| 6110202 LUBRICATING OIL, MULTIGRADE OIL, 5 L                                                          | 0.1362756 | 0.1052745 | 0.0310011 | 4645 |
| 6110203 LUBRICATING OIL, MULTIGRADE OIL, 500 ML                                                       | 0.1205808 | 0.0976431 | 0.0229377 | 4752 |
| 6110204 GHRIES                                                                                        | 0.098913  | 0.0728261 | 0.026087  | 3680 |
| 61103 TYRES AND TUBES                                                                                 |           |           |           |      |
| 611031 TYRES, NEW                                                                                     |           |           |           |      |
| 6110311 CROSS PLY, 600 X 14,6-PLY                                                                     | 0.1574279 | 0.1047056 | 0.0527223 | 4059 |
| 6110312 RADIAL PLY, 155 SR 13                                                                         | 0.1818881 | 0.1099789 | 0.0719092 | 5201 |
| 6110313 RADIAL PLY, 165 SR 13                                                                         | 0.1771859 | 0.1092453 | 0.0679406 | 5181 |
| 6110314 RADIAL PLY, 185 SR 14                                                                         | 0.1733911 | 0.1113954 | 0.0619957 | 5081 |
| 6110315 RADIAL PLY, 195 SR 14                                                                         | 0.1464157 | 0.0816496 | 0.0647661 | 3613 |
| 611032 TYRES, RETREAD                                                                                 |           |           |           |      |
| 6110321 RADIAL PLY, 155 SR 13                                                                         | 0.1383316 | 0.0873812 | 0.0509504 | 3788 |
| 6110322 RADIAL PLY, 165 SR 13                                                                         | 0.1354331 | 0.084252  | 0.0511811 | 3810 |
| 6110323 RADIAL PLY, 185 SR 14                                                                         | 0.1383063 | 0.0894611 | 0.0488452 | 3767 |
| 6110324 RADIAL PLY, 195 SR 14                                                                         | 0.1158708 | 0.0663624 | 0.0495084 | 2848 |
| 611033 TUBE                                                                                           |           |           |           |      |
| 6110331 NEW                                                                                           | 0.1253173 | 0.0752366 | 0.0500808 | 4333 |
| 61104 BATTERIES: MINIMUM GUARANTEE=12 MONTHS, NETT PRICE AFTER DEDUCTION OF ALLOWANCE FOR OLD BATTERY |           |           |           |      |
| 6110401 12 VOLT, 9 PLATE                                                                              | 0.1536899 | 0.1234484 | 0.0302415 | 4431 |
| 61105 SPARE PARTS                                                                                     |           |           |           |      |
| 6110501 SHOCK ABSORBER (REAR)                                                                         | 0.1628292 | 0.1211912 | 0.0416379 | 7253 |
| 6110502 DISC PADS (FRONT)                                                                             | 0.1394564 | 0.1018065 | 0.0376498 | 5923 |
| 6110503 BRAKE SHOES, BONDED (REAR)                                                                    | 0.1337604 | 0.0981537 | 0.0356066 | 5308 |



|                                                                                                                                                                   |           |           |           |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|------|
| 6110504 ENGINE CYLINDER HEAD GASKET                                                                                                                               | 0.1795697 | 0.1396166 | 0.0399532 | 6833 |
| 6110505 PISTON                                                                                                                                                    | 0.172043  | 0.1326716 | 0.0393714 | 6045 |
| 6110506 RINGS                                                                                                                                                     | 0.1543353 | 0.1109827 | 0.0433526 | 5190 |
| 6110507 VALVE, EXHAUST                                                                                                                                            | 0.1598908 | 0.1218143 | 0.0380765 | 6592 |
| 6110508 DISTRIBUTOR POINTS                                                                                                                                        | 0.1261283 | 0.0964371 | 0.0296912 | 4210 |
| 6110509 MAIN BEARING LINERS                                                                                                                                       | 0.1405614 | 0.1056353 | 0.0349261 | 4667 |
| 6110511 CLUTCH FRICTION PLATE                                                                                                                                     | 0.1514737 | 0.1104527 | 0.041021  | 6582 |
| 6110512 OIL FILTER ELEMENT                                                                                                                                        | 0.1388795 | 0.095416  | 0.0434635 | 5890 |
| 6110513 AIR FILTER ELEMENT                                                                                                                                        | 0.1220513 | 0.0907692 | 0.0312821 | 5850 |
| 6110514 SPARK PLUG                                                                                                                                                | 0.1353563 | 0.1005796 | 0.0347767 | 5866 |
| 6110515 FAN BELT                                                                                                                                                  | 0.1449642 | 0.1075994 | 0.0373648 | 7119 |
| 6110516 HEADLIGHT, SEALED OR SEMI-SEALED BEAM UNIT,<br>DOUBLE FILAMENT                                                                                            | 0.1561888 | 0.120006  | 0.0361827 | 6633 |
| 6110517 FUEL PUMP                                                                                                                                                 | 0.1760968 | 0.1311649 | 0.0449319 | 6610 |
| 6110601                                                                                                                                                           | 0.1033739 | 0.0779541 | 0.0254198 | 6491 |
| 6110602                                                                                                                                                           | 0.1058168 | 0.0816832 | 0.0241337 | 6464 |
| 61106 LUBRICATION AND MAINTENANCE SERVICES (COST<br>OF NORMAL SERVICE DURING NORMAL WORKING<br>HOURS - EXCLUDING COST OF MATERIALS USED,<br>E.G. OIL REPLACEMENT) |           |           |           |      |
