Investigating the Effects of Import Tariffs changes on Domestic Industry Protection, Goods prices and Consumers: The case of Zimbabwe (1996-2014)

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Declaration

This thesis is my original work and has not been presented for any degree award in any other University

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Dedication

To my loving wife, Pride, and our wonderful children, Kunashe and Michael, and my parents, Theresa and the late Alexio Mugocha.

Abstract

The effects of import tariffs on domestic industry protection, domestic goods prices and consumer welfare are relatively under-researched in sub-Saharan African countries. This study fills the void by investigating the Zimbabwean case over the period 1996-2014. This period is interesting as the Zimbabwean economy underwent three unique economic phases. Between 1996 and 1999, the economy was stable, followed by an economic crisis of 2000-2008, and an economic stabilisation period of 2009-2014. The latter period was characterised by a fiscal cash budget and a multiple currency economic system. This meant the country had lost control over its monetary and exchange rate policies. It also incurred fiscal problems as government revenue was mainly restricted to internal sources. Moreover, due to the preceding economic crisis, the country's industrial capacity had dwindled such that most consumer goods were imported from neighbouring countries. Consequently, this study investigates whether the associated import tariffs partly contributed to high goods prices, and compromised trade protection of manufacturing industries as well as household welfare in Zimbabwe. Associated results are important for informing the country's socio-economic development process, in addition to providing lessons to countries that have high chances of adopting both a cash budget and a multiple currency economic system in future.

While chapter 1 provides a broad introduction of the study, Chapter two analyses domestic industry protection in Zimbabwe's manufacturing industries in the case of import tariffs, over the period 1996-2014. Temporary protection of domestic 'infant' industries which cannot effectively compete with 'mature' foreign industries has been ranked as one of the crucial drivers of industrialisation. However, no study, to the best on our knowledge, has ever analysed the domestic industry protection for a country using a cash budget and a multiple currency economic system. The main research problem is the fall in industrial capacity over the period when the country was using the cash budget and the multiple currency economic system. There is a high chance of a connection between the above policies and the dropping industrial capacity working through the trade policy, particularly the import tariffs changes. Hence, this chapter investigates whether Zimbabwe's import tariff policy shifts over time affected domestic industry protection, with consequences on employment and local production. The analysis utilises scheduled import tariff rates from the Zimbabwe Revenue Authority, and data from Eora input-output tables and the World Integrated Trade Solution. Calculated Effective Rates of Protection over time are used as a method to track the trends of industrial protection. Results

showed that domestic industry protection was on the decrease from 1996 to 2014. Instead of protecting domestic industries during the multiple currency period (2009-2014), the Government of Zimbabwe opted to tax most of these industries. The government tended to have been charging higher import tariffs on intermediate inputs when compared to finished products. Furthermore, an analysis of the Effective Rates of Protection components shows that import tariffs on intermediate-inputs are the dominant factor relative to tariffs on finished products and the input-output coefficient. Thus, the Government of Zimbabwe is recommended to focus more on reducing tariffs for intermediate-inputs to address the distortionary effects of trade policy on local industrial development.

Following the negative effect of import tariffs on domestic industry protection, chapter 3 proceeds to investigate the import tariffs pass-through effect on domestic goods prices, over the period 2009-2014. The study of import tariffs pass-through has been observed to be crucial for policymaking, for instance, this may inflate some goods' prices which hurts individual welfare. However, the problem is that extant literature has largely ignored the possibility of spatial dependence of domestic goods prices which potentially brew imprecise estimates of the pass-through effect. This study goes beyond existing studies to account for domestic goods' price distribution across Zimbabwean districts in estimates of the import tariff pass-through effect. The analysis relies on a panel dataset of consumer goods for Zimbabwe and adopted some spatial regression methodology and descriptive techniques. To the best of our knowledge, this is the first study which estimates the import tariffs pass-through whilst accounting for spatial price distribution. Results show a positive spatial dependence on domestic goods prices in Zimbabwe's districts. The import tariff pass-through effect is also shown to be overestimated in models that do not account for domestic spatial price dependence. Thus, the study recommends for spatial rather than non-spatial models when estimating the import tariff pass-through effect, for more precise estimates. More importantly, the study finds that a positive and significant portion of import tariffs is passed on to domestic goods prices. Thus, there is a need for policy to be cautious of the import tariffs increase concerning national inflation and poverty targets.

After establishing the import tariff pass-through effect in chapter 3, chapter 4 goes on to estimate the benefit incidence of import tariffs in Zimbabwe over the period 2009-2014. The research problem here is the growing inequality between urban and rural households and also between male and female-headed households. The analysis relies on import tariffs data from

the Zimbabwe Revenue Authority and FinScope's Income and Expenditure Surveys. The incidence of import tariffs and expenditure shares are compared using Lorenz curve estimations; over time, between male and female-headed households, rural and urban households, and household income groups. The findings indicate that the import tariffs were regressive over the given period, especially in rural areas. Poor households bear much of the import tariff burden when compared to non-poor households. Female-headed households also have a higher import tariff burden compared to male-headed households. These results suggest the need for inequality reducing trade policy reforms. Importantly, designing import tariff structures that cushion poor households from the negative import tariffs effect is important for Zimbabwe. Reducing tariffs of goods largely consumed by poor households will significantly mitigate them from the negative welfare effects of import tariffs changes.

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Chapter 1: Introduction and problem statement

1.1 Background and Context

The literature of trade liberalisation and the assessment of its extent plus effects is pertinent as it is linked to economic growth and welfare changes (Frankel & Romer, 1999; Edwards, 1998; Fischer, 2000; Rodriguez & Rodrik, 1999; Johnson & Robinson, 2001; Rodrik et al., 2004). Kuznets (1951) postulated that high economic growth is associated with improved household welfare and reduced inequality, while Sachs and Warner (2003) maintained that trade liberalised countries grow faster than their less trade liberalised counterparts. Trade liberalisation serves to reduce import tariffs and trade protection which are associated with an increased importation of both finished goods and intermediate inputs. This, in turn, introduces new competition to traditional domestic producers. To withstand the competition domestic producers would be forced to increase efficiency and productivity levels; otherwise, they would exit the market (Shafaeddin, 1998). An increase in domestic producers' productivity is largely associated with more exports and economic growth. Nonetheless, while increased competition indirectly benefits some domestic firms, others are destroyed, threatening domestic production and employee welfare.

1.2 Problem statement

Currently, to the best of our knowledge, no study has investigated, for a country using a cash budget and a multiple currency economic system; firstly how, import tariff-based trade liberalisation affects domestic industry protection; secondly, how the same tariff changes translate to domestic consumer goods prices, namely the import tariffs pass-through effect – at a micro level factoring the spatial distribution of domestic goods prices into the estimations; thirdly, how the import tariff changes influence household welfare of different income groups – benefit incidence.

Existing studies look at import tariffs at a macro level, without considering intra-country regional and population heterogeneity (Rose et al., 2013; Greenaway & Milner, 1993; Hayakawa & Ito, 2015; Mallick & Marques, 2007; Daniels & Edwards, 2006; Selden & Wasylenko, 1992). We maintain that a country-specific study that assesses the effects of import tariff changes on industry protection, domestic goods prices and household welfare provides a comprehensive understanding of the economic effects of import tariff changes – trade liberalisation.

Apart from domestic industry protection, the significance of studying the theme herein is shown by McCulloch et al. (2001). In theory, they present three channels through which trade liberalisation (tariff changes) affects the economy. The first is based on government income and expenditure. The second works through the price transmission mechanism, while the third affects output, wages and employment. Thus, import tariff changes are associated with ‘distortionary’ effects on the economy, industry and household welfare. Understanding the extent of these import tariff effects is an important subject in general, and especially for sub-Saharan African countries. The latter is characterised by high levels of poverty, inequality and deteriorating social fabrics which hamper economic development.

As for domestic (infant) industry protection, List (1846), Mayer (1977), Shafeaddin (2000) and Kusum (2003) are prominent studies on the topic. Shafaeddin (1998) postulated that no country has developed its industry base without the use of infant industry protection, except for Hong Kong. Early industrialised and newly industrialised countries applied the same principle with varying degrees and in diverse ways. Anderson and Neary (1994; 1995), Fedderke and Vaze (2001), Edwards (2005) and Holden (2001) are some of the studies that focused on domestic industry protection, using effective tariff protection rates. These studies showed the significance of the domestic industry protection strategies that were pursued in the quest for industrialisation. However, none of these studies has extended the analysis to unpack whether the import tariff-based trade protection measures had effects on consumer goods prices.

Studies which focused on the effects of trade liberalisation on domestic goods prices include Ahn and Park (2014), Feenstra (1989), Kreinin (1977), Mallick and Marques (2007) and Cavallo et al. (2019). Such studies investigated how import tariffs are passed through to domestic goods prices. They also delved into the effect of the import tariffs pass-through effect on real economic variables like inflation, factor returns, industrialisation, economic growth and household welfare. This echoes the importance of the import tariffs pass-through effect for socio-economic development policies. Nonetheless, the existing studies’ estimates of the pass-through effect are fraught with estimation issues. For example, the price regression models that are usually employed for the analysis do not account for regional price distribution, which is amenable to an omitted variable bias. Currently, this estimation problem subsists in the global import tariffs pass-through literature which is mostly old and concentrated in non-African countries.

Apart from the pass-through effect, the welfare effect of import tariffs has also been investigated through the benefit incidence lens. However, this approach has currently received limited attention in sub-Saharan African countries, yet it aids in unpacking information about winners and losers of an import tariff policy within an economy (see, for instance, Daniels & Edwards, 2006; Prasad et al., 2003). Thus the main contribution of this thesis is of a welfare analysis nature which connects the temporal effect of tariffs on domestic industry protection, domestic goods prices and the tariffs' benefit incidence. This is based on a case study of Zimbabwe. More specifically, this thesis contributes to this strand of international trade literature by attaining three key research questions and objectives, with each examined as a separate empirical chapter.

1.3 Research questions

1. What has been the trend of domestic industry protection in Zimbabwe's manufacturing sector for the period 1996 to 2014?
2. What is the type of spatial distribution of domestic goods prices that exists in various districts of Zimbabwe?
3. Which household groups benefit the most from the recent (2009-2014) import tariffs changes?

1.4 Research objectives

To accompany the above research questions is a set of research objectives:

1. To investigate the trend in domestic industry protection in Zimbabwe's manufacturing sector (1996-2014), using the effective tariff protection rate.

2. To determine the spatial distribution of domestic consumer goods prices across Zimbabwean districts and incorporate it in an analysis of the import tariff pass-through effect (2009-2014).

3. To examine the benefit incidence of import tariffs changes among different population groups in Zimbabwe (2009-2014); male- versus female-headed households; rural vs. urban households.

Achieving these research objectives extends and updates sub-Saharan African studies on the economic effects of import tariff changes. It also helps to uncover whether import tariffs policies in Zimbabwe partly contributed to the country's challenges associated with production and deteriorating human welfare, and suggest some remedial measures. For instance, some of the thesis' key findings, based on applied micro econometric techniques, are that there was a temporal decline in domestic industry protection in key manufacturing industries over the given period. Not controlling for the domestic spatial distribution of prices overstated the non-trivial import tariff pass-through effect incurred in the country. Female-headed households carried a larger tariff burden relative to male-headed households. These findings broadly suggest that inclusive socio-economic development strategies in Zimbabwe need to consider the role of import tariff changes. To contextualise the thesis, the following is a discussion of relevant historical information.

Chapter 2: Background on Zimbabwe

2.1 Background on the economic policies which affected tariffs

Trade liberalisation is still an incomplete agenda in Zimbabwe. Trade liberalisation policies started in the early 1990s when Zimbabwe adopted the Economic Structural Adjustment Program (ESAP). Prior to ESAP, Zimbabwe was pursuing import substitution-based trade policies. This policy had its roots from the trade sanctions that followed the 1965 Unilateral Declaration of Independence[1] (Minter & Schmidt, 1988). During that period, Zimbabwe aimed at strengthening its industrial sector through colossal protection. The country had many trade controls including monitoring exchange rates and foreign currency flows.

All foreign exchange earnings and capital inflows had to be surrendered to the Reserve Bank of Zimbabwe. Industries would access foreign currency through the Direct Local Market Allocation (DLMA) system (Bjurek & Durevall, 1998). The country also had an Export revolving fund for export promotion (Ndlela & Robinson, 1995). The fund allowed exporters access, in advance, to foreign currency required for imported inputs that were used to manufacture goods for specific export orders. This condition pointed to high domestic industry protection. In the late 1990s, the import substitution drive started creating problems for the Zimbabwean economy. These included operational inefficiencies in economic sectors, the decline in import cover, market distortions, a strong parallel market, the creation of rent-seeking behaviour and massive foreign currency shortages (Mudzonga, 2009).

Encumbered with these economic problems, the Bretton Woods Institutions presented the ESAP to Zimbabwe. ESAP had economic reform strategies for all economic sectors. Focusing more on trade, the main objective of the ESAP was for Zimbabwe to undertake trade liberalisation. The Government of Zimbabwe (GoZ) accepted the reform strategies contained in the ESAP which had an incentive of World Bank loans amounting to US$700 million (Mhone & Bond, 2001). Zimbabwe was to remove export incentives, foreign currency controls,

[1] In December 1966, the UN Security Council adopted Resolution 232, which decided that all states shall prevent the 'sale or shipment of arms, ammunition of all types, military aircraft, military vehicles and equipment and materials for the manufacture and maintenance of arms and ammunition' to Southern Rhodesia. The arms embargo was imposed in response to the unilateral declaration of independence by the white Rhodesians in 1965. This was the first mandatory arms embargo agreed by the UN Security Council. In December 1979, satisfied with the progress towards the establishment of a 'free and independent Zimbabwe', the arms embargo was terminated by UN Security Council Resolution 460.

import licencing, reduce import tariffs and normalise the import tariffs band within the range 0 to 30 per cent, remove surtax as well as achieve an export growth of about 9 per cent in the five subsequent years (GoZ, 2000).

These ESAP strategies were implemented in four phases over the period 1993-1995. According to Tekere (2001), the ESAP did not bring the expected results, which culminated in a policy reversal. Table 2-1 shows the general import tariffs changes during and after ESAP. The table divulges the great effort that ESAP brought towards pushing trade liberalisation forward. However, the Zimbabwe Programme for Economic and Social Transformation (ZIMPREST) of 1996-2000 came and inverted the pro-ESAP efforts as seen by raising import tariff rates.

Table 2-1: Import Tariffs of selected goods before, after ESAP and during ZIMPREST

Item	Beginning of ESAP	End of ESAP	During ZIMPREST
Buses	30%	25%	50%
Other commercial vehicles	65%	25-65%	95-100%
Private vehicles	65-85%	60-80%	100%
Motor vehicles	30%	15%	50%
Bicycle parts	30%	15%	50%
Furniture	50%	40%	80%
Selected shoe components	30%	30%	65%
surtax on above commodities	20%	10%	15%

Source: Tekere (2001)

After the ZIMPREST, Zimbabwe implemented a battery of macroeconomic programmes, namely Millennium Recovery Programme (MERP) (2000-2002), National Economic Recovery Programme (NERP) (2003-2004), Macroeconomic Framework (2005-2006), National Economic Development Priority Programme (NEDPP) (2007-2009), Short Term Economic Recovery Programme (STEP) (2009-2010) and the more recent Medium Term Plan (MTP) (2011-2015). These were aimed at promoting export-led industrialisation, export developments, regional and multilateral trade arrangements among others.

Zimbabwe also embarked on trade liberalisation through its participation in multilateral, regional and bilateral trade agreements. Since 1947, Zimbabwe has been a member of the General Agreement on Tariffs and Trade (GATT). It also participated in the Uruguay Round of negotiations during 1986-1994. In 1995, Zimbabwe became a member of the World Trade Organization (WTO), following the termination of the GATT. The main agenda of these multilateral trade agreements concerned trade liberalisation. The specific strategies were the removing of import licences, reduction of tariffs, removal of foreign currency controls, liberalisation of financial sectors, provision of access to markets for the member countries, removing subsidies, reducing protection of domestic industries, among other ingenuities (GoZ, 2009).