| 6110611 LARGE CAR                                                                                                                                                 | 0.1125345 | 0.0855341 | 0.0270004 | 5074 |
| 6110612 SMALL CAR                                                                                                                                                 | 0.1142106 | 0.0863149 | 0.0278957 | 4947 |
| 61107 INSTALLATION COSTS                                                                                                                                          |           |           |           |      |
| 6110701 SECURITY SYSTEM (ALARM, IMMOBILISER, ETC.)                                                                                                                |           |           |           |      |
| 6110702 AIR CONDITIONING SYSTEM                                                                                                                                   |           |           |           |      |
| 6110801 PANEL-BEATING REPAIRS AND OTHER REPAIR WORK                                                                                                               |           |           |           |      |
| 6110901 LICENCE AND REGISTRATION FEES                                                                                                                             |           |           |           |      |
| 61110 PARKING FEES                                                                                                                                                |           |           |           |      |
| 6111001 MONTHLY                                                                                                                                                   |           |           |           |      |
| 6111002 DAILY                                                                                                                                                     |           |           |           |      |
| 6111003 HOURLY - FIRST HOUR                                                                                                                                       |           |           |           |      |
| 6111004 HOURLY - SECOND HOUR                                                                                                                                      |           |           |           |      |
| 6111101 TOLL FEES                                                                                                                                                 |           |           |           |      |
| 6111201 TRAFFIC FINES                                                                                                                                             |           |           |           |      |
| 61113 DRIVING LESSONS                                                                                                                                             |           |           |           |      |
| 6111301 PER HOUR                                                                                                                                                  |           |           |           |      |
| 6111401 MOTOR VEHICLE INSURANCE                                                                                                                                   | 0.18      | 0.1363636 | 0.0436364 | 1100 |
| 6111501 CAR WASH AND VALET SERVICES                                                                                                                               |           |           |           |      |
| 6111601 OTHER RUNNING COSTS (SPECIFY)                                                                                                                             |           |           |           |      |
| 612 PUBLIC AND HIRED TRANSPORT                                                                                                                                    |           |           |           |      |
| 61201 BUS FEES                                                                                                                                                    |           |           |           |      |
| 6120101 MUNICIPAL TARRIFFS                                                                                                                                        | 0.0266667 | 0.0266667 | 0         | 900  |
| 6120102 SUBSIDISED TARRIFFS (BLACKS)                                                                                                                              | 0         | 0         | 0         | 1100 |
| 6120103 LONG DISTANCE TARRIFFS                                                                                                                                    |           |           |           |      |
| 61202 TRAIN FEES                                                                                                                                                  |           |           |           |      |
| 612021 SUBURBAN                                                                                                                                                   |           |           |           |      |
| 6120211 FIRST CLASS                                                                                                                                               | 0.0272727 | 0.0263636 | 0.0009091 | 1100 |
| 6120212 THIRD CLASS                                                                                                                                               | 0.0290909 | 0.0290909 | 0         | 1100 |
| 612022 MAIN LINE                                                                                                                                                  |           |           |           |      |
| 6120221 FIRST CLASS                                                                                                                                               | 0.16      | 0.08      | 0.08      | 1100 |
| 6120222 SECOND CLASS                                                                                                                                              | 0.16      | 0.08      | 0.08      | 1100 |
| 6120223 THIRD CLASS                                                                                                                                               | 0.16      | 0.1       | 0.06      | 1100 |
| 61203 TAXI'S AND RENTED VEHICLES                                                                                                                                  |           |           |           |      |
| 6120301 TARRIFF BY METRE - TAXI'S                                                                                                                                 |           |           |           |      |
| 6120302 OTHER - TAXI'S                                                                                                                                            |           |           |           |      |
| 6120303 RENTED VEHICLE                                                                                                                                            |           |           |           |      |
| 6120401 BOAT TRANSPORT                                                                                                                                            |           |           |           |      |
| 6120501 AEROPLANE (AIR TRANSPORT TARRIFFS)                                                                                                                        | 0.94      | 0.48      | 0.46      | 1100 |
| 6120601 OTHER TRANSPORT (LIFT-CLUBS, ETC.)                                                                                                                        |           |           |           |      |
| 62 COMMUNICATION                                                                                                                                                  |           |           |           |      |
| 6201 TELEPHONE FEES                                                                                                                                               |           |           |           |      |
| 62011 TELEPHONE RENTAL AND INSTALLATION                                                                                                                           |           |           |           |      |

|         |                                                                                     |           |           |           |      |
|---------|-------------------------------------------------------------------------------------|-----------|-----------|-----------|------|
| 6201101 | MONTHLY RENTAL                                                                      |           |           |           |      |
| 6201102 | INSTALLATION COSTS                                                                  |           |           |           |      |
| 62012   | TELEPHONE CALLS                                                                     |           |           |           |      |
| 6201201 | PRIVATE                                                                             |           |           |           |      |
| 6201202 | FROM PUBLIC PHONES (TELEPHONE BOOTHS)                                               |           |           |           |      |
| 6201203 | FROM CELL PHONES                                                                    | 0.3421053 | 0.2368421 | 0.1052632 | 836  |
| 6201301 | LINK TO CELLULAR TELEPHONE NETWORK                                                  | 0.06      | 0.06      | 0         | 1100 |
| 6201302 | RENT FOR CELLULAR TELEPHONE NETWORK                                                 | 0.1578947 | 0.1578947 | 0         | 836  |
| 6201401 | SUBSCRIPTION TO INTERNET/BELTEL                                                     | 0         | 0         | 0         | 1100 |
| 6202101 | POSTAGE                                                                             | 0         | 0         | 0         | 1100 |
| 6203    | OTHER COMMUNICATION COSTS                                                           |           |           |           |      |
| 6203101 | RENTING OF POST OFFICE BOX                                                          |           |           |           |      |
| 6203102 | TELEGRAMMES                                                                         | 0         | 0         | 0         | 1100 |
| 6203103 | COURIER SERVICES                                                                    | 0         | 0         | 0         | 1100 |
| 71      | RECREATION AND ENTERTAINMENT                                                        |           |           |           |      |
| 7101    | COMPUTER AND TELECOMMUNICATION EQUIPMENT                                            |           |           |           |      |
| 71011   | COMPUTER EQUIPMENT                                                                  |           |           |           |      |
| 7101101 | PERSONAL COMPUTER                                                                   | 0.3025135 | 0.1283662 | 0.1741472 | 1114 |
| 7101102 | COMPUTER SOFTWARE                                                                   | 0.2558614 | 0.1060143 | 0.1498471 | 981  |
| 7101103 | COMPUTER DISKETTES                                                                  | 0.1444921 | 0.0672389 | 0.0772532 | 699  |
| 7101104 | CALCULATOR (ADDING MACHINE)                                                         | 0.1548673 | 0.0818584 | 0.0730088 | 452  |
| 7101105 | PRINTERS                                                                            | 0.2488889 | 0.1048889 | 0.144     | 1125 |
| 7101106 | MODEMS                                                                              | 0.1880597 | 0.0706468 | 0.1174129 | 1005 |
| 71012   | COMMUNICATION EQUIPMENT                                                             |           |           |           |      |
| 7101201 | CORDLESS TELEPHONES                                                                 | 0.2508475 | 0.0847458 | 0.1661017 | 295  |
| 7101202 | CELLULAR TELEPHONES                                                                 | 0.3247012 | 0.0896414 | 0.2350598 | 1506 |
| 7101203 | MOTOR TELEPHONES                                                                    | 0.0857143 | 0.0857143 | 0         | 35   |
| 7101204 | FAX MACHINES                                                                        | 0.2481203 | 0.0887218 | 0.1593985 | 665  |
| 7101205 | ANSWERING MACHINES                                                                  | 0.0677966 | 0.0254237 | 0.0423729 | 118  |
| 7101206 | CELL PHONE ACCESSORIES                                                              | 0.1147541 | 0.0568306 | 0.0579235 | 915  |
| 7101301 | TWO-WAY RADIO'S                                                                     | 0.2898551 | 0.1304348 | 0.1594203 | 69   |
| 7102    | MUSICAL INSTRUMENTS                                                                 |           |           |           |      |
| 7102001 | PIANOS                                                                              | 0.0867347 | 0.0408163 | 0.0459184 | 196  |
| 7102002 | ORGANS                                                                              | 0.147541  | 0.0655738 | 0.0819672 | 61   |
| 7102003 | GUITAR                                                                              | 0.1873016 | 0.1047619 | 0.0825397 | 315  |
| 7102004 | FLUTE                                                                               | 0.0773481 | 0.038674  | 0.038674  | 181  |
| 7102005 | TRUMPET                                                                             | 0.0872093 | 0.0465116 | 0.0406977 | 172  |