Zimbabwe has also been a member of the Southern African Development Community (SADC) and Common Market for Eastern and Southern Africa (COMESA) regional integration groups. In these groups, members undertook unilateral trade liberalisation. The country also had bilateral trade agreements with South Africa, Botswana, Namibia, among others. Participation in these trade agreements is meant to propel trade liberalisation. Ideally, this is supposed to benefit member countries through access to markets, exchange of production technology, administration skills, market information, inter alia.

2.2 Multiple-currency and Cash budgeting economic system

Adverse economic effects of ESAP, combined with political-economic developments such as the unbudgeted compensation to War Veterans in 1997 and the Fast Track Land Reform Programme of the early 2000s, spurred the country into an economic crisis - 2000-2008. This was characterised by hyperinflation and a loss in value and confidence in the domestic currency, inflation soared to 231 million per cent in 2008. Moreover, there was a high and unjustifiable budget deficit; a rising balance of payments deficit and dwindling government foreign currency reserves; low industrial capacity, high unemployment, and a growing multiple-currency parallel market, among others. Consequently, the Zimbabwean government abandoned the Zimbabwean dollar as the only legal tender and adopted a multiple-currency regime during the period 2009-2014. This was akin to a full currency substitution where domestic currency was replaced by foreign currency in domestic transactions (Ho, 2003).

Currency substitution is mostly pursued to bring temporary stability to an economy plagued by hyperinflation and massive devaluation of domestic currency (Sarajevs, 2000)[2]. Other countries that used foreign currencies as legal tender or were dollarised at some point in time include Guatemala, Ecuador, Liberia, Monaco, Micronesia, Andorra (Minda, 2005; See Appendix Table 2-A.1). In 2009, Zimbabwe adopted the United States of American Dollar, the

[2] However, some countries dollarise/ use foreign currencies as legal tender in preparation to join a monetary union, while others do so with the aim of attracting a foreign investor for whom it would be easier to invest in the adopted currency.

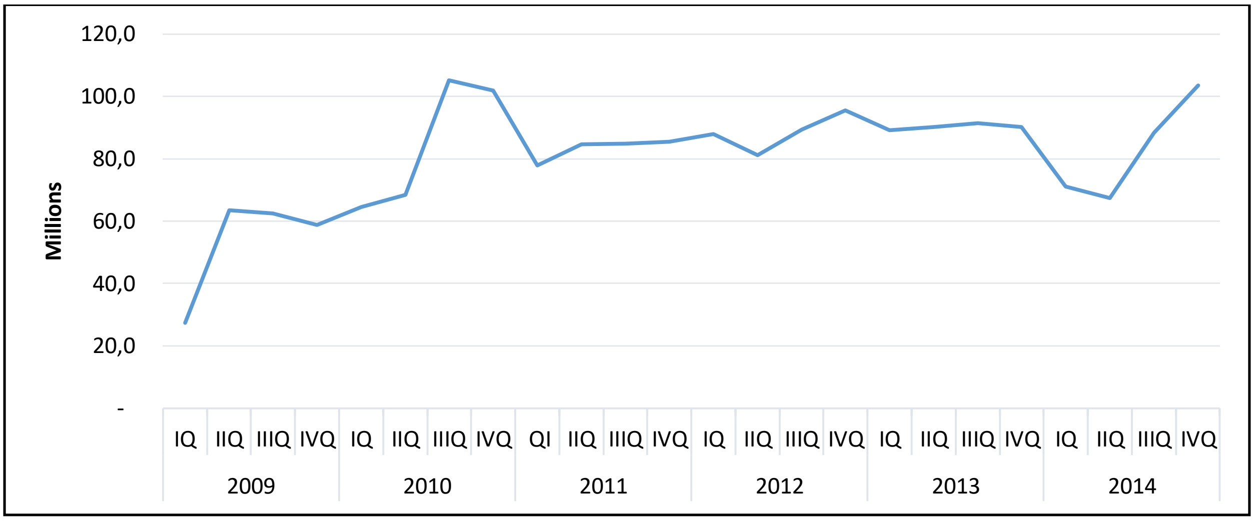
Euro, the United Kingdom Pound sterling, the South African Rand and the Botswana Pula. In 2014, four additional currencies were included, namely the Australian Dollar, the Chinese Yuan, the Indian Rupee, and the Japanese Yen (Reserve Bank of Zimbabwe, 2014). Although the multi-currency system had positive effects on domestic consumers, the government had limited power to protect the country from imported goods' pricing models. For instance, it had lost control over monetary and exchange rate policies.

Simultaneous with the multiple-currency, the GoZ adopted a cash budget system - labelled as "What we gather is what we eat" or "We eat what we kill" (GoZ, 2009, 2010). This aimed to inculcate fiscal discipline and reduce the government deficit[3]. Government expenditure was limited to tax revenues and grants from donors; there was no quasi-fiscal expenditure and money printing. The system also prohibited financing of government deficits (GoZ, 2009) which further ruled out external or internal borrowing. All government revenues were directly remitted to the national treasury for allocation to different line ministries. Figure 2-1 shows the quarterly custom duty collected by the government from 2009 to 2014.

The extent to which this system reduced the budget deficit and improved fiscal discipline, however, remains unknown. Nonetheless, chances are high that taxes were increased to mobilise revenue and match growing government expenditure. Thus, import tariffs could have been targeted given the contemporaneous reliance on foreign goods. The line graph in Figure 2-1 shows a general upward trend. However, this trend is not purely attributable to import tariffs as customs duty also includes surcharges and rebates. This raises a need to unpack reasons for this trend, and the effects of import tariff changes on the Zimbabwean economy concerning industry and household welfare.

[3] A few countries have at a certain point implemented the cash budget in their fiscal revenue and expenditure controls. The countries include Peru, Bosnia-Herzegovina, Tanzania, Uganda and Zambia (Stasavage & Moyo, 1999). The main objective of adopting a cash budget is to reduce budget deficits through expenditure control (Campos, Ed & Sanjay, 1996). There are also some disadvantages which come with the cash budget. These include; the increase in volatility of expenditure, the skewed composition of expenditure and sometimes side-lining of line ministries in the budgeting process (Keefer & David, 1998).

Figure 2-1: Customs Duty Collections (US$ millions)



Sources: Government of Zimbabwe (2015). Fiscal Policy Statement.

2.3 Structure of the thesis

The remainder of the thesis is structured as follows. Chapter 3 investigates domestic industry protection in Zimbabwe's manufacturing industries using effective protection rates and distinguishes the key components of the effective protection rates. Chapter 4 analyses the import tariffs pass-through effect accounting for the spatial distribution of domestic consumer goods prices in Zimbabwe. Chapter 5 carries out a benefit incidence analysis of import tariffs. The general conclusion and policy recommendations are discussed in Chapter 6.

Notably, Chapter 3 covers the period 1996-2014. Chapters 4 and 5 are based on the period 2009-2014 - that is the period when Zimbabwe was using the multiple currency and the cash budget economic system. The reason for Chapter 3 starting before 2009 is to provide a longer view of the behaviour of domestic industry protection. The period before 2009 is compared to the period 2009-2014 as we contrast the trends in domestic industry protection. Domestic protection trends could also have been estimated from years before 1996. However, the scheduled import tariffs rates pre-1996 are not easily available in the Zimbabwe National Statistical Agency library. The upgrade of the Zimbabwe Revenue Authority (ZIMRA) Automated Systems for Customs Data (ASYCUDA) system in 2001 to ASYCUDA version 3.0 also makes it hard to access the import tariffs schedule pre-1996.

Chapter 3: Domestic Industry Protection: Case for tariffs in Zimbabwe's manufacturing sector (1996-2014)

3.1 Introduction

Dating back to as early as the 18th (Smith, 1776; Hamilton, 1790) and 19th (List, 1846) centuries, the argument for the protection of domestic industries against foreign competition remains a contentious topic in international trade (List, 1846; Mayer, 1977; Breslin, 2011; Cheng et al., 2019a). Some countries institute tariff and non-tariff barriers to international trade to protect their domestic (infant) industries against unfair competition from countries that subsidise their exporting industries (Shafeaddin, 2000; Greenaway & Milner, 1993). Domestic industry protection also allows infant industries time to grow before they can compete fairly with 'mature' international industries (Kusum, 2003). Shafaeddin (1998) postulated that no country has developed its industry base without the use of infant industry protection, except for Hong Kong. The author claims that early industrialised and newly industrialised countries applied the same principle with varying degrees and in diverse ways. In trying to promote domestic industrial development, domestic industry protection is also instrumental in protecting domestic employment (Breslin, 2011). However, infant industry protection may be met with some operational inefficiencies and rent-seeking behaviour such that some targeted industries may never grow to the level of foreign competitors (Cheng et al., 2019b). It may also solicit retaliation from trading partners. Thus, whether domestic industry protection is good or bad is debatable among trade economists. What is agreed is that domestic industry protection affects the industries' value-added.

An increase in import tariffs of finished goods and a decrease in tariffs of intermediate goods serves to increase domestic industries' value-added, ceteris paribus, while the opposite also applies (Corden, 1985; Rose et al., 2013). Value-added is linked to firms' profitability and survival. Industries with a high value-added receive relatively higher profits and have greater chances of survival than the opposite (Milner, 1990; Moser & Rose, 2011). Firms' survival and profitability are further connected to the performance of the aggregate economy. Greenaway and Milner (1991) showed that domestic industry protection is directly connected to employment, productivity and economic growth. Thus, all economies strive to establish high value-addition industries that translate into better economic indicators. Arguably, the study of domestic industry protection is costly for policy-makers in developing countries to ignore. Especially, given that there is a resurgent interest in the topic since major trading economies such as the United Kingdom and the United States of America are moving back into trade protectionism (Cavallo et al., 2019).

In assessing the progress of domestic industry protection/ trade liberalisation, literature uses qualitative and quantitative techniques. These include Nominal Rates of Protection and Effective Rates of Protection (also referred to as Effective Protection Rates - EPR[4]). For instance, using EPR, Krueger et al. (1981) found high levels of domestic industry protection in Uruguay, Pakistan, Tunisia, Chile and Brazil. The World Trade Organisation (WTO) (2000) discovered a gradually declining domestic industry protection in Bangladesh during the period 1992-2000. Gang and Pandey (1998) revealed different domestic protection rates when using ex-post and ex-ante import tariffs for India. The findings that domestic industry protection varied over time and across countries were also discovered for South Africa (Edwards, 2005; Fedderke & Vaze, 2001, Rangasamy & Harmse, 2003). However, this branch of the empirical literature is now mostly outdated and has been relatively scarce in sub-Saharan Africa. The former is understandable given the importance of free trade in the 21st century. For instance, Sachs and Warner (2003) maintained that trade liberalised countries tended to grow faster than less liberalised ones. This study, nonetheless, argues for an update of empirical studies on domestic industry protection, especially given that some national interests are not covered by WTO provisions for reducing trade barriers. For instance, employment in the textile and poultry industries in some African countries is under threat from foreign competition (Edwards, 2005).

Furthermore, to the best of this author's knowledge, none of the extant domestic industry protection studies has carried out a decomposition analysis of the EPR to ascertain their key components (see, for instance, Anderson, 1995; Anderson & Neary, 1994; Fedderke & Vaze, 2001; Edwards, 2005; Holden, 2001; Holden & Holden, 1978). The EPR is made up of industrial input-output coefficients which can show the level of industrial efficiency, and import tariffs on finished and intermediate goods. Isolating the importance of each of these three components is important for policy purposes. For instance, if the input-output coefficient

[4] EPRs have been used repeatedly in assessing domestic protection regardless of their limitations. Some of the limitations include challenges to incorporate rebates, non-tariffs barriers, and product quality difference, input substitution between imported and domestic inputs, among others.

carries more weight in explaining the EPR, then recommendations for domestic industry protection should place more emphasis on industrial efficiency rather than on import tariffs.

In light of the above, this study has two objectives:

1. To estimate the domestic industry protection trend for Zimbabwe over the period 1996 to 2014, using EPR.
2. To assess the relative importance of EPR components for policy purposes.

Previous studies on EPR for Zimbabwe are either too old or do not cover all industries (Davies, 1973; Zengeni, 2014). Hence, this study serves to update the literature on domestic industry protection in general and in sub-Saharan Africa in particular, using calculated EPR. Its context is also interesting in its own right as the country experienced different economic phases over the given period. From 1996-2008, Zimbabwe was using its currency, and from 2009-2014, it adopted a multiple currency and a cash budget economic system due to political-economic hardships. The cash budget meant that government revenue was mostly raised from taxes and import tariffs. Inasmuch as the government could raise import tariffs to boost revenue collection, this could have hurt domestic industries (Corden, 1985; Kusum, 2003; Pandey, 2004). As such, during part of the period under study, Zimbabwe has been suffering from low economic performance, high unemployment and a declining value-addition in the manufacturing sector (United Nation Development Programme, 2013). Therefore, studying EPR before and during the multiple currency period helps to highlight whether the policy move served to protect or tax domestic industries with adverse effects on the economy. For the analysis, the EPR is calculated using data derived from the Zimbabwe Revenue Authority, World Integrated Trade Solution (WITS) and Eora[5]. Objective two is answered through the analysis of the components of the ERP. The Principal Component Analysis, Factor Analysis and correlation analysis help in identifying key components of the ERP that should be targeted by economic policy.

This chapter is motivated by a massive shut down of manufacturing industries in Zimbabwe that occurred over the period 2009-2014. The National Social Security Authority 2014 report

[5] https://worldmrio.com/

pointed to an average of 10 companies closing down monthly since June 2013[6]. In addition, according to the Confederation of Zimbabwe Industries' (CZI) 2012 survey, the few manufacturing industries that remained were operating below full capacity. Though the country's Macroeconomic Policies focused on outward-oriented growth, Tekere (2001) observed a massive reversal of Trade Liberalisation that was linked to increasing import tariffs post-ESAP period. Such developments threatened the viability of the manufacturing sector.

At the beginning of 2009, the sector was operating at less than 10 per cent capacity level before closing at an average of 36.3 per cent in 2014 (Fiscal Policy Review 2009; CZI, 2009, 2010, 2014). The manufacturing sector's performance was at its peak in the 1990s, well known for its diversity of products and as an important contributor to the country's GDP (16 per cent) (Reserve Bank of Zimbabwe, 2009). It played a key role in the economy as it supplied 50 per cent of its output to the agricultural sector and received 63 per cent of its inputs from this sector. The manufacturing sector was the biggest contributor to GDP between 1980 and 1990 at 22 per cent, followed by agriculture at 14 per cent (CZI, 2009). Some of the manufacturing sector's constraints include foreign competition and lack of a robust industrial policy that can protect and revive the sector. Therefore, this chapter analyses the manufacturing industry's domestic protection from the period 1996-2014. Section 3 presents the theoretical and empirical literature review. Methodology and data are discussed in section 3.3. Findings and conclusion of the study are discussed in sections 3.5 and 3.6.

3.2 Theoretical literature review

Prior to the concept of the Effective Protection Rate (EPR), economists used to rely on the Nominal Protection (NP) rate to evaluate trade protection (Davies, 1973). Nominal protection pertains to the value of finished goods under restrictive trade less the value of the same goods in a free trade situation. The underlying theory of nominal protection was considered restrictive as it only used primary inputs as factors of production. Thus, the NP rate was considered to be biased as it failed to acknowledge the role of intermediate inputs in the production process. This led to the development of a better domestic protection evaluation measure, namely the EPR, by Balassa (1965) and Corden (1966).

[6] National Social Security Authority-Nssa 2014 Annual report. https://www.nssa.org.zw/wp-content/uploads/2013/3/NSSA-ANNUAL-REPORT-2014.pdf

The EPR is generally defined as the proportionate increase in value-added per unit of output induced by import tariffs (Corden, 1971). Value-added refers to the difference between the value of final output and value of inputs used in its production, considering imported finished and intermediate inputs. These also include primary inputs such as labour and capital, intermediate inputs include finished products used to produce other goods. Focusing more on intermediate inputs and following Corden (1985), the mathematical form of value-added of good 1 without tariff distortions, VA_1 , can be represented as:

$$VA_1 = P_1 - P_1 a_{i1} \quad \text{[3.1]}$$

Where P_1 is the unit price of good 1 and a_{i1} is the quantity of intermediate input *i* used in producing a unit of good 1. Equation [3.1] is for the case where both product 1 and intermediate input *i* are produced and obtained on the domestic market. Let's now assume that both product 1 and intermediate input *i* are imported. Then, the tariff distorted VA_1can be presented as:

$$VA_1^* = P_1[(1 + t_1) - a_{i1}(1 + t_i)] \quad \text{[3.2]}$$

where t_1 is import tariff for good 1 and t_i is the import tariff for the intermediate input.

Using equations [3.1] and [3.2] Corden (1985) defined the EPR (r) as:

$$r = \frac{VA_1^* - VA_1}{VA_1} \quad \text{[3.3]}$$

Substituting [3.1] and [3.2] into [3.3] gives:

$$r = \frac{P_1[(1+t_1) - a_{i1}(1+t_i)] - P_1(1 - a_{i1})}{P_1(1 - a_{i1})} \quad \text{[3.4]}$$

Simplifying 3.4 will produce 3.5

$$r = \frac{t_1 - t_i a_{i1}}{1 - a_{i1}} \quad \text{[3.5]}$$

The following inferences can be drawn from [3.5]:

a. if $t_1 = t_i$ then $r = t_1 = t_i$ which means the EPR will be equal to the import tariff rate.
b. if $t_1 > t_i a_{i1}$ then $r > 0$ which implies a positive EPR. This means domestic industries are given some form of protection from international industries. This condition can also

be taken as a sign of a less liberalised economy as the import tariffs policy is being used to prohibit free trade for international industries.

c. if $t_1 < t_i a_{i1}$ or if $t_1 = 0$ then $r < 0$ this translates into a negative EPR. A negative EPR means that domestic industries are being taxed more instead of being protected from international industries. Thus, indicating a liberalised trade policy which is open to trade with the rest of the world.

d. $\frac{\partial r}{\partial t_1} = \frac{1}{1-a_{i1}}$ which means that the EPR increases as import tariffs on a final product increase because $a_{i1} < 1$. Thus an increase (decrease) in import tariffs on final goods will protect (expose) domestic industries from external competition.

e. $\frac{\partial r}{\partial t_i} = -\frac{a_{i1}}{1-a_{i1}}$ which implies that the EPR decreases as import tariffs on intermediate inputs increase.

f. $\frac{\partial r}{\partial a_{i1}} = \frac{t_1 - t_i}{(1-a_{i1})^2}$ which means the relation between EPR and the share of intermediate inputs in total production is positive when $t_1 > t_i$ and negative when $t_1 < t_i$.

The EPR in [3.5] can be further specified as r_k where k is a set of industries ranging from 1, 2, 3…..n. Also if the number of intermediate inputs is expanded to (i=1; 2; …. ; n) then, [3.5] can be generalised as;

$$r_k = \frac{t_k - \sum_{i=1}^{n} a_{ik} t_i}{1 - \sum_{i=1}^{n} a_{ik}} \quad \text{[3.6]}$$

Equation [3.6] has been applied in many analyses of the EPR. Notably, in the derivation above, only two products were considered. However, the computation of effective protection is normally done at an industrial level which means bundling of multiple products that belong to the same industry. They are also made complex as the intermediate inputs of these product bundles should also be accounted for.

It should be noted that the success of equation [3.6] hinges on some assumptions. These include that domestic production and imports are perfect substitutes, fixed international prices are calibrated to 1, import tariffs are the major price wedge between domestic and foreign goods, there are only two groups of factors of production, namely primary and intermediate inputs, the value-added of an industry rises with output as the prices of primary factors also rise. However, despite the extensive application of 3.6 in the literature, it also has some criticisms. Among others, these include the fact that there is no perfect substitution between import and domestic products, the substitution can also be found among the domestic produced goods where expensive intermediate inputs might be substituted with a cheaper and not so good input (Edwards, 2005).

3.3 Empirical literature review

Early studies that applied the EPR concerning trade and industry protection policy include the works of Barber (1955) for Canada, Balassa (1965) for multiple countries, namely, the United States of America (USA), the United Kingdom (UK), Sweden and Japan; Basevi (1966) for the USA. Barber (1955) found low protection for Canada over the period 1929-1955 but cited increasing tariff complexity. Also, on average 20-22.5 per cent tariffs on intermediate goods producing an EPR of 35-40 per cent. Balassa (1965) calculated the EPR for thirty-six industries and found that industries in the USA and Sweden were more protected relative to those in the UK and Japan. Across industries, the USA had the highest protection for industries such as rubber, automobiles, bicycles and motorcycles, other steel products, metal castings, agriculture machinery, among others. Sweden had the highest protection in thirteen industries which include clothing, paper products, other chemical material, chemical products, *inter alia*. The author found effective duties to be lower than nominal tariffs in selected products which included printed matter and ships. Some cases of negative effective protection were recorded in agricultural machinery in the USA, pig iron and paper products in Sweden.

Basevi (1966) found that the EPR for USA industries were much higher than nominal tariffs rates for 1958-1960. EPRs were about one and a half times as high as nominal tariffs. The study showed high protection rates for watches and clocks (102 per cent), lighting fixtures (77.3 per cent), leather gloves and mittens (75.9 per cent). Negative protection was found for petroleum refining with a protection rate of (-7.3 per cent), fertilizers (-6.7 per cent), rice milling (-31.3 per cent), among other products.

Many relatively recent domestic industry protection studies also utilised EPR in their quest to unearth the protection trend. Such studies analyse and compare EPR at different levels, inter-industry and intra-industry (Nambiar, 1983; Greenaway & Milner, 1991; Milner, 1990), cross country (Krueger., et al, 1981) and inter-temporal comparisons (Nambiar, 1983; Kusum, 2003; Pandey, 2004; World Trade Organisation (WTO), 2000).

Nambiar (1983) was among some of the researchers on domestic industry protection during the 1980s when the topic was a more popular study area. The study focused on India, using data for 1961, 1963 and 1973. The author calculated EPR for 44 products/ industries which were later grouped into four, namely, intermediaries, investment and consumption goods comprising basic consumption and non-basic consumption. To complement the EPR, the study also calculated the price difference between domestic and international goods, factoring in the transport cost which should be the wedge difference in the price for complete liberal trade policy. EPR was observed to be lower, compared to the protection derived from comparing the price difference between domestic and international prices. The study also weighted the EPR with imports as it assessed the robustness of a pure EPR. EPRs were found as high as 29950 per cent for rail equipment, 2621 per cent for wood products, 1277 per cent for vegetable oil, and 1240 per cent for plastics. Negative EPRs were obtained for jute textile at -346.30 per cent, petroleum at -334.70 per cent, paper products at -205 per cent, bolts and nut at -82 per cent and tea and coffee at -47.80 per cent. Over time the study found a decrease in protection for intermediaries, non-basic consumer goods and all manufactured goods. Protection was observed increasing for basic consumer goods. Such findings were expected, given an import substitute type of industrial policy which India was pursuing during that period. However, government price controls, differences in product quality and subsidies were cited to have had compromised the EPR calculations.

Kusum (2003) was another inter-temporal EPR study aimed at answering the question “Has protection declined in India manufacturing?” over the period 1980-2000. This study was carried out following restrictive trade regimes in India from the 1950s to the 1970s. The study examined both tariffs and non-tariff barriers covering 72 industries. Three methods of evaluating domestic protection were used, namely, EPR, import coverage and import penetration. The Indian economic trend was broken down into four phases, phase one covered the period 1980-1985, phase two covered 1986-1990 and phase three and four covered the period 1991-1995 and 1996-2000 respectively. The study found that during the first phase, about 70 per cent of the industries had an EPR ranging from 50-150 per cent with the iron and steel, and the fabrics industries having EPR greater than 200 per cent. Phase 2 had a lower protection level with 80 per cent of the industries having EPR in the range 50-100 per cent. Phase 4 was characterised with even lower EPR, with 80 per cent of the industries having EPR ranging from 0-50 per cent. Using the import coverage, the study found a similar trend of reduction of protection across the four phases. WTO (2000) also uncovered for Bangladesh a similar trend of declining domestic protection over the period 1992-2000. This was understandable as many countries were embarking on trade liberalisation during that period.

Another inter-temporal domestic industry protection study for India over the period 1980-1990 was Pandey (2004). It aimed at examining the structure of protection in India's industries and to relate it to later changes in trade policy and industry performance. The study found a declining domestic industry protection trend, and that the manufacturing sector recorded an impressive annual growth rate in output and gross value-addition. Employment growth also increased during 1997-1990, labour productivity, average wages, and the volume and value of exports similarly showed an increasing trend. These favourable economic indicators were largely attributed to trade openness through the reduction of tariff and non-tariff barriers. These findings show the importance of decomposing the EPR and determining the productivity trend in the presence of import tariffs changes.

Gang and Pandey (1998) differentiated tariffs into ex post-realised and ex-ante. The ex-ante tariffs rates are the published ones, also known as the statutory tariffs rates. They inform the market about the formal or potential protection structure to be adopted by the government. Ex post is the realised tariffs rate which is the amount of import duty actually collected divided by the value of actual imports. Such tariffs account for all duty exemptions that the government would have permitted. Ex-ante tariffs rate is adjusted for prohibitive tariffs, quantitative restrictions, price control and illegal activities, such as smuggling and under-invoicing. The study thus found high domestic industry protection when using ex-ante tariffs. Lower and negative protection rates were observed when using ex-post tariff rates.

Krueger et al. (1981) is one of the cross country studies of EPR in manufacturing. The study calculated and compared EPR for 10[7] countries at different time periods. The authors found EPR to be relatively high in Uruguay with an average EPR of 384 per cent ranging from a minimum of 17 per cent to a maximum of 1014 per cent. Following Uruguay was Pakistan with an average EPR of 356 per cent ranging from -6 per cent to 595 per cent. Korea was found to have the least EPR having an average of -1 per cent with a minimum of -15 per cent and a maximum of 82 per cent, followed by Colombia which had an average EPR of 19 per cent with a minimum of -8 per-cent and a maximum of 140 per-cent. The other countries also had

[7] Brazil, Pakistan, Korea, Uruguay, Colombia, Chile, Indonesia, Thailand, Tunisia and Ivory cost

different EPR[8]. This shows that there were no cross country empirical regularities on the extent of domestic industry protection.

Under the domestic protection studies which focused on an inter-industry analysis were Greenaway and Milner (1991) and Milner (1990). These studies reported more detailed estimations of EPR at or below industry level. Greenaway and Milner (1991) focused on Burundi in 1984. The authors analysed the EPR of 9[9] industries specified by-products. At that time, Burundi's food, drink and tobacco products were receiving the highest form of protection with weighted average EPR of 216 per cent ranging from a minimum of 86 per-cent to 2017 per cent. Second in the ranking were wood and paper products which had a weighted average EPR of 159 per cent. The least protected products were in agriculture followed by pharmaceuticals with EPR of 1 per cent and 8 per cent respectively. Milner (1990) undertook a similar study for Cameroon industries. The author grouped the industries into 10 and calculated the EPR weighted by total sales, domestic sales and export sales. The study also found a disproportionate distribution of protection across different products and industries. Again, this suggests that existing findings on EPR cannot be generalised across countries and industries.

Holden (2001) is one of the few studies that applied the theory of effective protection to African countries. The study used South African data and found that during the period 1993-1997 (the period after trade liberalisation in South Africa), effective protection was more correlated to changes in output than the nominal protection. Fedderke and Vaze (2001) also used EPR to evaluate the extent of trade liberalisation in South Africa. Their findings concluded that South Africa was more protected in 1994-98 than it was in 1988-93. In other words, South Africa had actually reversed trade liberalisation.

These findings can be criticised, based on the choice of the import tariffs used. The nominal tariffs which are formulated using the collected rates are not the best tariffs to use. In the presence of huge exemption and rebates, collection rates will bias the EPR. Collection rates do not factor in the tariffs amount that was paid back in rebates or exemptions. Edwards (2005)

[8] Brazil average 62 ranging (4 to 252), Chile average of 175 (-23 to 1140), Indonesia average 119 (-19 to 278), Tunisia average 250 (1 to 737), Ivory Coast average 41 (-25 to 278) and Thailand with an average of 27 (-27 to 236)

[9] Agriculture products, Food, drink and tobacco, Leather and footwear, Textile, Wood and paper products, Metal products, Chemicals, Pharmaceuticals and lastly, Construction.

highlighted that during the period under consideration there were huge exemptions and rebates mostly in the motor vehicle and clothing industries. Rangasamy and Harmse (2003) re-appraised the findings by Fedderke and Vaze (2001). They used scheduled tariff rates, not collection rates, in their EPR estimations. They found a general decline in domestic industrial protection with some variations across industries.

Edwards (2005) used the same model as that of Rangasamy and Harmse (2003) and Fedderke and Vaze (2001). However, he used the schedule import tariffs rate and adjusted for surcharges. The study found that a significant reduction in import tariffs has been achieved in South Africa over the years. However, the reduction is not extraordinary as it was in line with import tariffs reductions in other lower-middle-income countries. Apart from South Africa, there are also studies on protection which were done for African countries such as Ghana (USAID, 2008). USAID (2008) calculated EPR for Ghana with a focus on industry groups strategic to Ghana's industrialisation. Results showed an average EPR of 15 per cent. Furniture had the highest protection rate of 319 per cent followed by plastics at 211 per cent. Basic chemicals recorded the lowest EPR of 7 per cent. However, the study did not look at the inter-temporal EPR dynamics and comparison of protection level of Ghana against other countries in the region or beyond.

There are two studies of EPRs for Zimbabwe. Davies (1973) used qualitative methods to assess the level of domestic protection in the Federation of Rhodesia. Zengeni (2014) calculated the EPR for the Zimbabwean poultry industry only. Therefore, there is a need to update this literature and broaden the industrial focus. The analysis should also cover periods before and after Zimbabwe adopted the cash budget and multiple currency economic system. This helps to assess whether domestic industrial protection was sensitive to these policy changes, especially, given that the reviewed studies were carried out for countries which did not experience fiscal budget problems associated with the cash budget system. Also they did not have exchange rate limitations, for export promotion, associated with the usage of foreign currencies.

An omission that we can observe from the studies reviewed above is that none of them considered the need to decompose or breakdown the EPR to decipher the relative importance of its underlying components. Rather, the studies concentrated on import tariffs without evidence that the tariffs were indeed the dominant component in the EPR and not the input-output coefficient. Taken together, this literature shows that domestic industry protection studies are few in sub-Saharan African countries; hence this study serves to update and extend the literature.

3.4 Methodology

As highlighted in Section 3.1, this study utilises EPRs to measure the extent of domestic trade protection in Zimbabwe. It is reiterated that the EPR is specified as:

$$r_k = \frac{t_k - \sum_{i=1}^{n} a_{ik} t_i}{1 - \sum_{i=1}^{n} a_{ik}} \qquad [3.7]$$

where t_k is import tariff on k[th] finished good, a_{ik} is the input-output coefficient of the i[th] input used to produce k[th] output (or the quantity of the intermediate input good *i* used in the production of one unit of *k*) and t_i is the import tariff on the i[th] intermediate good (Fedderke & Vaze, 2001). As highlighted in Fedderke and Vaze (2001) and Edwards (2005), the equation [3.7] shows that the EPR rises with the increase in import tariffs on final goods, a fall in import tariffs on intermediate inputs, and the rise in the share of intermediate input in total production (Fedderke & Vaze, 2001; Edwards (2005). Adjustments are going to be made to [3.7] to include the amounts of imports. In that respect, imports tariffs will be weighted with the value of products imported in the respective industries. This adjustment will produce:

$$r_k = \frac{t_k w_i - \sum_{i=1}^{n} w_i a_{ik} t_i}{1 - \sum_{i=1}^{n} a_{ik}} \qquad [3.8]$$

where *w* is the weight of the value of imports for the respective industry *i*. More adjustments will be done in terms of grouping and linking the product lines to the appropriate industries in the Zimbabwean context.