| 7103    | SOUND AND VIDEO EQUIPMENT                                                           |           |           |           |      |
| 71031   | TELEVISION SETS                                                                     |           |           |           |      |
| 7103101 | MONOCHROME, 250 - 350 MM SCREEN (PORTABLE)                                          | 0.1362496 | 0.0613123 | 0.0749373 | 2789 |
| 7103103 | COLOUR, REMOTE CONTROLE, 510 MM SCREEN                                              | 0.1863865 | 0.0794884 | 0.1068981 | 6567 |
| 7103104 | COLOUR, REMOTE CONTROLE, 700 MM SCREEN                                              | 0.1478054 | 0.0634585 | 0.0843469 | 3782 |
| 71032   | DECODERS                                                                            |           |           |           |      |
| 7103201 | M-NET DECODER                                                                       | 0.0643635 | 0.0321817 | 0.0321817 | 2113 |
| 7103301 | VIDEO RECORDERS                                                                     | 0.1485474 | 0.0608441 | 0.0877033 | 5473 |
| 7103302 | DVD                                                                                 | 0.1517899 | 0.0529986 | 0.0987913 | 4302 |
| 7103401 | AERIALS AND SATELITE DISHES                                                         | 0.10246   | 0.0530213 | 0.0494387 | 4187 |
| 71035   | RADIOS                                                                              |           |           |           |      |
| 7103501 | RADIO/TAPE COMBINATION, PORTABLE                                                    | 0.1025219 | 0.0556469 | 0.046875  | 3648 |
| 7103502 | MUSIC CENTRE OR HI-FI SYSTEM, WITH CD PLAYER, RADIO, DOUBLE TAPE DECK (MEDIUM SIZE) | 0.1453007 | 0.0595967 | 0.085704  | 5554 |
| 7103503 | MOTOR CAR RADIO, RADIO/TAPE COMBINATION, WITH SPEAKERS                              | 0.1151697 | 0.0588741 | 0.0562957 | 2327 |
| 7103601 | VIDEO TAPES, 180 MINUTES PLAYTIME, BLANK                                            | 0.0739419 | 0.0402856 | 0.0336563 | 1961 |
| 7103602 | AUDIO TAPES, 60 MINUTES PLAYTIME, BLANK                                             | 0.0841552 | 0.0506246 | 0.0335306 | 1521 |
| 7103603 | AUDIO TAPES, 90 MINUTES PLAYTIME, BLANK                                             | 0.0731354 | 0.0477915 | 0.025344  | 1381 |
| 7103604 | COMPACT DISCS, VARIOUS ARTISTS, SINGLE                                              | 0.0712909 | 0.0462428 | 0.0250482 | 519  |
| 7103605 | AUDIO TAPES, 60 MINUTES PLAYTIME, VARIOUS ARTISTS                                   | 0.0661157 | 0.0330579 | 0.0330579 | 121  |
| 7103606 | AUDIO TAPES, 90 MINUTES PLAYTIME, VARIOUS ARTISTS                                   | 0.0653595 | 0.0392157 | 0.0261438 | 153  |
| 7104    | PHOTOGRAPHY                                                                         |           |           |           |      |
| 71041   | EQUIPMENT                                                                           |           |           |           |      |
| 7104101 | CAMERAS                                                                             | 0.0898813 | 0.0412663 | 0.048615  | 1769 |
| 7104102 | VIDEO CAMERAS                                                                       | 0.1370469 | 0.0530504 | 0.0839965 | 1131 |
| 7104103 | PROJECTORS                                                                          | 0.1064426 | 0.0392157 | 0.0672269 | 357  |
| 7104104 | FLASHES                                                                             | 0.0649819 | 0.0361011 | 0.0288809 | 554  |

|                                                                      |           |           |           |      |
|----------------------------------------------------------------------|-----------|-----------|-----------|------|
| 71042 FILMS                                                          |           |           |           |      |
| 7104202 35 MM COLOUR FILM, 24 EXPOSURES                              | 0.1279409 | 0.0769979 | 0.050943  | 5143 |
| 7104203 35 MM COLOUR FILM, 36 EXPOSURES                              | 0.1319667 | 0.0723895 | 0.0595772 | 4683 |
| 71043 DEVELOPING OF FILMS                                            |           |           |           |      |
| 7104301 DEVELOPING OF 35 MM COLOUR FILM, 24 EXPOSURES                | 0.0604122 | 0.0461976 | 0.0142146 | 1407 |
| 7104302 DEVELOPING OF 35 MM COLOUR FILM, 36 EXPOSURES                | 0.0677233 | 0.04683   | 0.0208934 | 1388 |
| 7105 SPORTS EQUIPMENT                                                |           |           |           |      |
| 7105001 TENNIS RACKET                                                | 0.0852965 | 0.0487409 | 0.0365556 | 1231 |
| 7105002 TENNIS BALLS                                                 | 0.0918092 | 0.049505  | 0.0423042 | 1111 |
| 7105003 CRICKET BAT                                                  | 0.0818966 | 0.0445402 | 0.0373563 | 1392 |
| 7105004 CRICKET BALL                                                 | 0.0766667 | 0.0506667 | 0.026     | 1500 |
| 7105005 LEG PADS - CRICKET                                           | 0.0621558 | 0.0369788 | 0.025177  | 1271 |
| 7105006 NETBALL - BALL                                               | 0.0581626 | 0.0337079 | 0.0244547 | 1513 |
| 7105007 GOLF BALLS                                                   | 0.0737463 | 0.0383481 | 0.0353982 | 1017 |
| 7105008 BOWLING BALLS                                                | 0.0641628 | 0.0516432 | 0.0125196 | 639  |
| 7105009 SOCCER BALLS                                                 | 0.0572979 | 0.0325694 | 0.0247286 | 1658 |
| 7105011 FISHING RODS, FISHING-LINE, FISH-HOOK, ARTIFICIAL BAIT, ETC. | 0.0570627 | 0.0327409 | 0.0243218 | 1069 |
| 7105012 RIFLES AND AMMUNITION                                        | 0.0958904 | 0.0739726 | 0.0219178 | 365  |
| 7106 CAMPING EQUIPMENT                                               |           |           |           |      |
| 7106001 TENT                                                         | 0.2269939 | 0.1042945 | 0.1226994 | 163  |
| 7106002 SLEEPING BAG                                                 | 0.1610738 | 0.114094  | 0.0469799 | 149  |
| 7106003 GROUND-SHEET                                                 | 0.0866142 | 0.0393701 | 0.0472441 | 127  |
| 7106004 SPACE BLANKET                                                | 0.0408163 | 0.0204082 | 0.0204082 | 49   |
| 7106005 RUCKSACK                                                     | 0.1511628 | 0.0581395 | 0.0930233 | 86   |
| 7106006 GAS LAMP                                                     | 0.0862069 | 0.0287356 | 0.0574713 | 174  |
| 7106007 GAS STOVE                                                    | 0.1157025 | 0.0413223 | 0.0743802 | 121  |
| 7106008 THREE-LEGGED POT                                             | 0.0510949 | 0.0364964 | 0.0145985 | 137  |