Given that the EPR in [3.7] is made up of three components; t_k, a_{ik} , t_i as defined above, the second objective of this study is to assess the relative importance of these components in explaining the EPR. Hypothetically, if either t_k or t_i is more important than a_{ik} it suggests that Zimbabwe needs a trade policy reform to maximise benefits from trade. If a_{ik} is the dominant component, then import tariff reforms will be trivial for trade protection. However, if all three components are equally important in driving the EPR, import tariffs reform will remain relevant for policy purposes.

As for the methodology, naturally a simple linear ordinary least square regression (OLS) of r_k on t_k, a_{ik}, t_i and other regressors could have sufficed for the purpose. The standardised regression coefficients of t_k, a_{ik}, t_i give an indication of the relative importance of these variables in explaining r_k. However, this study is constrained to estimate the OLS equations by data constraints – no information on other determinants of r_k than t_k, a_{ik}, t_i. This also renders regression-based decomposing methods such as Shapley value decomposition and Oaxaca-Blinder (1973) type decompositions difficult to implement in this study.

In breaking down the EPR components, the study intends to use the Principal Component Analysis (PCA) and the Factor Analysis (FA). The idea here is that we express EPR as an index which is calculated using tariffs on finished goods (t_k), input and output coefficient (a_{ik},) and tariffs on intermediate inputs (t_i). The strategy compares the weights attached to these three components in EPR. Principal Component Analysis is a variance-focused approach seeking to reproduce the total variable variance, in which components reflect both common and unique variance of the variable (Jolliffe, 2002). PCA uses eigenvalue decomposition of a data covariance matrix or singular value decomposition of a data matrix, usually after a normalisation step of the initial data (Abdi & Williams, 2010). Through this approach, PCA will show which variable has greater variations which are called loadings under respective components. FA is similar to principal component analysis, in that factor analysis also involves linear combinations of variables.

Different from PCA, FA is a correlation-focused approach seeking to reproduce the inter-correlations among variables, in which the factors represent the common variance of variables, excluding unique variance (Brown, 2006). Under both the PCA and the FA, a valid component should have an eigenvalue equal or greater than 1, the strength of the variable will then be determined using the loading value (Apley & Shi, 2001). A greater loading value means more strength of the variable in determining the variations in the main variable which is EPR in our case. The Kaiser-Meyer-Olkin (KMO) test is done to justify the credibility to the PCA and FA, given our dataset. The KMO return the values between 0 and 1, the rule of thumb is that a KMO value of 0.00 to 0.49 is unacceptable, 0.5 to 0.59 is miserable, 0.60 to 0.69 is mediocre, 0.70 to 0.79 is middling, and 0.80 to 0.89 is meritorious and 0.90 to 1 is marvellous (Cerny & Kaiser, 1977).

One limitation of the PCA and FA is that they force a linear relationship between the variables being tested. The non-linear PCA called Categorical Principal Components Analysis (CATPCA) works with a categorical variable which is not applicable to our continuous variable. To support the PCA and FA we also do a simple Correlation Analysis (CA). CA is a statistical method used to evaluate the strength of the relationship between two quantitative variables. A high correlation means that two or more variables have a strong relationship with each other, while a weak correlation means that the variables are hardly related. In other words, it is the process of studying the strength of that relationship with available statistical data. Correlation analysis is performed to identify the strength of relationships between a pair of variables. The correlation coefficient r varies between −1 and +1 where a perfect correlation is ±1 and 0 is the absence of correlations. Values of r between 0 and 1 reflect a partial correlation, which can be significant or not (Gagné & Iuliano, 2014). The strategy here is to do the pairwise correlation of EPR and the three components t_k, a_{ik}, t_i. The strength of the relationship is determined with the correlation coefficient.

3.5 Data Sources and Analysis

The calculations of the EPR make use of the input and the output tables. The latest complete input-output tables for Zimbabwe were constructed in 1991 by the Zimbabwe Statistical Agency. These input-output tables are old and cannot be used to analyse the period 2009 to 2014. In this regard, the study seeks to use the input-output tables from Eora[10].

Eora input-output tables are employed to calculate the input-output coefficients used in computing the EPRs. Eora publishes individual countries' input-output tables (IOT) and also regional IOT. If domestic statistical agencies publish IOT, Eora will adopt them as they are

[10] https://worldmrio.com/countrywise/ the tables have 26 industries namely Agriculture; Fishing; Mining and Quarrying; Food & Beverages; Textiles and Wearing Apparel; Wood and Paper; Petroleum; Chemical and Non-Metallic; Mineral Products; Metal Products; Electrical and Machinery; Transport Equipment; Other Manufacturing; Recycling; Electricity, Gas and Water; Construction; Maintenance and Repair; Wholesale Trade; Retail Trade; Hotels and Restaurants; Transport; Post and Telecommunications; Financial Intermediation and Business Activities; Public Administration; Education, Health and Other Services; Private Households; Re-export & Re-import

(Lenzen et al., 2012). In the case where the local IOT is not available, Eora constructs proxy IOT using macroeconomics data from different sources including the United Nations System of National Accounts, COMTRADE database, Eurostat and numerous national agencies. Local statistical agencies in Zimbabwe's latest complete IOT were published in 1991. Thus, all the IOT after 1991 that Eora has for Zimbabwe were constructed using the proxy Eora technique. The main advantage of using the Eora input-output tables is that they can give us a longer trend to view the fluctuations in the effective protection rates. It should be noted that the Eora input-output tables have some limitations.

Using multiple data sources is a good idea but can create problems when there are data conflicts. When there is data conflict, Eora runs the data through an optimisation algorithm that gives a weighted result (Lenzen et al., 2012). Using an optimisation method can be problematic since there are many optimisation methods including quadratic, non-linear or linear programming and iteration, among others, which can give different results even when using the same data set. Eora IOT for Zimbabwe from 1996 to 2014 is characterised by small and high fluctuation cell elements between the years which can be challenged along the lines of reliability.

The raw data from different sources used in the construction of Eora IOT might not be enough to support all the cell elements of the IOT matrices. In such a case, the Eora uses an educated guess which will be adjusted as information becomes available. The adjustments are also done using the optimisation algorithm (Lenzen et al., 2013). Therefore, there might be some empty cells in the Eora IOT.

The study also uses import tariffs dataset from the Zimbabwe Revenue Authority. Import tariffs are published in the import tariff handbook and adjustments are made through the statutory instruments. The structure of Zimbabwe's tariffs handbook is so detailed and it is broken down in ways that reflect the trade agreements to which Zimbabwe is a signatory. The Tariff's handbook is broken down into 20 broader topics or chapters. In every chapter, there are subgroups of other headings that describe the finer detail of the product lines covered in those small headings.

The 20 broad headings are also separated into 14 columns as given in Table 3-1 below.

Table 3-1: Column of the import tariffs in Zimbabwe

General	MFN	COMESA/FTA/TAG/MZ	RSA Bilateral	SADC/ZA	SADC-differentiated offers	VAT	Surtax General	Surtax SADC/ZA	SADC differentiated offers

Source: Zimbabwe Revenue Authority 2012 Tariff handbook.

The first column is for the heading codes followed by the commodity codes and the product description columns. The quantity column is the unit of measurement that will be used for every product. Columns 5 to 10 are for duty rates for products from different countries and regions. This study takes the average import tariffs of the product lines and groups them into 26 groups matching the 26 broad topics which are linked to 26 industries. The import tariffs vary across months but yearly averages are constructed for 1996 to 2014. Changes in import tariffs over time were updated using the period's statutory instruments. To elucidate whether there were indeed any variations in import tariffs over the given time, Table 3-2 presents yearly averages of these ad valorem import tariffs across product lines.

Table 3-2 shows the average ad valorem tariffs rate for the periods 1996-1999, 2000-2008 and 2009-2014. These three groupings were not randomly chosen, rather they are justified by Zimbabwe's history. In 1996-1999, the Zimbabwean economy was stable and the country was using its currency. This was followed by an economic crisis period of 2000-2008. During this period, inflation was about 231 million per cent, budget and balance of payments deficits were unsustainable, and there were shortages in foreign exchange and low industrial capacity, among others.

Subsequently, in 2009-2014 the country adopted the multiple currency and cash budget system in a quest to stabilise the economy. Overall, 1996-1999 had relatively high import tariff rates relative to 2000-2008. From period 2000-2008 to 2009-2014, there was a mixture of increasing and decreasing tariffs across industries.

Most industries had higher tariff rates in 1996-1999 when compared to 2000-2008; except for mining of chemical, fertiliser minerals quarrying; processing and preserving of fish and fish products, and manufacture of motor vehicles. As cited in chapter two, post-2000 was associated with trade liberalisation and trade openness as the country was pushing for export-oriented growth. To exemplify the irregularity of tariff changes across industries from 2000-2008 to 2009-2014, manufacturing of electric motors experienced a decrease in tariffs from 52.2 to 14.41 per cent, while manufacturing of furniture's tariffs decreased from 67.78 to 36.47 per cent. On the contrary, manufacturing of other food products had a tariff increase from 6.34 to 22.40 per cent, and manufacturing of beverage and tobacco products' increased from 7.18 to 35.84 per cent.

Table 3-2: Descriptive Statistics of the Ad valorem import tariffs[11]

Variable	Average	Average	Average
Year	1996-1999	2000-2008	2009-2014
Mining of non-ferrous metal ores. except uranium and thorium ores	31.74	23.53	17.77
Quarrying of stone sand and clay	32.71	23.58	17.48
Mining of chemical. fertilizer minerals quarrying	43.15	**56.0**	10.74
Processing and preserving of fish and fish products	51.08	**58.64**	26.25
Manufacture of other food products	15.94	6.34	**22.40**
Manufacture of beverages and tobacco products	14.41	7.18	**35.84**
Textiles Spinning .weaving and finishing of textiles;	22.5	13.78	**26.43**
Manufacture of wearing apparel	21.76	13.37	**25.72**
Manufacture of footwear	20.13	16.64	**43.89**
Sawmilling and planning of wood	22.41	15.59	**25.32**
Manufacture of paper. paper products	17.21	10.14	**18.16**
Publishing of books. brochures	15.02	7.91	**18.13**
Manufacture of chemical products	30.27	18.89	**19.74**
Manufacture of rubber products	29.54	17.64	**19.54**
Manufacture of glass and glass products	22.84	14.83	**27.58**
Manufacture of non-metallic mineral products	20.74	13.31	**14.12**
Manufacturing of basic iron and steel	35.93	21.6	17.87
Manufacture of non-ferrous basic metals	41.9	22.57	17.64
Manufacture of structural metal products	12.05	8.04	**14.59**
Manufacture of general-purpose machinery	15.0	9.55	**14.24**
Manufacture of electric motors	53.75	52.22	14.41
Manufacture of motor vehicles	53.75	60.56	**85.85**
Manufacture of furniture	75.0	67.78	36.47
Manufacture of other products not elsewhere classified	80.0	62.78	20.25
Production. collection and distribution of electricity: Collection. purification	65.0	59.56	14.41
Building materials and construction parts of civil engineering	75.0	44.44	27.58

Source: Computation using Zimbabwe Revenue Authority datasets https://www.zimra.co.zw/customs/tariff-handbook.

3.6 Effective Protection Rates

This section presents the results and analysis of EPR. The computation followed equation 1.7, for the 26 manufacturing industries, excluding services, as classified in the Eora IOT. The study managed to calculate the EPR using average ad valorem tariffs rates of the three tariffs columns in the Zimbabwe tariff handbook. Starting at an aggregated level, the computations were based on the average of the industrial protection rates during the study period. Balassa (1965) maintained that weighting the EPR with total imports, domestic consumption or domestic production distorted the calculations of the EPR. Hence, this study uses both weighted and un-

[11] The ones in bold experienced an increase in tariffs compared to the previous period.

weighted tariffs in calculating EPR. Weighted tariffs rates utilised nominal import values as weights[12]. The results are shown in Figure 3-1. Specifically, Figure 3-1 presents the economic average EPR from 1996 to 2014. This presentation is in line with Holden (2001) who propounded that an EPR for a single industry is not informative, hence the need for an economic average. On the left-hand side of Figure 3-1, are un-weighted EPR and on the right-hand side, are weighted EPR.

There are some similarities in the trends between the weighted and the un-weighted EPR. A downward trend subsisted from 2000 to 2007 for both EPR measures. The un-weighted EPR declined from 217.4 per cent in 1999 to -80.3 per cent in 2007, while the weighted EPR declined by 4.2 percentage points from 21.2 per cent in 1999. Besides, there was a sharp decline in both weighted and un-weighted EPR during 2006-2008. Post-2008 was characterised by fluctuations in both EPR types, albeit at low rates.

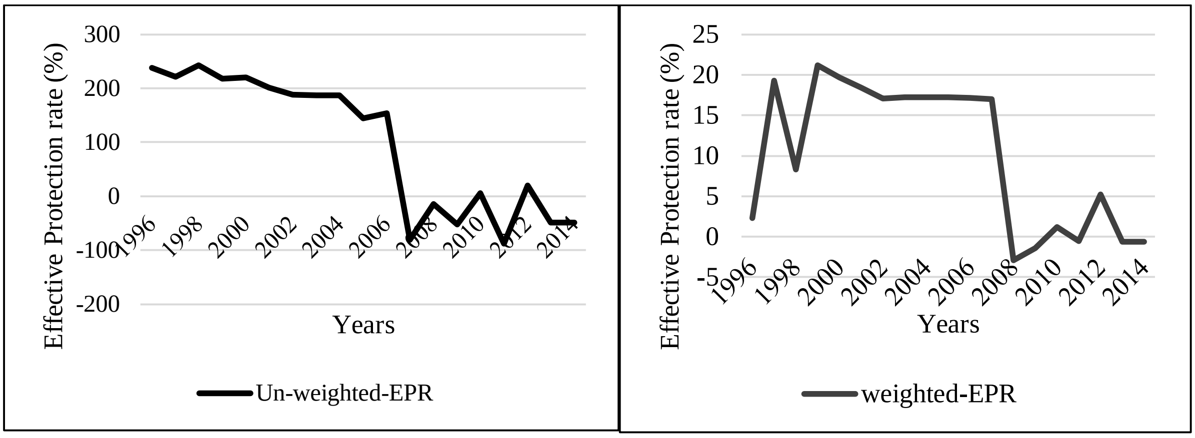
The difference in weighted and un-weighted EPR is attributed to the fact that weighting removes product lines with prohibitive import tariffs. Prohibitive tariffs discourage importation of such products, thus the import will be close to zero. Due to the trend similarity between the two EPR measures, and the constraint of calculating real imports adjusted for inflation, the emphasis was placed on un-weighted EPRs. Weighting with real import values was constrained by different inflation base years used by Zimbabwe. From 1996-2007, they re-based the inflation to 2001. In 2009-2014, the base year was 2012. Zimstats did not publish inflation rates for 2008 due to the hyperinflation. Thus this study utilised nominal imports in US$ terms. These challenges support the use of un-weighted ERP over the weighted EPR.

From 1996 to 2005, we observed a general decline in the EPR. This result was however not unique to Zimbabwe only. For instance, a comparable result was found for Bangladesh; from 75.7 per cent in 1992 to 24.5 per cent in 2000 (WTO, 2000). For Zimbabwe, the decline was consistent with the contemporaneous macroeconomic policies that leaned towards economic liberalisation. It is reiterated that the country pursued three macroeconomic programmes between 1996 and 2005; ZIMPREST, MERP and NERP. These promoted outward-oriented

[12] Weighting with real import value is constrained due to different inflation base years used by Zimbabwe. From 1996-2007, they re-based the inflation to 2001 base year. In 2009-2014, the base year was 2012. Zimbabwe Statistical Agency did not publish inflation rates for 2008 due to the hyperinflation. Thus we are using nominal imports in US Dollar terms.

growth strategies which included trade liberalising through tariff reduction, export promotion, and a free-market ideology (Mudzonga, 2009).

Figure 3-1: Economic average Effective Protection Rates



Source: Computation using Eora and Zimbabwe Revenue Authority datasets.