| 7107101 AEROPLANES                                                   |           |           |           |      |
| 7108101 BOATS (INCLUDING OUTBOARD MOTORS)                            |           |           |           |      |
| 7109101 GO-CARTS                                                     |           |           |           |      |
| 7110 ADMISSION CHARGES                                               |           |           |           |      |
| 7110001 CINEMA                                                       | 0.08      | 0.08      | 0         | 1100 |
| 7110002 DRIVE-IN THEATRE                                             | 0.06      | 0.06      | 0         | 1100 |
| 7110003 THEATRE                                                      |           |           |           |      |
| 7110004 CONCERT                                                      |           |           |           |      |
| 7110005 SWIMMING POOL (PUBLIC)                                       |           |           |           |      |
| 7110006 SPORT FACILITIES                                             |           |           |           |      |
| 7111 LICENCES AND RENTAL FEES                                        |           |           |           |      |
| 7111001 TELEVISION LICENCES                                          |           |           |           |      |
| 7111002 RENTAL OF TELEVISION SET                                     | 0.1086957 | 0.0869565 | 0.0217391 | 46   |
| 7111003 M-NET SUBSCRIPTION, MONTHLY FEE                              | 0.04      | 0.04      | 0         | 1100 |
| 7111004 RENTAL OF M-NET DECODER                                      | 0.0990909 | 0.0990909 | 0         | 1100 |
| 7111005 RENTAL OF VIDEO MACHINE                                      | 0.057047  | 0.0402685 | 0.0167785 | 298  |
| 7111006 RENTAL OF VIDEO TAPES                                        | 0.0622951 | 0.052459  | 0.0098361 | 305  |
| 7112 PETS                                                            |           |           |           |      |
| 7112001                                                              | -         | -         | -         | 0    |
| 7112002                                                              | -         | -         | -         | 0    |
| 7112003                                                              | -         | -         | -         | 0    |
| 7112004                                                              | -         | -         | -         | 0    |
| 71121 PURCHASE OF PETS                                               |           |           |           |      |
| 7112101 DOG                                                          | 0.0888252 | 0.0601719 | 0.0286533 | 349  |
| 7112102 CAT                                                          | 0.0458015 | 0.0267176 | 0.019084  | 262  |
| 7112103 PARROT                                                       | 0.1301483 | 0.0609555 | 0.0691928 | 607  |
| 7112104 BUDGIE                                                       | 0.0697013 | 0.0526316 | 0.0170697 | 703  |
| 7112105 COCKATIEL                                                    | 0.0894886 | 0.0539773 | 0.0355114 | 704  |
| 7112106 HAMSTER                                                      | 0.0621469 | 0.0324859 | 0.029661  | 708  |
| 71122 FOODS/FEEDS                                                    |           |           |           |      |
| 7112201 DOG BISCUITS (E.G. "BEENO")                                  | 0.1907855 | 0.1250254 | 0.0657601 | 4927 |
| 7112202 DOG FOOD, PELLETS (E.G. "EPOL")                              | 0.1737844 | 0.1100775 | 0.0637068 | 7095 |
| 7112203 DOG FOOD, IN TINS                                            | 0.1860977 | 0.1288369 | 0.0572608 | 7265 |
| 7112204 CAT FOOD, IN TINS                                            | 0.187905  | 0.1282697 | 0.0596352 | 8334 |
| 7112205 BIRD SEED                                                    | 0.1403221 | 0.0883996 | 0.0519224 | 6086 |
| 71123 CARE                                                           |           |           |           |      |
| 7112301 DOGGY PARLOUR                                                | 0         | 0         | 0         | 132  |
| 7112302 VETERINARY COSTS                                             |           |           |           |      |
| 7112303 DOG-KENNEL                                                   |           |           |           |      |
| 7112304 DOG-COLLAR                                                   |           |           |           |      |
| 7112305 FLEA POWDER                                                  |           |           |           |      |
| 7112306 MEDICINE FOR WORMS                                           |           |           |           |      |
| 7112307 SHAMPOO                                                      |           |           |           |      |
| 7113 GARDENING                                                       |           |           |           |      |
| 7113001 SEED                                                         |           |           |           |      |
| 7113002 PLANTS                                                       |           |           |           |      |

|         |                                                                                  |           |           |           |      |
|---------|----------------------------------------------------------------------------------|-----------|-----------|-----------|------|
| 7113003 | SHRUBS                                                                           |           |           |           |      |
| 7113004 | TREES                                                                            |           |           |           |      |
| 7113005 | PLANT AND PEST SPRAY REMEDIES                                                    |           |           |           |      |
| 7114001 | BOUQUETS AND CUT FLOWERS FOR HOUSEHOLD USE                                       |           |           |           |      |
| 7115001 | GAMES, TOYS AND HOBBIES                                                          |           |           |           |      |
| 7116    | MEMBERSHIP FEES                                                                  |           |           |           |      |
| 7116001 | LIBRARY FEES AND FINES                                                           |           |           |           |      |
| 7116002 | GYMNASIUMS                                                                       |           |           |           |      |
| 7116003 | HEALTH CLUBS                                                                     |           |           |           |      |
| 7116004 | SPORTS CLUBS                                                                     |           |           |           |      |
| 7116005 | SOCIAL CLUBS                                                                     |           |           |           |      |
| 7117    | OTHER                                                                            |           |           |           |      |
| 7117001 | POWER DRIVEN AND OTHER TOOLS                                                     |           |           |           |      |
| 7117002 | POTTERY CLASSES                                                                  |           |           |           |      |
| 7117003 | CLASSES IN WOODWORK                                                              |           |           |           |      |
| 7117004 | CLASSES IN INTERIOR DECORATING                                                   |           |           |           |      |
| 7117005 | OTHER                                                                            |           |           |           |      |
| 72      | READING MATTER                                                                   |           |           |           |      |
| 721     | BOOKS                                                                            |           |           |           |      |
| 72101   | BIBLE                                                                            |           |           |           |      |
| 7210101 | AFRIKAANS                                                                        | 0.0635593 | 0.0514528 | 0.0121065 | 1652 |
| 7210102 | ENGLISH                                                                          | 0.0735632 | 0.0597701 | 0.0137931 | 1740 |
| 72102   | DICTIONARY                                                                       |           |           |           |      |
| 7210201 | ENGLISH                                                                          | 0.0812721 | 0.0594817 | 0.0217903 | 1698 |
| 7210202 | BILINGUAL (ENGLISH/AFRIKAANS)                                                    | 0.0815013 | 0.0595174 | 0.0219839 | 1865 |
| 7210301 | CHILDREN'S ENCYCLOPEDIA                                                          | 0.0522388 | 0.0298507 | 0.0223881 | 268  |
| 7210401 | COOKING/RECIPE BOOK                                                              | 0.0498054 | 0.0381323 | 0.0116732 | 1285 |
| 7210501 | GARDENING BOOK                                                                   | 0.0630252 | 0.0406162 | 0.022409  | 714  |
| 7210601 | ATLAS                                                                            | 0.0675676 | 0.0540541 | 0.0135135 | 1406 |
| 7210701 | PRINCIPLES OF ECONOMICS - P.A. SAMUELSON                                         | 0.1078652 | 0.0786517 | 0.0292135 | 445  |
| 7210801 | TEACH YOURSELF CALCULUS                                                          | 0.0581717 | 0.0360111 | 0.0221607 | 361  |
| 72109   | WILLIAM SHAKESPEARE                                                              |           |           |           |      |
| 7210901 | JULIUS CAESAR                                                                    | 0.0634191 | 0.0496324 | 0.0137868 | 1088 |
| 7210902 | ROMEO AND JULIET                                                                 | 0.0800801 | 0.0620621 | 0.018018  | 999  |
| 72110   | VOLUME OF VERSE                                                                  |           |           |           |      |
| 7211001 | AFRIKAANS                                                                        | 0.0497018 | 0.0397614 | 0.0099404 | 503  |
| 7211002 | ENGLISH                                                                          | 0.0686901 | 0.0543131 | 0.014377  | 626  |
| 72111   | STORYBOOK - CHILDREN                                                             |           |           |           |      |
| 7211101 | AFRIKAANS                                                                        | 0.0413223 | 0.0268595 | 0.0144628 | 968  |
| 7211102 | ENGLISH                                                                          | 0.0460653 | 0.0297505 | 0.0163148 | 1042 |
| 72112   | FICTION - ADULTS                                                                 |           |           |           |      |
| 7211201 | AFRIKAANS                                                                        | 0.0448485 | 0.030303  | 0.0145455 | 825  |
| 7211202 | ENGLISH                                                                          | 0.0474138 | 0.0280172 | 0.0193966 | 928  |
| 7221001 | MAGAZINES                                                                        | 0.8       | 0.8       | 0         | 1100 |
| 7231001 | NEWSPAPERS                                                                       | 0.66      | 0.66      | 0         | 1100 |
| 73      | EDUCATION                                                                        |           |           |           |      |
| 7301    | TUITION AND ATTENDANCE FEES                                                      |           |           |           |      |
| 7301101 | DAY-CARE MOTHERS, CRECHES AND PLAYGROUPS                                         |           |           |           |      |
| 7301102 | PRE-PRIMARY SCHOOLS, AFTER SCHOOL CENTRES                                        |           |           |           |      |
| 7301103 | SCHOOL FEES                                                                      |           |           |           |      |
| 7301104 | TEACHERS' TRAINING, AGRICULTURAL AND TECHNICAL COLLEGES AND TECHNICON            |           |           |           |      |
| 7301105 | UNIVERSITY FEES                                                                  |           |           |           |      |
| 7301106 | PRIVATE TUITION (IN SCHOOL SUBJECTS)                                             |           |           |           |      |
| 73021   | OTHER COSTS                                                                      |           |           |           |      |
| 7302101 | CONTRIBUTIONS TO SPORT GROUNDS, DONATIONS FOR BUILDING OF EXTRA CLASSROOMS, ETC. |           |           |           |      |
| 7302102 | EXCURSIONS, FIELDTRIPS                                                           |           |           |           |      |
| 8       | PERSONAL CARE                                                                    |           |           |           |      |
| 801     | HAIRDRESSING                                                                     |           |           |           |      |
| 8011    | MEN AND HIGH SCHOOL BOYS                                                         |           |           |           |      |

|                                           |           |           |           |      |
|-------------------------------------------|-----------|-----------|-----------|------|
| 8011001 HAIR CUT                          | 0.0452481 | 0.0428154 | 0.0024327 | 6166 |
| 8012 PRIMARY SCHOOL BOYS                  |           |           |           |      |
| 8012001 HAIR CUT                          | 0.0447368 | 0.0381579 | 0.0065789 | 6080 |