During 2009-2014, the EPR were mostly negative (except for a few points). Table 3-3 shows that 1996-1999 was characterised by high un-weighted EPR of 94.23 per cent compared to 33.79 per cent and -1.54 per cent for 2000-2008 and 2009-2014, respectively. The weighted EPR, however, showed that Zimbabwe was more protected during 2000-2008 compared to 1996-1999 and 2009-2014. However, due to the discussion above, our emphasis is on un-weighted EPRs. The trend is shown by the un-weighted EPR that partly depicted an economy that was gradually opening up to international trade. However, the economic crisis could also have significantly contributed to such a huge drop in the EPR; to a negative value.

Table 3-3: Inter-temporal EPR comparison[13]

	Un-weighted EPR	Weighted EPR
1996-1999	94.23	12.76
2000-2008	33.79	15.34
2009-2014	-1.54	0.54

Source: EPR using Eora and Zimbabwe Revenue Authority datasets.

[13] The three periods selected are unique to Zimbabwe, the period 1996-1999, the Zimbabwean economy was stable and the country was using its own currency. The period of 2000-2008, the economy was in a crisis with inflation reaching about 231 million per cent, budget and balance of payments deficits were unsustainable, shortages in foreign exchange and low industrial capacity, among others. The period 2009-2014, the country adopted the multiple currency and cash budget system in the quest to stabilise the economy.

A negative EPR implies that instead of protecting domestic industries against foreign competition, the GoZ was actually taxing them.

To situate these findings in existing literature, Edwards (2005) found a general decline in EPR for South Africa during 1993-2003. The study established that effective protection varied across industries with the service sector having negative EPR. Fedderke and Vaze (2001) also found a slow decline in domestic industrial protection in South Africa, and that mining, finance and insurance industries had negative effective protection. The major difference between these South African studies and the current study is that for Zimbabwe, even the manufacturing industries had negative EPR. This difference was partly attributable to the cash budget and the multiple currency economic system in Zimbabwe. In a quest to maximise revenue, the Zimbabwean government ended up increasing import tariffs of 57.78 per cent industries from the period 2000-2008 to the period 2009-2014 (Table 3-2). However, there is a possibility that it was charging higher import tariffs on intermediate inputs compared to finished products. Regrettably, this could have worked to reverse domestic industrialisation.

3.6.1 Effective Protection Rates at Industrial Level

This section discusses un-weighted EPR at the industry level. Table 3-4 shows the results as summarised for the three periods specified above. For most of the industries, 1996-1999 was characterised by relatively high EPR which is consistent with the aggregate analysis above. Furthermore, manufacture of other products not elsewhere classified had the highest EPR of 374.41 per cent followed by the publishing industry and the manufacturing of paper at 235.98 and 235.84 per cent, respectively. The least protected industry was textiles, knitted, crocheted fabrics articles at 12.39 per cent followed by mining of chemical, fertilizer minerals, extraction of salt, quarrying at 13.18 per cent.

Industrial protection mostly decreased from 1996-1999 to 2000-2008. During 2000-2008, the least protected industry was manufacture of beverages and tobacco products with EPR of -0.03 per cent followed by manufacture of glass and glass products at 9.62 per cent. On the upper end of the scale were processing and preserving of fish and fish products; publishing of books, brochures, musical books, and other publications with EPR of 109.93 and 109.92 per cent, respectively.

Table 3-4: Effective Protection Rates of selected industries

Industry	1996-1999	2000-2008	2009-2014
Mining of non-ferrous metal ores	44.01	14.02	6.32
Quarrying of stone sand and clay	14.81	17.00	6.32
Mining of chemical, fertiliser minerals, extraction of salt, quarrying	13.18	15.53	0.80
Processing and preserving of fish and fish products	123.69	109.93	-8.17
Manufacture of other food products	17.11	14.49	17.12
Manufacture of beverages and tobacco products	16.84	-0.03	-6.59
Textiles, knitted, crocheted fabrics articles	12.39	12.48	-6.39
Manufacture of footwear	18.22	18.68	-2.48
Sawmilling and planning of wood	235.74	57.42	-7.03
Manufacture of paper	235.84	98.44	0.10
Publishing of books, brochures, musical books and other publications	235.98	109.92	1.70
Manufacture of basic chemicals	114.25	10.22	0.14
Manufacture of glass and glass products	44.25	9.62	1.11
Manufacture of non-metallic mineral products	15.08	11.40	1.26
Manufacture of motor vehicles	79.10	9.76	5.09
Manufacture of furniture	86.50	8.46	2.77
Manufacture of other products not elsewhere classified	374.41	92.80	4.00
Production, collection and distribution of electricity	21.25	16.68	2.10
Building materials and construction parts of civil engineering	87.78	15.29	-47.36

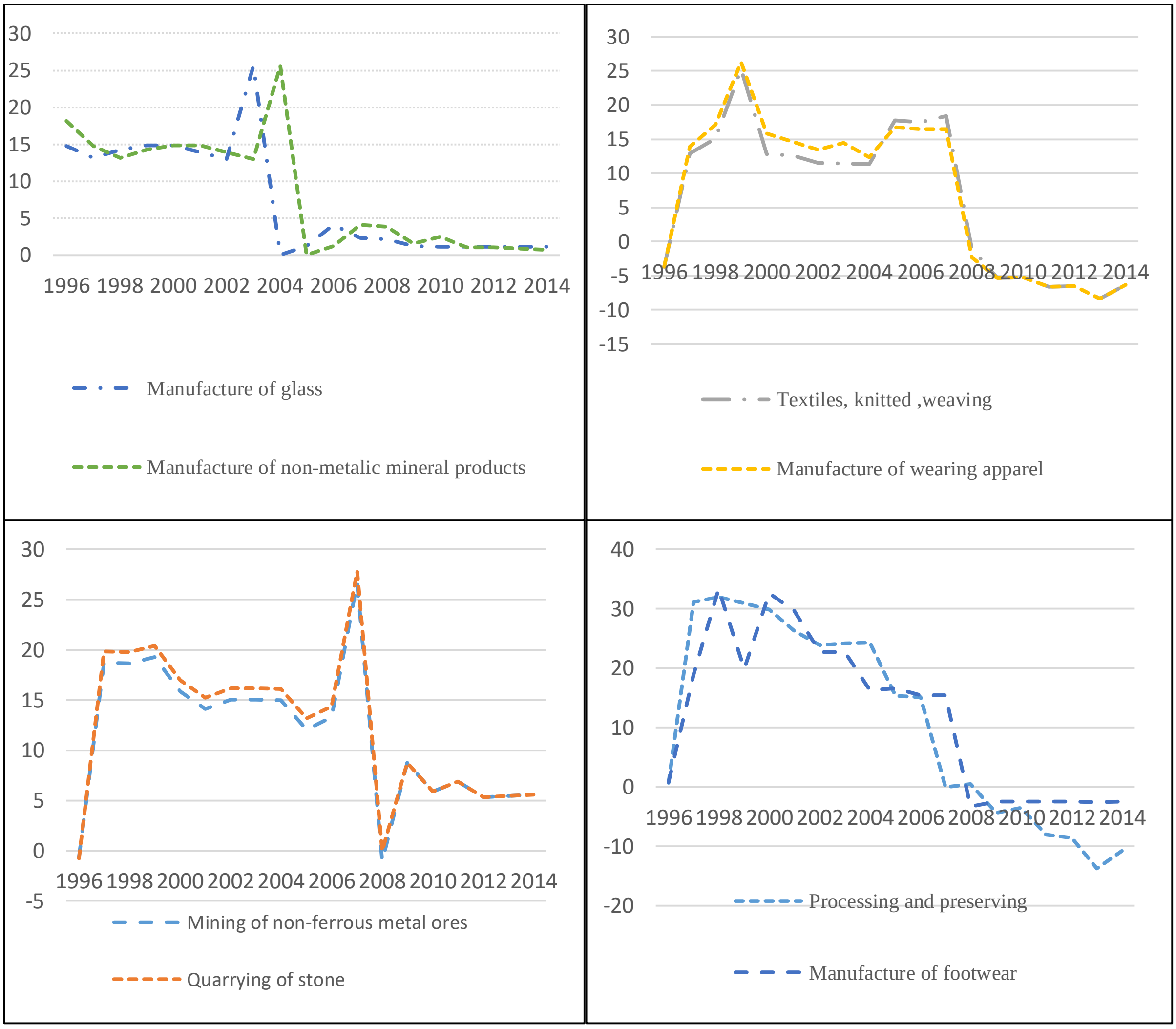
Source: Computation using Eora and Zimbabwe Revenue Authority datasets.

Figure 3-2 shows the EPR trends of grouped industries, these are similar to those for the economic average (Figure 3-1). Of the 26 industries, there were four groups formed following EPR trends for specific industries, as shown in Figure 3-2. The first group contains six industries, namely, Manufacturing of non-ferrous basic metals, Manufacturing of basic iron and steel, Manufacturing of non-metallic mineral, Manufacturing of glass products, Manufacturing of rubber products, and Manufacturing of publishing materials[14]. Industries in this group had positive EPR in the range of 10-20 per cent from 1996-2000. After 2000, they experienced some increases in EPR followed by some sharp decline from 2004-2008. At the end of 2014, these industries had positive but small EPR in the range of 0-5 per cent. The second group contains industries like Textile, Knitted, weaving, Manufacturing of wearing apparel, Manufacturing of general-purpose machinery, and Manufacturing of electric motors. These industries achieved their highest EPR during 1997-1998 within the range 20-30 per cent

[14] Only two industries of each group are shown in figure 3-2 to make the viewing less crowded.

and had a general declining EPR post-1998. The EPR for these industries were negative in 2013-2014.

Figure 3-2: EPR graphs of selected industries[15]



Source: Computation using Eora and Zimbabwe Revenue Authority datasets.

The third group had industries such as Mining of non-ferrous metals, Quarrying stone and mining of chemicals. These all started with negative EPR in 1996 before receiving positive protection in 1997-1998 with EPR as high as 20 per cent. They also had their highest EPR during 2005-2007. The overall and general trend of EPR for these industries was downward similar to the overall trend.

Industries in the fourth phase all had a downward trend in their EPR, having had relatively large protection in the earlier years, with protection gradually decreasing over the years. To a

[15] the y-axis measure EPR in percentages.

large extent, this analysis shows that there was no single industry that independently dominated the economic average EPR. The first similarity of the individual industrial effective protection rates is that from 1996 to 2007/2008, the EPR had a general declining trend which was consistent with the contemporaneous macroeconomic policies (except for the textile industry). For 2007-2014, most industries experienced negative EPR, similar to those found for the aggregate picture.

The other ungrouped nine industries had unique EPR trends which were different from each other and the above-mentioned groups. Their EPR trends are shown in Appendix B-A1. Overall, we observe that there was relatively lower protection in Zimbabwe compared to other countries, such as India. Nambiar (1983) found EPR as high as 29 950 per cent for the railway equipment, 2621 per cent for wood products, 1277 per cent for vegetable oil products, and 1240 per cent for the plastic industry

However, the study also found some high negative EPR in industries like petroleum with an EPR of -334.70 per cent, paper products with an EPR of -205 per cent, among other industries.

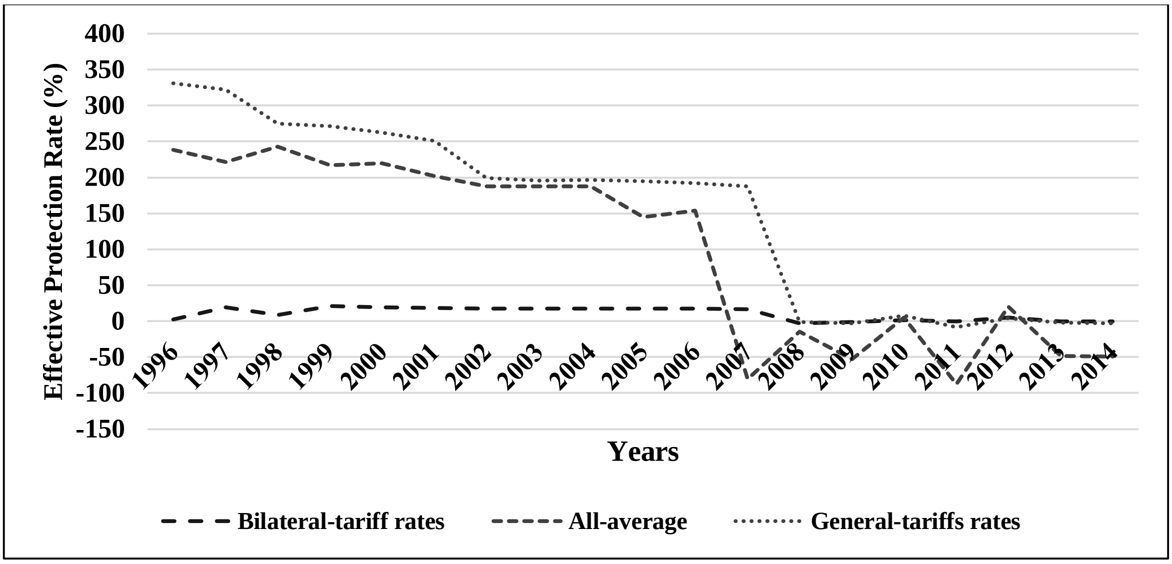
The above findings attest that when the Zimbabwean economy was relatively stable (before 2000), the government was charging import tariffs rates which genuinely protected the domestic industries. The trend for the EPR during the relatively economic stable years was, however, declining. This could be used as an indicator of a country that was embracing gains of trade integration as it reduced its import tariffs and liberalised trade. During the multiple-currency and the cash budgeting economic system, the Zimbabwean government changed its policies and started taxing the domestic industries. As highlighted above, this could have been due to pressure to finance government expenditure from limited sources of revenue.

The overall effect of these policy changes was that it led to the reversal of domestic industrialisation as domestic firms were more profitable from importing finished products and reselling them rather than producing domestically. This negative effect on the domestic industry could have had ripple effects that affected economic growth, employment and further reduced tax revenue.

3.6.2 Robust checks

As highlighted before, Figures 3-1 and 3-2, showed EPR computed using the average tariffs of the three columns as displayed in the Zimbabwe tariffs handbook. For sensitivity checks, EPR for the aggregate analysis were also calculated using the average tariffs of the individual tariffs columns. This aimed to verify whether using individual average tariffs columns would affect the results. Figure 3-3 shows the results, we have economic average EPR computed using bilateral tariff rates, the general tariff rates, and all average tariff rates.

Figure 3-3: Effective Protection rates using different import tariffs columns



Source: Computation using Eora and Zimbabwe Revenue Authority datasets.

Evidently, the scale and size of the EPR were sensitive to the tariff column used. However, the associated trends did not show huge differences across the employed tariff columns. That the domestic industry protection trends uncovered so far are insignificantly sensitive to the tariff column employed in the EPR estimations is reassuring of the robustness of the outcomes.

3.6.3 Analysing the relative significance of the Effective Protection Rate's Components

The objective now is to analyse the relative significance of each respective EPR component towards explaining the EPR. As suggested in section 3.3, Table 3-5 shows the Kaiser-Meyer-Olkin (KMO) sampling adequacy test results. All the variables have middling KMO values under both PCA and FA, except for tariffs on finished goods with a meritorious KMO value. The KMO values for PCA (FA) are 0.7271 (0.7673), 0.8305 (0.787) and 0.7795 (0.7684) for input-output coefficient, tariffs on finished goods and tariffs on intermediate inputs respectively. The overall KMO values of 0.7761 and 0.7592 for PCA and FA are also reasonably high, thus validating the use of PCA and FA.

Table 3-5: Kaiser-Meyer-Olkin measure of sampling adequacy

Variable	PCA	FA
Input-output coefficient	0.7271	0.7673
Tariffs on finished goods	0.8305	0.8476
Tariffs on intermediate inputs	0.7795	0.7684
Overall	0.7761	0.7592

Source: Stata computation using the Eora and Zimbabwe Revenue Authority datasets

Tables 3-6 and 3-7 show outcomes for the PCA and FA analyses. Table 3-6 starts by determining the number of components or factors under the PCA (panel A) and under the FA (panel B) respectively. For both PCA and FA, an eigenvalue greater than or equal to 1 classifies a valid component of factor to be used in the analysis. In panel A, we observe that component 1 has an eigenvalue of 2.3984 while components 2 and 3 have eigenvalues of 0.5673 and 0.0342 respectively. This means component 1 is the only valid component which can be used in the PCA analysis. A similar outcome is also found in panel B under the FA. Factor 1 has an eigenvalue of 2.2646 while the factors 2 and 3 have eigenvalues of 0.3014 and -0.0579 respectively. This means the PCA and the FA both agree to the use of the first component or factor.

Table 3-6: Principal components and factor correlation

Panel A: Principal components/correlation				
Component	Eigenvalue	Difference	Proportion	Cumulative
Comp 1	2.3984	1.8310	0.7995	0.7995
Comp 2	0.5673	0.5331	0.1891	0.9886
Comp 3	0.0342	-	0.0114	1.0000
Panel B: Factor analysis/correlation				
Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	2.2646	1.9633	0.9029	0.9029
Factor 2	0.3014	0.3594	0.1202	1.0231
Factor 3	-0.0579	-	-0.0231	1.0000

Source: Stata computation using the Eora and Zimbabwe Revenue Authority datasets

Based on component 1 for FA and PCA, the study ascertains the loading coefficients (weights) of each of the three variables in EPR; input-output coefficient, import tariffs on intermediate-inputs and import tariffs on finished goods.

Table 3-7 contains the variables' loading coefficients. The relative absolute values of the loading coefficients indicate the relative significance of the three variables in the EPR. For the PCA, Panel A (component 1) shows that the tariffs on intermediate inputs have the largest absolute weight of 0.7018, followed by the input-output coefficient at 0.6338 and finished goods at 0.5886.

The same ranking applies to FA in Panel B where tariffs on intermediate inputs, the input-output coefficient and tariffs on finished goods, respectively had absolute factor loadings of 0.9768, 0.7865 and 0.7129.

Table 3-7: EPR variables contribution/loading

Panel A: Principal components (eigenvectors)	
Variable	Component 1
Input-output coefficient	0.6338
Tariffs on finished goods	0.5886
Tariffs on intermediate inputs	-0.7018
Panel B: Factor Components Factor loadings (pattern matrix)	
	Factor 1
Input-output coefficient	0.7865
Tariffs on finished goods	0.7129
Tariffs on intermediate inputs	-0.9768

Source: Stata computation using the Eora and Zimbabwe Revenue Authority datasets

As pointed in section 3.3, Table 3-8 shows the correlation coefficients of EPR and the three components. The values in brackets are the p-value and they show statistically significant correlation at the 5 per cent significant level for all the correlation coefficients.

Table 3-8: Correlation coefficient

	Effective Protection Rate
Effective Protection Rate	1.0000
	(0.0000)
Input-output coefficient	0.3274
	(0.0000)
Tariffs on intermediate inputs	-0.4431
	(0.0000)
Tariffs on finished goods	0.3073
	(0.0000)

Source: Stata computation using the Eora and Zimbabwe Revenue Authority datasets

Similar to the PCA and the FA analysis, tariffs on intermediate inputs have a greater correlation with EPR of 0.4431 followed by the input-output coefficient with a correlation coefficient of 0.3274 and lastly, tariff on finished goods with a correlation coefficient of 0.3073.

Although the correlations are not very high, this finding suggests that trade policy in Zimbabwe should pay significant attention to tariff reforms to improve value-addition in the manufacturing sector and maximise benefits from the gains of trade. Also important is a need to improve the efficiency levels of domestic industries to reduce domestic industry protection.

3.7 Conclusion

This study set out to investigate the trend in domestic industry protection for the manufacturing sector in Zimbabwe over the period 1996-2014, using effective protection rates (EPR). It further analysed the relative importance of the underlying components for the EPR. Results showed that from 1996 to 2007, the domestic industrial protection for Zimbabwe was on a decline. After 2007, the industries were being taxed as shown by mostly negative domestic industrial protection rates. These trends also persisted when the analysis was done for specific industries rather than at an aggregate level. The EPR showed that several industries were highly disadvantaged by the government import tariffs policy. Industries with negative effective protection rate include key manufacturing industries such as beverage and tobacco, textile, footwear, sawmilling and planning and building and construction. In 2012, the manufacturing sector was contributing 15 to 30 per cent to GDP and 26 to 50 per cent to exports (Ministry of Industry and Commerce, 2012). Implications of negative EPR is that industries could have experienced higher import tariffs when importing raw materials than when households and retailers were importing finished goods. This could have created disincentives for further production among the industries, to the detriment of the economy.

The above findings highlight the government's objective of raising revenue mostly given that negative EPR were observed for the multiple-currency and the cash budget period. 57.7 per cent of the manufacturing industries experienced an increase in tariffs from 2000-2008 to 2009-2014. This evidence serves as a lesson to countries which might pursue a cash budget and multiple currency system. Such a system will reduce revenue collection. Inasmuch as raising import tariffs would improve revenue collection, raising tariffs on intermediate inputs more than tariffs on finished goods would reduce the value added by the domestic industry. If such policy persists, it might lead to the closure of domestic industries, thus increasing unemployment with negative effects on the collection of Pay-as-you-earn tax. Thus, in a cash budget and a multiple currency system, the government should strike a balance between tariffs on intermediate input and tariffs on finished goods.

An analysis of the components of EPR showed that import tariffs on intermediate goods dominated the input-output coefficient and the tariffs on finished goods. This means for the

GoZ to address imbalances caused by trade policy, more focus should be on tariffs for intermediate inputs. This targeted result goes beyond what can be deduced from existing studies which is important for policy purposes.

This study was however not immune to some limitations. First, due to data limitations, it only focused on tariff barriers without controlling for other concepts that may be convoluted with the tariffs such as non-tariff barriers, and rebates paid by the revenue authorities. Second, calculating weighted EPR with real import values has been hampered by different inflation base years used by Zimbabwe. From 1996-2007, they re-based the inflation to 2001 base year. In 2009-2014, the base year was 2012. Zimbabwe Statistical Agency did not publish inflation rates for 2008 due to the hyperinflation. Thus the study could only use nominal imports in US$. Thirdly, the study was limited to using Eora IOT which are characterised by many imputations; the Zimbabwe National Statistics Agency has not published complete IOT for Zimbabwe over the period under study. Hence, future studies can benefit from addressing challenges that are linked to these data constraints, should appropriate data be available.

Chapter 4: Import Tariff Pass-through Effect and the Spatial Distribution of Domestic Consumer Goods Prices: Zimbabwe (2009-2014)

4.1 Introduction

The impact of import tariffs on domestic goods prices has long been receiving attention in international trade literature (c.f. Brander & Spence, 1984; Feenstra, 1989; Mallick & Marques, 2007; Han et al., 2013; Hayakawa & Ito, 2015; Ludema & Yu, 2016). It is well-known as the pass-through effect (ITPTE hereafter)[16]. The accorded scholarly attention has been associated with the welfare effects of international trade under the terms of trade argument (Feenstra, 2015). For instance, in the context of imperfect competition, Brander and Spence (1984) theoretically asserted that if an importing country imposes a tariff on a product, the exporting country may reduce its export price, to gain a larger market in the foreign country. By implication, the exporter absorbs part of the tariff (partial pass-through) which culminates into

[16] The ITPTE ranges from an incomplete to a complete pass through effect. An incomplete import tariffs pass through effect means that a change in import tariff will result in a small effect on domestic goods prices. A complete pass through implies that, for example a 10 per cent increase in import tariffs will also result in a 10 per cent increase in domestic goods prices - entire change in import tariffs is passed on to domestic goods prices.

terms of trade gain for the importing country (Brander & Spence, 1984, Feenstra, 2003, p.305; Hayakawa & Ito, 2015). In turn, the ITPTE may intricately affect real economic variables like inflation, factor returns, industrialisation, economic growth and household welfare (Ahn & Park, 2014; Feenstra, 1989; Kreinin 1977; Mallick & Marques, 2007; Cavallo et al., 2019). Consequently, economic development imperatives have made the topic of interest to many scholars and policy analysts, especially in developed countries (c.f., Feenstra, 1989; Mallick & Marques, 2007; Han et al., 2013; Hayakawa & Ito, 2015; Ludema & Yu, 2016). This policy relevance highlights the importance of precise estimates of the ITPTE.

Existing studies of the ITPTE have been carried out at national (e.g. Hayakawa & Ito, 2015), industry (e.g. Feenstra, 1989, Mallick & Marques, 2007) and firm-level (e.g. Hayakawa & Ito (2015). The most common finding is that of an incomplete rather than a complete ITPTE. However, the size of the estimates vary with context, for instance, Feenstra (1989) found a complete ITPTE ranging from 94.9-138.8 per cent for Japanese motorcycles imported in the United States of America (USA), and a 60 per cent for Japanese trucks. Hayakawa and Ito (2015) found an average incomplete ITPTE ranging from 28.2–72.7 per cent for countries such as Singapore, Japan, Italy, France, among others.

Although all previous studies are informative, their estimates may be compromised by the underlying regression models' failure to control for the nature of price distribution at the estimation level of the ITPTE. As an example, for an ITPTE estimated at regional level, the regression model's dependent variable 'domestic goods price', can be randomly distributed or autocorrelated across regions - positively or negatively. A random price distribution implies independence of goods prices across regions. Positive (negative) spatial autocorrelation means that prices in one region are positively (negatively) linked to prices in proximate regions. Thus, the existing studies' estimates of the ITPTE could be biased by an 'omitted variable problem'[17] should domestic goods prices be positively (negatively) autocorrelated. The severity of the omitted variable bias is highlighted in Wooldridge (2002); Green (2012) and Clarke (2005).

[17] This is whereby a regression model leaves out relevant variables. Therefore, the model will attribute the effect of the missing variables to the estimates of the included variables, which compromises precision of the latter estimates.

In cases of a random price distribution, a change in import tariffs is likely to affect regional prices independently without a second-round effect; due to lack of spatial price correlation (Beag & Singla, 2014). When there is spatial autocorrelation, an import tariffs change may have second and third-round effects on domestic goods prices due to the regional price linkages (Sekhar, 2012). The latter implies that more precise estimates of the ITPTE call for incorporating spatial price dependence in existing 'traditional' estimation models, i.e. 'spatial' models.

Estimating 'spatial' import tariff pass-through models is increasingly becoming relevant given the growing discipline of spatial econometrics modelling. For instance, there are a few intra-trade studies which focused on determining the existence or non-existence of spatial dependence of agriculture product prices between different markets (c.f. Deodhar et al., 2007; Ghosh, 2011; Beag & Singla, 2014). Tapping into this literature, this study delves into the currently missing connection between the spatial distribution of domestic goods prices and the ITPTE, at the global level.

The analysis in this study focuses on Zimbabwe as a case study since import tariff pass-through studies are scarce for sub-Saharan Africa and particularly, for the country. Specifically, this chapter aims to incorporate the distribution of domestic goods prices across Zimbabwean districts in analysing the country's ITPTE. It has two objectives. First, is to analyse whether there is spatial dependence in domestic goods prices across Zimbabwean districts using micro-data for the period 2009-2014. Second, is to investigate whether a failure to control for the spatial distribution of domestic goods prices results in over- or under-estimation of the ITPTE effect. Prices survey data from the Zimbabwe Statistical Agency (Zimstat), import tariff rates from Zimbabwe Revenue Authority (ZIMRA) and Zimbabwe shapefiles are employed for the analysis. To achieve the first objective, the study uses spatial maps, spatial regression models, local and global Moran's I, Geary's C, and Getis and Ord's G indices. The second objective is realised by comparing estimates of the ITPTE from the 'traditional' and the 'spatial' regression model that accounts for the distribution of domestic goods prices.

This study does not only extend developing country import tariff pass-through analyses. In the recent past (2009-2014), Zimbabwe experienced hyperinflation and adopted a unique economic system of multiple currencies and a fiscal cash budget (ZEPARU[18], 2012; RBZ, 2014; CZI, 2013). The multiple currencies limited the country's influence on exchange rates. It could only affect trade flows by adjusting import tariff rates and non-tariff barriers. Hence, analysing the ITPTE for Zimbabwe during the specified period is crucial for understanding whether import tariffs partly contributed to concurrent price-related economic hardships faced by many Zimbabweans, with implications for pro-welfare policies. Moreover, the number of countries that are adopting other countries' currencies is growing; e.g. Ecuador, Liberia, Zimbabwe and Guatemala (Minda, 2005). A further increase in such countries is also anticipated with growing pressure towards currency unions. Hence, this study will also serve to inform such countries of the likely effects of import tariffs on domestic goods prices.

The rest of the chapter is structured as follows; sections 4.1-4.2 provide some background for the chapter. Sections 4.3-4.4 present the theoretical and empirical literature review. Methodology and data are discussed in sections 4.5-4.6. Findings of the study are analysed in sections 4.7-4.8 while section 4.9 concludes.

4.2 Spatial price distribution in Zimbabwe

The declining economic performance of the manufacturing sector has brought about disproportionate benefits and cost of import tariffs to households in diverse regions (RBZ, 2009). In 2008, subsequent to hyperinflation that was linked to other economic challenges in Zimbabwe, the economy started depending on imported products (CZI, 2010). Such an atmosphere meant dissimilar regional goods prices in the face of import tariffs. Following the gravity model, McCulloch et al. (2001) and Winters (2000c) suggested that regions that are situated closer to the country's major borders, such as Beitbridge and Matabeleland South, could have incurred lower goods prices compared to those far from the borders, due to low transport cost, for instance. This makes it important to study the import tariffs pass-through effect in Zimbabwe accounting for price differences across the country's regions. Import tariffs were a significant source of revenue for the country post–the hyperinflation period, hence it is crucial to delve into their potential effect on domestic goods prices with implications for household welfare.

[18] ZEPARU - Zimbabwe Economic Policy and Research Unit; RBZ - Reserve Bank of Zimbabwe; CZI - Confederation of Zimbabwe Industries.

There are four possible reasons why goods prices in Zimbabwe's districts could be highly interdependent. Firstly, Zimbabwe is relatively small in geographical size (covers 390 352 km^2 with roughly 14 million people as of 2014[19]) and its districts are close to each other which means what happens in one district can be quickly communicated across districts. Secondly, most Zimbabwean markets are highly centralised. Some good examples are the markets for grain-maize, fresh vegetables, cotton and tobacco[20]. Tobacco and cotton produced from different districts find their way to Harare, the capital city, where the central market and auctions are located. This would mean a strong cotton price dependence between Harare and the major cotton-producing districts namely, Gokwe South, Mbire, Chiredzi, Kadoma and Mwenezi district (Cotton Company of Zimbabwe Limited, 2018[21]; Agriculture Marketing Authority, 2017[22]). The price dependence would be much stronger among the districts which are closer to each other and would be expected to fade away as the distance between the districts grows. The same goes with fresh vegetables from different districts which also find their way to Harare-Mbare where the biggest vegetable market is located.

Thirdly, during the period 2009-2014, the local industrial capacity was low such that most goods which were consumed in Zimbabwe were imported. South Africa was Zimbabwe's biggest trading partner at the time; supplying most of the country's imports. Prices of these goods across Zimbabwe's districts were bound to be influenced by economic conditions in South Africa. Hypothetically, prices of similar imported products are expected to be correlated across districts, factoring in distribution costs like transport, packaging and regulation factors.

Fourthly, the hyperinflationary period of 2006-2008 created a strong interconnection of markets in Zimbabwe. Prices of goods would change more rapidly and retailers had to keep up with price changes as they feared failure to restock their shops. Most retailers across the country depended on black markets for foreign exchange to import the goods. The black markets in different cities were all connected to what was happening in the capital city - Harare. A change of the exchange rate in Harare would be quickly communicated to other cities as they tried to

[19] https://data.worldbank.org/country/zimbabwe

[20] These goods are included in some product groups later used in the analysis, the implication of the above market is that they point to greater likelihood of price dependence across districts.