| 8013 WOMEN AND GIRLS                      |           |           |           |      |
| 8013001 CUT AND BLOW-WAVE                 | 0.0495595 | 0.0453377 | 0.0042217 | 5448 |
| 8013002 SET                               | 0.0486456 | 0.0429225 | 0.005723  | 5242 |
| 8013003 COLOUR SHAMPOO                    | 0.0472973 | 0.0437078 | 0.0035895 | 4736 |
| 8013004 HIGHLIGHTS                        | 0.0493886 | 0.0457924 | 0.0035963 | 4171 |
| 8013005 PERMANENT WAVE ("PERM")           | 0.0425654 | 0.0389387 | 0.0036266 | 5239 |
| 802 ELECTRICAL APPLIANCES                 |           |           |           |      |
| 8021001 HAIRDRIER                         | 0.08      | 0.04      | 0.04      | 75   |
| 8021002 HOT BRUSH                         | 0.1388889 | 0.0555556 | 0.0833333 | 36   |
| 8021003 WARM CURLERS                      | 1         | 0.5       | 0.5       | 2    |
| 8021004 SHAVER, ELECTRICAL                | 0.1538462 | 0.0512821 | 0.1025641 | 39   |
| 803 HAIR PREPARATIONS                     |           |           |           |      |
| 8031001 SHAMPOO                           | 0.1560936 | 0.1001048 | 0.0559888 | 8591 |
| 8031002 HAIR SPRAY                        | 0.1467282 | 0.0975033 | 0.0492249 | 8451 |
| 8031003 MOUSSE                            | 0.120385  | 0.0775751 | 0.0428099 | 6961 |
| 8031004 GEL                               | 0.12687   | 0.0782509 | 0.0486191 | 6952 |
| 8031005 RELAXERS                          | 0.1224653 | 0.072572  | 0.0498933 | 3748 |
| 8031006 COLOUR SHAMPOO                    | 0.1188856 | 0.0759251 | 0.0429604 | 4702 |
| 8031007 CONDITIONER                       | 0.1448821 | 0.0881832 | 0.0566989 | 7337 |
| 8031008 OTHER                             | 0.1233234 | 0.0774963 | 0.0458271 | 2684 |
| 804 CLEANSERS                             |           |           |           |      |
| 8041001 TOILET SOAP                       | 0.1910303 | 0.1240398 | 0.0669905 | 8852 |
| 8041002 BATH OILS                         | 0.1369472 | 0.086226  | 0.0507212 | 6309 |
| 8041003 BATH SALTS                        | 0.1347165 | 0.0998617 | 0.0348548 | 7230 |
| 805 DENTAL CLEANSERS                      |           |           |           |      |
| 8051001 TOOTHPASTE                        | 0.2254335 | 0.130717  | 0.0947166 | 9861 |
| 8051002 TOOTH BRUSH                       | 0.1236094 | 0.0767614 | 0.046848  | 8090 |
| 8051003 MOUTH-WASH                        | 0.1564832 | 0.1061101 | 0.0503731 | 8576 |
| 8051004 DENTAL FLOSS                      | 0.1319014 | 0.0892081 | 0.0426934 | 7589 |
| 806 SHAVING REQUISITES                    |           |           |           |      |
| 8061001 SHAVING SOAP                      | 0.1242105 | 0.0702256 | 0.053985  | 6650 |
| 8061002 SHAVING CREAM                     | 0.1349063 | 0.0850798 | 0.0498265 | 7205 |
| 8061003 RAZOR BLADES                      | 0.1313709 | 0.0809083 | 0.0504626 | 5945 |
| 8061004 AFTER-SHAVE LOTION                | 0.1098325 | 0.0786344 | 0.0311981 | 7821 |
| 807 SKIN CREAMS AND LOTIONS               |           |           |           |      |
| 8071001 FACIAL CREAM                      | 0.152452  | 0.1018124 | 0.0506397 | 7504 |
| 8071002 HAND- AND BODY LOTION             | 0.1975847 | 0.1156212 | 0.0819635 | 8943 |
| 808 PERFUMES AND COLOGNES                 |           |           |           |      |
| 8081001 PERFUME                           | 0.0794783 | 0.0553043 | 0.0241739 | 5750 |
| 8081002 COLOGNE                           | 0.0875639 | 0.0609881 | 0.0265758 | 5870 |
| 809 MAKE-UP PREPARATIONS                  |           |           |           |      |
| 8091001 LIPSTICK                          | 0.0740691 | 0.0549202 | 0.0191489 | 7520 |
| 8091002 FOUNDATION                        | 0.0863968 | 0.0606484 | 0.0257484 | 6447 |
| 8091003 EYELINER                          | 0.0750104 | 0.0519409 | 0.0230695 | 7239 |
| 8091004 MASCARA                           | 0.0895651 | 0.0610019 | 0.0285632 | 6967 |
| 8091005 NAIL POLISH                       | 0.0790038 | 0.0570675 | 0.0219363 | 6063 |
| 8091006 NAIL POLISH REMOVER               | 0.1038322 | 0.0713361 | 0.0324961 | 7724 |
| 8091007 EYE SHADOW                        | 0.0726296 | 0.0551081 | 0.0175215 | 7077 |
| 8091008 BLUSHER                           | 0.0680659 | 0.0524705 | 0.0155954 | 6861 |
| 810 WIGS, HAIR PIECES AND HAIR EXTENSIONS |           |           |           |      |
| 8101001 WIG                               | 0.073396  | 0.0540986 | 0.0192974 | 6063 |
| 8101002 HAIR PIECE                        | 0.1210416 | 0.0898979 | 0.0311437 | 7642 |
| 8101003 HAIR EXTENSIONS                   | 0.1849292 | 0.1129745 | 0.0719547 | 8825 |
| 811 POWDER AND DEODORANTS                 |           |           |           |      |
| 8111001 FACIAL POWDER                     |           |           |           |      |
| 8111002 BODY POWDER                       |           |           |           |      |
| 8111003 BABY POWDER                       |           |           |           |      |
| 8111004 DEODORANT - ROLL ON               | 0.171694  | 0.1075048 | 0.0641892 | 8288 |
| 8111005 DEODORANT - AEROSOL               | 0.1829021 | 0.1129359 | 0.0699663 | 8890 |
| 8121001 TOILET PAPER                      | 0.1437083 | 0.0897274 | 0.0539809 | 5539 |
| 813 OTHER REQUISITES                      |           |           |           |      |
| 8131001 DISPOSABLE NAPPIES                | 0.1189076 | 0.072479  | 0.0464286 | 4760 |
| 8131002 PAPER HANDKERCHIEFS               | 0.1042159 | 0.0685579 | 0.035658  | 5076 |
| 8131003 TISSUES                           | 0.1557349 | 0.0992445 | 0.0564904 | 5824 |
| 8131004 SANITARY TOWELS                   | 0.1598235 | 0.1002715 | 0.0595521 | 5894 |
| 8131005 TAMPONS                           | 0.1666953 | 0.1041416 | 0.0625537 | 5819 |
| 8131006 CONDOMS                           | 0.116129  | 0.0792627 | 0.0368664 | 4340 |
| 8131007 OTHER                             | 0.1664362 | 0.1021431 | 0.0642931 | 5786 |
| 901 OTHER GOODS AND SERVICES              |           |           |           |      |

|         |                                                             |           |           |           |      |
|---------|-------------------------------------------------------------|-----------|-----------|-----------|------|
| 9010101 | WATCHES                                                     |           |           |           |      |
| 9010201 | HANDBAGS                                                    |           |           |           |      |
| 9010301 | TRAVELLING BAGS                                             |           |           |           |      |
| 9010401 | SCHOOLBAGS                                                  |           |           |           |      |
| 9010501 | PRAMS AND PUSH-CARTS FOR BABIES (3 IN 1)                    | 0.0480349 | 0.0262009 | 0.0218341 | 458  |
| 9010601 | CARRY-COTS                                                  | 0.075     | 0.04375   | 0.03125   | 160  |