[21] http://www.thecottoncompany.com/

[22] https://www.ama.co.zw/

keep up. This market chain arguably had some time lags but it shows the strong connectedness of markets in Zimbabwe.

Before determining the spatial distribution of prices and the spatial effects of import tariffs, we note that the country's historical spatial settlement patterns, rainfall patterns and agriculture regions already indicate price difference across regions. Prior to independence in 1980, European White settlers had relocated black Zimbabweans to the country's less fertile and semi-arid regions. Zimbabwe is generally divided into five Natural Farming Regions (NFR) as shown in Table 4-1.

White settlers forced the majority-black Zimbabweans to move from NFR 1 and 2 into NFR 3, 4 and 5 which have high temperatures and receive lower rainfall (Dube, 2008). Provinces in NFR 1 and 2 also happened to have better roads and railway infrastructure and they also house most of the country's agriculture industries (Dube et al., 2013). Though the 1980 independence tried to address this disparity, the effects are still being felt. For instance, prices of agriculture products are expected to be higher in NFR 3, 4 and 5. However, this is subject to a good rainfall season and good economic performance. Recently, the country has not been receiving enough rainfall as shown in Figure 4-1 below.

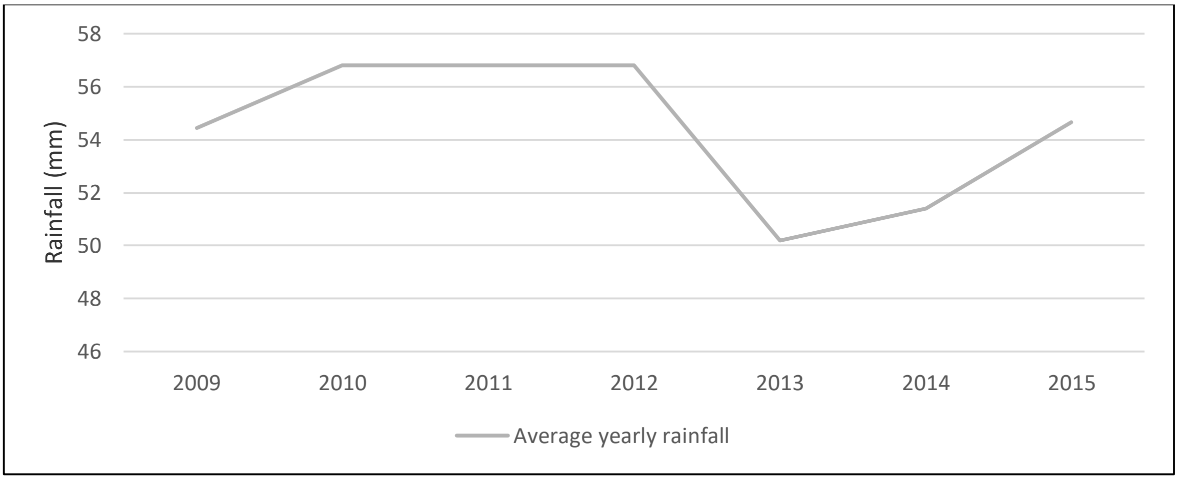
Table 4-1: Natural Farming Regions in Zimbabwe

Natural Farming Region (NRF)	Province covered	Characteristics
1	Manicaland	1050mm or more rainfall per annum, relatively low temperature
2	Mashonaland East, Harare, Mashonaland Central	700-1050 mm rainfall per annum
3	Mashonaland West, Midland	500-700mm rainfall per annum, relatively high temperatures, subjective seasonal droughts
4	Matabeleland North, Matabeleland South	450-600mm rainfall per annum and subject to frequent seasonal droughts
5	Masvingo	less than 500mm rainfall per annum, poorer soil

Source: Dube (2008).

Over the 2009-2014 period, the country received a yearly average maximum rainfall of 56.7 millimetres between 2010 and 2012, and a minimum yearly average rainfall of 50 millimetres in 2013. Its economic performance had also been subdued, given an average GDP growth rate of 6.3 per cent yet the country was recovering from a negative 17.7 GDP growth rate which was recorded in 2008[23], resulting in dependence on imports. This benefitted more regions which are located closer to the country's major trading partners like South Africa, Botswana and Namibia. This situation partly implies that goods prices were expected to be lower in Matabeleland North, Matabeleland South and Masvingo provinces.

Figure 4-1: Average Yearly Rainfall



Source: World Bank Climate Data Portal (2018).

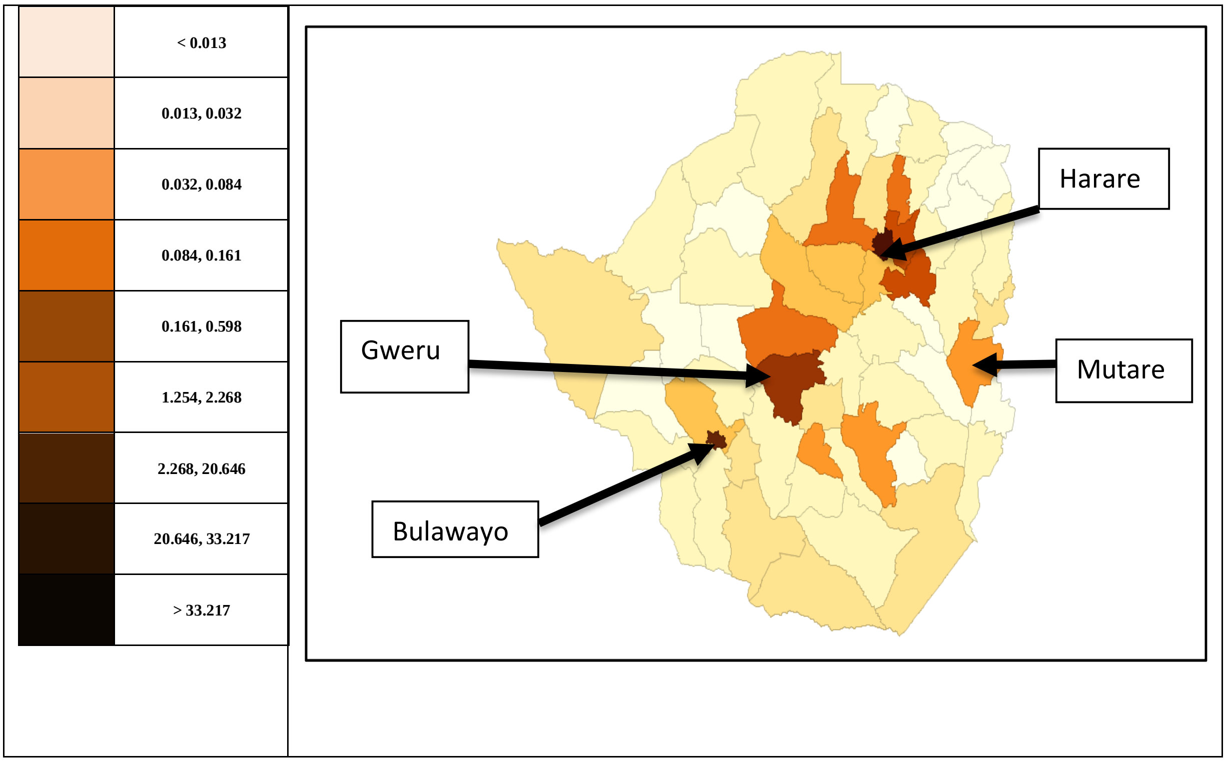
Another indicator which can also show the a priori spatial difference of prices in Zimbabwe is the level of economic activities across different districts. Night light has been used as a proxy of measuring economic growth or the level of economic activities (Ebener et al., 2005; Doll et al., 2009; Xi et al., 2010). In Figure 4-2 we present the spatial map of night light in Zimbabwe for the year 2012. The data used in the map were taken from QGIS Rasta files.

Figure 4-2 shows night light distribution in Zimbabwe, a proxy for economic activities. It reveals some differences in levels of economic activities across districts in Zimbabwe. In Figure 4-2, the darker the colour, the more the night light intensity, which implies higher economic activity. Districts in Harare and Bulawayo have the highest levels of economic activities, followed by other districts like Mutare, Gweru, Zvishavane and Marondera, among others. There are industrial hubs or mining activities in these districts with high night light intensity. A district located closer to an industrial hub is highly likely to enjoy lower prices of the industrial hub's output. Following the price gravity model, price varies with distance (Campa & Goldberg, 2011). Therefore, districts far away from the industrial hub are bound to

[23] https://data.worldbank.org/country/zimbabwe

have higher prices. This map thus provides a priori information on how prices in Zimbabwe are likely to be distributed.

Figure 4-2: Night Light Map of Zimbabwe for the Year 2012



Source: https://www.arcgis.com/home/item.html?id=6e30256ec1da4f8a9d13a110db4508ec

4.3 Theory of import tariffs pass through to domestic goods prices

The theoretical model of import tariffs pass through to domestic goods prices largely borrows from the law of one price (LOP) which encompasses the works of Engel and Rogers (1996); Ceglowski (2004) and Goldberg (1996), among others. The LOP states that in a well-functioning economy, the price of similar goods should be the same in different regions, subject to transport cost. If at one point the price of, say bread, is $1 in region A and $2 in region B then, traders would arbitrage by buying bread from region A and selling it in region B. Over time, prices in both markets will change in response to the forces of supply and demand such that the disparities will disappear as prices conform to the LOP (Rogoff et al., 2001).

Evidence has shown some inconsistencies in prices meeting the LOP. Some studies have pointed to the movement towards the LOP being currently slower compared to the situation in the fourteenth and thirteenth centuries (Maurice & Rogoff, 2000; Alan, 2000). The main drivers of the failure of prices to conform to the LOP have been cited as growing domestic nominal price rigidities, high nominal exchange rate volatilities, market segmentation, capital controls, co-ordinated financial regulation and co-ordination in trade policies (Rogoff et al., 2001).

Other evidence for the failure of the LOP is that goods have different attributes even when they are similar and also that consumers have imperfect information about prices in different places (Ceglowski, 2004). This study acknowledges the growing evidence of the failure of the LOP and accepts that prices are different across regions even after accounting for transport cost and exchange rate variation. Against this backdrop, we assume that the consumer basket comprises imported and domestically produced goods. Betts and Devereux (2000) noted that imported goods prices are temporarily rigid if markets block the transmission of import tariffs to domestic goods prices. Obstfeld and Rogoff (2001) also pointed out that the import tariffs pass through to domestic goods prices is influenced by whether prices are set in a producer or local currency. Prices are relatively sticky downwards in the producer's currency. Thus, the production and distribution channels affect the pass-through mostly if intermediate inputs are imported. These models consider all the economic agents in optimisation behaviour to explain the effects of import tariffs on domestic goods prices. This study focuses on the price function and acknowledges that the price-setting dynamics affect the import tariffs pass through, and also that the average unit price of goods is a function of domestic and imported goods prices.

4.4 Theoretical framework - domestic price dependence and import tariff pass-through

The theoretical framework adopted for this study closely follows Engel and Rogers (1996). We hypothesise a mark-up over marginal cost and a Cobb-Douglas production function. Thus, the average unit price of good 1 in district j, P_{1j} can be represented in the form:

$$P_{1j} = \mu_{1j}(P^D)^{\gamma}\left(P_{1j}^I\right)^{1-\gamma} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [4.1]$$

where μ_{1j} is the mark-up over marginal cost of product *1* in district *j*, P^D captures the price of domestically sourced intermediate input, P^I is the price of imported intermediate input and $\gamma < 1$ is the substitution effect between imported and domestically sourced inputs. If $\gamma = 1$ P_{1j} will only be influenced by domestic inputs' price, and by imported inputs' price only when $\gamma = 0$. Instead of these extreme cases, we assume P_{1j} to depend on both domestic and imported inputs' prices. Furthermore, we assume that the price of imported goods P_{1j}^I is made up of import tariffs and other distribution constraint variables *(X)* which include district *j*'s distance from the border, money supply, exchange rate, distance from industrial hubs, inter alia. Hypothetically, the further district *j* is from the border, the higher will be the distribution costs of the imported inputs, which feeds into a higher final price. Assuming the quantity theory of money holds, an increase in money supply will affect P_{1j}^{I} as per the marginal propensity to import. Importing a good also involves the exchange rate, its appreciation or depreciation alters the import price. Thus P_{1j}^{I} will be expressed as:

$$P_{1j}^{I} = P_{1}^{B}(1 + t_1) + X \quad [4.2]$$

where P_{1}^{B} is the border price of imported inputs before the addition of import tariffs, t is the ad valorem import tariffs rate at a given time, X [24]is a vector of control variables mentioned above. Due to possible spatial autocorrelation of goods prices ρP_{1k}^{I} is added to equation 4.2. Where ρ captures the correlation between the import price of good 1 in district *j* and district *k* i.e. P_{1j}^{I} and P_{1k}^{I}. This gives:

$$P_{1j}^{I} = P_{1}^{B}(1 + t_1) + \rho P_{1k}^{I} + X \quad [4.3]$$

When P_{1j}^{I} is independent from P_{1k}^{I}, it implies an absence of spatial price autocorrelation, i.e. a random price distribution. Then $\rho = 0$ and we revert to equation 4.2. If $\rho \neq 0$, it denotes a spatial correlation between P_{1j}^{I} and P_{1k}^{I}; prices in the two districts depend on each other. Noteworthy in 4.3 is that P_{ik}^{I} is also a function of import tariffs and prices from other districts such that, for simplicity, P_{ik}^{I} can be expressed as:

$$P_{1k}^{I} = P_{1}^{B}(1 + t_1) + X + \rho P_{1l}^{I} \quad [4.4]$$

If we substitute 4.4 into 4.3 we get

$$P_{ij}^{I} = P_{1}^{B}(1 + t) + X + \rho P_{1}^{B}(1 + t) + \rho X + \rho^2 P_{1l}^{I} \quad [4.5]$$

Notably P_{1l}^{I} also depends on import tariffs and prices from other districts. Without loss of generality, we assume that there are three districts only, i.e. *j*, *k* and *l*. However, in reality, these districts can go even up to 100. Transforming 4.1 into logarithms, substituting 4.5 and differentiating with respect to import tariffs *t* we get;

[24] It should be noted that there is a thin line between imported intermediate and imported final goods, someone's intermediate input is another one's final goods thus X remain valid in equation 4.2.

$$\frac{\partial logP_{1j}}{\partial t} = \frac{(1-\gamma)P_1^B(1+\rho)}{P_1^B(1+t)(1+\rho)+X(1+\rho)+\rho^2 P_{1l}^I}\frac{\partial P_{1l}^I}{\partial t} \quad \text{[4.6[25]]}$$

Given that $\gamma < 1$, then $\frac{\partial logP_{1j}}{\partial t} > 0$ ……………………………………………………..[4.7]

Equation 4.7 implies a positive relationship between import tariff changes and domestic goods prices, which can be less or greater than 1 depending on the other components of 4.6. That is the post-tariff percentage change in the domestic price of good 1 can be less than the percentage change in import tariffs (incomplete pass-through), or 100 per cent of changes in import tariffs can be transmitted to goods prices (complete pass-through).