| 9010701 | SITTING CHAIR, FOR USE IN CAR                               | 0.1219512 | 0.0792683 | 0.0426829 | 328  |
| 9010801 | UMBRELLAS                                                   |           |           |           |      |
| 9010901 | SUNGLASSES                                                  |           |           |           |      |
| 9011001 | POCKET-KNIVES                                               |           |           |           |      |
| 90111   | STATIONERY                                                  |           |           |           |      |
| 9011101 | WRITING PAD                                                 | 0.0787037 | 0.0500842 | 0.0286195 | 2376 |
| 9011102 | WRITING PAD WITH ENVELOPES - SET                            | 0.0443491 | 0.0314735 | 0.0128755 | 699  |
| 9011103 | ENVELOPES                                                   | 0.057724  | 0.0401319 | 0.0175921 | 1819 |
| 9011104 | POSTCARDS                                                   | 0.0409664 | 0.0346639 | 0.0063025 | 952  |
| 9011105 | PENCILS                                                     | 0.0806321 | 0.0583468 | 0.0222853 | 2468 |
| 9011106 | PENS                                                        | 0.0819239 | 0.0554968 | 0.0264271 | 1892 |
| 90112   | MEMBERSHIP AND MEMBERS' FEES                                |           |           |           |      |
| 9011201 | TRADE UNIONS AND STAFF ASSOCIATIONS                         |           |           |           |      |
| 9011202 | PROFESSIONAL ASSOCIATIONS                                   |           |           |           |      |
| 9011203 | SCIENTIFIC, ART AND CULTURAL SOCIETIES                      |           |           |           |      |
| 90113   | SMOKERS' REQUISITES                                         |           |           |           |      |
| 9011301 | PIPE                                                        |           |           |           |      |
| 9011302 | CIGARETTE LIGHTER                                           |           |           |           |      |
| 9011303 | CIGARETTE FILTERS                                           |           |           |           |      |
| 90114   | PROFESSIONAL FEES                                           |           |           |           |      |
| 9011401 | LEGAL FEES                                                  |           |           |           |      |
| 9011402 | ARCHITECTS' FEES                                            |           |           |           |      |
| 9011403 | AUDITOR- OR ACCOUNTANT FEES                                 |           |           |           |      |
| 90115   | FUNERAL EXPENSES                                            |           |           |           |      |
| 9011501 | COST OF FUNERAL                                             | 0.9536364 | 0.7281818 | 0.2254545 | 1100 |
| 9011502 | GRAVESTONE                                                  | 0.9536364 | 0.7281818 | 0.2254545 | 1100 |
| 9011503 | MAINTENANCE OF GRAVES                                       |           |           |           |      |
| 90116   | FINANCE AND BANK CHARGES                                    |           |           |           |      |
| 901161  | BANK CHARGES                                                |           |           |           |      |
| 9011611 | CHEQUE BOOKS                                                | 0         | 0         | 0         | 1100 |
| 9011612 | SERVICE CHARGES                                             | 0         | 0         | 0         | 1100 |
| 9011613 | INTEREST/FINANCE CHARGES                                    | 0.22      | 0.08      | 0.14      | 1100 |
| 9011614 | REPAYMENTS ON PERSONAL AND OVER DRAFT LOANS                 | 0.22      | 0.08      | 0.14      | 1100 |
| 90117   | INSURANCE                                                   |           |           |           |      |
| 9011701 | LIFE AND ENDOWMENT POLICIES                                 | 0         | 0         | 0         | 1100 |
| 9011702 | FUNERAL POLICIES                                            | 0         | 0         | 0         | 1100 |
| 9011703 | ACCIDENT POLICIES (holidays(luggage medical))               | 0         | 0         | 0         | 1100 |
| 9011704 | INSURANCE OF CONTENTS OF DWELLING                           | 0.1063636 | 0.1009091 | 0.0054545 | 1100 |
| 9011705 | PACKAGE INSURANCE (COMPREHENSIVE INSURANCE)                 | 0         | 0         | 0         | 1100 |
| 90118   | MEALS AND SNACKS CONSUMED AWAY FROM HOME                    |           |           |           |      |
| 9011801 | CONSUMED IN HOTELS, RESTAURANTS                             | 0.9709091 | 0.68      | 0.2909091 | 1100 |
| 9011802 | TAKE-AWAY MEALS                                             | 0.9709091 | 0.68      | 0.2909091 | 1100 |
| 9011803 | IN STAFF CAFETERIAS                                         | 0.9709091 | 0.6809091 | 0.29      | 1100 |
| 90119   | OTHER                                                       |           |           |           |      |
| 9011901 | CONTRIBUTIONS TO PENSION FUNDS, PROVIDENT AND ANNUITY FUNDS |           |           |           |      |
| 9011902 | SWIMMINGPOOL EQUIPMENT AND REPAIRS                          |           |           |           |      |
| 9011903 | GARDEN AND SWIMMING POOL MAINTENANCE                        |           |           |           |      |
| 9011904 | ALIMONY PAID TO FAMILY MEMBERS AND DEPENDANTS               |           |           |           |      |
| 9011905 | GIFTS                                                       |           |           |           |      |
| 9011906 | TRIBAL LEVIES                                               |           |           |           |      |
| 9011907 | POCKET MONEY FOR CHILDREN                                   |           |           |           |      |
| 9011908 | DONATIONS TO CHURCHES                                       |           |           |           |      |
| 9011909 | DONATIONS TO CHARITY AND POLITICAL ORGANISATIONS            |           |           |           |      |
| 9011911 | CONTRIBUTIONS TO STOKVEL                                    |           |           |           |      |
| 9011912 | SHARES AND UNIT TRUSTS                                      |           |           |           |      |
| 9011913 | INVESTMENT PLANS                                            |           |           |           |      |
| 9011914 | LOBOLA/DOWRY PAID                                           |           |           |           |      |
| 9011915 | RELIGIOUS AND TRADITIONAL CEREMONIES                        |           |           |           |      |
| 9011916 | FINES (E.G. FOR STRAYING LIVESTOCK)                         |           |           |           |      |
| 9011917 | OTHER EXPENDITURE                                           |           |           |           |      |

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