When $\rho = 0$ that is spatial price randomness, then

$$\frac{\partial logP_{1j}}{\partial t} = \frac{(1-\gamma)P_1^B}{P_1^B(1+t)+X} \quad \text{[4.8]}$$

Equations 4.6 (positive spatial dependence) and 4.8 (spatial randomness) show that the effect of import tariffs changes on domestic goods prices depends on the nature of spatial price distribution. There could also be a negative spatial dependence where that prices in proximate districts move in opposite directions, thus ρ in 4.6 will have a negative sign. The aspect of the spatial weights matrix will be introduced in the next section to capture the closeness of the districts to each other, i.e. price network effect. As such, the ITPTE could be influenced by the underlying characterisation of the domestic goods price distribution across regions. It is also noteworthy that the import tariff effect can differ across regions within a country which accentuates the importance of regional variables in this framework

It can also be inferred from equation 4.6 that if ρ and X increase independently then $\frac{\partial logP_{1j}}{\partial t}$ which is the import tariffs pass-through will decrease, ceteris paribus. Thus, high levels of spatial dependence and distribution constraints are associated with low import tariffs pass-through. A further inference is that as the imported and domestic input substitution effect γ

[25] $logP_{1j} = log\mu_{ij} + \gamma logP^D + (1-\gamma)logP_{1j}^I$…….4.1.1

Substituting 3.5 into 3.1.1 $logP_{1j} = log\mu_{ij} + \gamma logP^D + (1-\gamma)\log[P_1^B(1+t) + X + \rho P_1^B(1+t) + \rho X + \rho^2 P_{1l}^I]$… 4.5.1

Differentiation 3.5.1 with respect to import tariff t $\frac{\partial logP_{1j}}{\partial t} = \frac{(1-\gamma)P_1^B(1+\rho)}{P_1^B(1+t)(1+\rho)+X(1+\rho)+\rho^2 P_{1l}^I}\frac{\partial P_{1l}^I}{\partial t}$……4.6

decreases, the import tariffs pass-through effect increases. This implies that it becomes difficult to pass-through a larger share of import tariffs changes to domestic goods prices when a greater portion of imported inputs are used to produce final goods.

4.5 Empirical literature review

The topic of how import tariffs are transmitted to domestic retail prices has for a long time been receiving considerable attention in international trade literature (Feenstra, 1989; Mallick & Marques, 2008; Han et al., 2013; Hayakawa, 2015b; Ludema & Yu, 2016). Feenstra (1989 is one of the founding authors on the subject. This study aimed to test the symmetry hypothesis that suggests an identical long-run pass-through of import tariffs and exchange rate to domestic prices. It found import tariffs pass through to be perfect ranging from 94.9-138.8 per cent for Japanese motorcycles imported in the United States of America (USA). However, only 60 per cent of import tariffs were passed on to domestic goods prices in the case of trucks. Thus, the ITPTE may vary across products. The reasons for a more than unit tariffs pass-through for motorcycles were, firstly, the increase in import tariffs affected both imports from Japan and motorcycles which were produced in the USA. This was because goods produced in the Foreign Trade Zones were also liable for import tariffs. Secondly, there was a drop in the supply of motorcycle post the import tariffs increase while the demand remained high. This coerced prices to rise resulting in a greater than unit price change following a unit increase in import tariffs.

Post-Feenstra (1989), literature was awash with pass-through studies that were skewed towards exchange rates (Froot & Klemperer, 1989; Dixit, 1989; Hooper & Mann, 1989; Kim, 1990; Athukorala, 1991; Parsley, 1993; Athukorala & Menon, 1994; Gross & Schmitt, 1996; Goldberg & Knetter, 1997; Lee, 1997; Tange, 1997; Yang, 1997). Recently studies which addressed both import tariffs and exchange rate pass-through have been growing. For instance, Mallick and Marques (2007) investigated a combination of import tariffs and exchange rate pass-through for India at the industry level, over the period 1990-2001. Results showed complete import tariffs pass through in six industries such as pharmaceuticals, specialised machinery, rubber, and transport. An incomplete pass through ranging from 12-60 per cent was also found in 36 out of the 42 industries. Import tariffs pass through was observed to increase with the level of domestic protection; on the contrary, it decreased with an industry's share of imports. However, exchange rate pass-through tended to be more dominant relative to import tariff pass-through. This separation of the exchange rate and import tariffs pass-through effects is not only crucial for policy purposes, but also for countries which are not using their currencies but have control on import tariffs.

Han et al. (2013) estimated the effects of market structure and size of the private sector on the transmission of import tariffs to consumers in urban China. The study hypothesised that imperfect market structures are likely to result in less price decrease following a reduction in import tariffs. This follows as profit margins and mark-ups absorb the tariff change. About 35 per cent of the import tariffs were estimated to be passed through to domestic prices for an average size private sector. The import tariffs pass-through was found to be low for state-owned enterprises at the rate of 16 per cent and increased by 4 per cent for each 10 per cent of private ownership. Trade liberalisation in China was found to produce welfare gains which were intensely pro-poor, mostly when the substitution between tradable and non-tradable goods was factored in the import tariff pass-through model.

Recently, Cavallo et al. (2019) investigated the impact of changes in USA trade policy on importers, consumers and exports. The authors collected retail and border price of goods imported and exported between the USA and a number of its trading partners, namely, Canada, China, EU and Mexico. Using fixed-effects regressions, the study found that when the USA increased import tariffs ranging from 10-50 per cent, its trading partners also imposed retaliating tariffs. A further finding was that of a high ITPTE in the USA ranging from 50-60 per cent.

Hayakawa and Ito (2015) went beyond country-specific ITPTEs to investigate the global average import tariffs pass-through. The study used tariff line-level import price data between 46 importing countries and 174 exporting countries over the period 2007-2011. It found that a 10 per cent reduction of the applied tariffs rate raised import price by 2-3 per cent margin. Import tariffs pass-through was greater for Regional Trade Agreement (RTA) import tariffs (72.7 per cent) and less for Most Favoured National tariff rates (28.2 per cent). The major reason for such disparities was associated with additional costs incurred by exporters under RTAs, related to compliance with the rules of origin[26].

[26] Compliance with the rules of origin entails additional cost in preparing several documents which includes list of inputs, production flow charts, production instructions, contracts and invoices, among other documents.

Beyond the national and industry level studies, there are firm-level studies of the ITPTE. Ludema and Yu (2016) used the Melitz and Ottaviano (2008) model[27] to explore import tariff pass-through at the firm level. The study utilised USA export data and tariffs for other countries against USA exports of different products at the plant level. It showed that the ITPTE depended on firm heterogeneity, product differentiation and productivity. An incomplete ITPTE was observed as firms absorbed import tariffs changes when they adjusted mark-ups and product quality.

So far the studies discussed were carried out outside the African region. Currently, the ITPTE has received scant attention in Africa, especially sub-Sahara. To the best of our knowledge, Mudenda (2016) is the only sub-Saharan Africa study that investigated the ITPTE to domestic prices. The study went beyond previous literature which produced aggregated findings for the ITPTE at a national level to explore whether the ITPTE differed across domestic retail prices across districts in Zambia. It utilised Zambia preferential import tariff rates offered to South Africa, and showed that the import tariff effect was heterogeneous across prices in different districts. Regions that were more exposed to external shocks, such as border regions, experienced greater effects of trade policy changes than interior districts. This finding accentuates the importance of factoring regional price heterogeneities in import tariff pass-through analyses. For Zimbabwe, Mugano et al. (2013) undertook a study on the effect of import tariffs on the Zimbabwean economy. However, the study did not delve into the ITPTE which leaves a void for an ITPTE analysis for the country. This is also in order, given that none of the current studies were conceptualised in an environment which employed multiple currencies and a cash budgeting fiscal system.

Taken together, this brief review shows that although most studies found an incomplete ITPTE to domestic prices, the extent differs across countries, regions, industries, products and estimation models. Also, none of the available studies has considered that the prices of the domestic goods, which are affected by import tariffs, may not be randomly distributed across regions within a country. This omission could bias resultant estimates of the ITPTE as spatial econometrics models emphasise high chances of spatial dependence among observations

[27] The Melitz and Ottaviano (2008) model is based on a monopolistically competitive approach of trade with firm heterogeneity in terms of productivity differences. It also includes endogenous differences in the roughness of competition across markets in terms of the number and average productivity of competing firms. The model looks at how market size and market integrations are linked to productivity and average mark-ups. It postulates that larger and more integrated markets exhibit higher productivity and thus lower mark-ups.

across regions (LeSage & Pace, 2005; 2009). As such, observations in a region tend to exhibit values similar to those from contiguous regions. This suggests that extant ITPTE studies which do not incorporate space when using variables with a location component are inundated with problems of spatial dependence and spatial heterogeneity. This could bias the ITPTE, and hence motivates for import tariff pass-through studies that consider domestic regional price dependence, to obtain more precise estimates.

4.6 Methodology

4.6.1 Determining the spatial distribution of prices.

To determine the nature of the spatial distribution of domestic goods prices across Zimbabwean districts, the study uses spatial maps, Moran's I (Moran, 1948), Geary's C (Geary, 1954), Getis and Ord's G (Getis & Ord, 1992) indices and spatial regression methods. Tests based on these indices are carried out at global and local levels. The global, I, G and C indices present the overall degree of dependence between spatially close regions in a study area (A) with respect to a numeric variable *x* (Pisati, 2012). Their local versions present for each location i in area A the degree of similarity between that region and its neighbouring regions with respect to *x*. Thus, global indices capture a general tendency towards clustering, while local indices detect specific spatial clusters (Pisati, 2012; Pfeiffer et al., 2008). Consequently, results for local indices may differ from those of global indices when spatial dependence is clustered among a few districts. The following formal discussion of these indices closely follows Viton (2010) and Technical Stata Bulletin (2001).

The global Moran's I uses the z-score to test the null-hypothesis of no spatial autocorrelation against the alternative of spatial autocorrelation. It is defined for a variable of interest *x* as:

$$I = \frac{R}{\sum_i \sum_j w_{ij}} \frac{\sum_i \sum_j w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_i (x_i - \bar{x})^2} \qquad [4.10]$$

where R is the number of locations in the analysis. w_{ij} are elements of the spatial weights matrix W for location pair (i, j). x_i is the value of x at location *i*. $\bar{x}$ is the mean of x. If *I* is larger (smaller) than its expected value, then the distribution of x has a positive (negative) spatial dependence. This implies that values of x in surrounding districts tend to be similar (dissimilar). The global Moran's I treats districts which are 50 and 500 kilometers away from the same as if they are in the neighbourhood. This concept slightly contradicts Tobler's (1970) first law of geography - everything is related to everything else but closer things are more related than distant things, which motivates for the local measure.

Unlike Moran's I, the global Geary's C (Geary, 1954) index is sensitive to local autocorrelation. This is formally defined as:

$$C = \frac{R-1}{\sum_i \sum_j w_{ij}} \frac{\sum_i \sum_j w_{ij}(x-\bar{x})^2}{\sum_i (x_i-\bar{x})^2} \text{...} [4.11]$$

Under the null hypothesis of no global spatial autocorrelation, the expected value of c equals 1. If c is larger (smaller) than 1 then the x has a negative (positive) spatial dependence (Pisati, 2012).

Getis and Ord's G statistic is specified as:

$$G = \frac{\sum_{i \neq j} w_{ij} x_i x_j}{\sum_{i \neq j} x_i x_j} \text{...} [4.12]$$

If G is larger (smaller) than its expected value, then the overall distribution of x has a positive spatial dependence with a prevalence of high (low)-valued clusters (Getis & Ord, 1992).

As for the local I, G and C indices, they are derived from the global indices and share their basic properties (Pisati, 2012; Pfeiffer et al., 2008).

Spatial maps of price distribution among Zimbabwean districts are drawn using shapefiles from ArcGIS and the GeoDa software programmes. The shapefiles have 60 districts covering 10 provinces, they also provide the districts' latitude and longitude co-ordinates. Goods prices at the district level are sourced from Zimstat. A visual analysis of the maps gives an indication of the nature of price distribution across the districts.

The study also runs five types of spatial regression models that are consistent with panel data. These models are:

1. Spatial Autoregressive Model (SAR) with a lagged dependent variable, which can be formally specified as:

   $$P_t = \alpha_{ln} + \rho W P_t + X_t \beta + \mu_t \text{............ .... } [4.13]$$

   For a panel dataset in which n units (districts) are observed for exactly T periods, P_t is an $n \times 1$ column vector of log of prices and ι_n is an n×1 vector of ones associated with the constant term parameter α. Given that the dataset at use has time and individual effects, model testing is applied to exhibit whether the appropriate model is a fixed effect or a random effect. W is an $n \times n$ spatial weights matrix. Each element (j, k) of W denoted by $w_{j,k}$ shows the degree of spatial proximity of district j and k. Thus, W controls for the nature of spatial price distribution encountered in this data; it captures the network and interactions of pricing agents in districts j and k (Anselin, 2002; Pisati 2012). X_t is an $n \times k$ matrix of log regressors associated with parameters β contained in a $k \times 1$ vector and $\mu_t = (\mu_i, \dots, \mu_n)^T$ is a vector of independently and identically distributed disturbance terms (zero mean and variance σ^2). ρ is the spatial autoregressive parameter. If ρ is positive (negative) and statistically significant, it implies that there is positive (negative) spatial price autocorrelation; an insignificant ρ implies random price distribution.

2. To capture the possibility that some regressors in X_t are spatially autocorrelated, for instance, temperature and rainfall patterns tend to be similar in proximate districts, the study employs the Spatial Durbin Model (SDM). The SDM is a generalised SAR model which includes spatially weighted independent variables as explanatory variables. The model is specified as:

   $$P_t = \alpha_{ln} + \rho W P_t + x_t \beta + \emptyset \gamma \eta_t + \mu_t \text{ .... [4.14]}$$

   where η_t is an $n \times 1$ matrix of log of regressors which depict spatial dependence, γ is an $n \times n$ spatial weights matrix for the spatially lagged regressors, the other variables are as explained in equation 4.13.

3. The Spatial Autoregressive Model with Spatially Autocorrelated Errors (SAC) - this model combines the SAR with a spatial autoregressive error. It is specified as:

   $$P_t = \alpha_{ln} + \rho W P_t + x_t \beta + V_t \text{ .... [4.15]}$$

   where $V_t = \lambda E V_t + \mu_t$. E is the $n \times n$ spatial weights matrix for idiosyncratic error terms.

4. Spatial Error Model (SEM) - this model can be treated as a special case of both the SAR and SDM. It focuses on spatial autocorrelation in the error term, thus it treats spatial dependence as a nuisance (Pisati, 2012). The model is specified as:

   $$P_t = \alpha_{ln} + x_t \beta + \mu_t \text{ .... [4.16]}$$

where $\mu_t = \lambda E v_t + \varepsilon_t$ ....[4.17]

5. Generalised Spatial random-effect model (GSPRE), which is represented as:

$P_{1kt} = \alpha + x_t\beta + \mu_t$ ....[4.18]

where $\mu_t = \lambda E v_t + \varepsilon_t$ ....[4.19]

and $\alpha = \theta W\alpha + \eta$ ....[4.20]

The GSPRE assumes panel effects α are spatially correlated, η and ε_t are independently normally distributed errors so that the model is necessarily a random-effects model.

Post-estimation of models 1-5, the Likelihood Ratio test (LR test), Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) are used to determine the most appropriate model for the study. The study employs STATA version 14 statistical package to run the above regression models.

Notably, there are two approaches to constructing the spatial weights matrix; contiguity and based on distance. The contiguity approach creates the matrices based on spatial units which share common borders. Under this approach, there is the Rook criterion which uses common borders, Bishop criterion which uses common vertex and the Queen criterion which uses either common borders or common vertex. For weights matrices based on distance, there are the Euclidean matrix, Manhattan matrix and the Minkowski matrix (Anselin, 1988). This study considers the different types of spatial weights matrices. Appendix C-A1 provides a description of variables used in the analysis as well as a priori expected relationships between the covariate and dependent variables.

4.6.2 Incorporating price distribution into the import tariffs pass-through model

This study estimates two types of import tariff pass-through models 'traditional and 'spatial' and compares the results, especially the ITPTE. The 'spatial' models control for spatial distribution of domestic goods prices while the 'traditional' models do not. The 'traditional' model used to estimate the ITPTE is presented in equation 4.21 (Liu & Tsang, 2008; Marazzi et al., 2005; Mumtaz et al., 2006; Zubair et al., 2013).

$\Delta logP_t = \beta_0 + \beta_1 \Delta logtar_t + \beta_2 logmon_t + \beta_3 \Delta logexc_t + \beta_4 \Delta x_t + \beta_5 y_t + \epsilon_t$.. [4.21] where $\Delta logP_t$ is a change in the log of domestic goods prices of good *i* at time *t*, β_0 is a constant, $\Delta logtar_{1t}$ denotes a change in the log of import tariffs of good *i* at time *t* (policy consistent factor), mon_t is money supply at time *t* (policy consistent factor), exc_t is the exchange rate of the United States of American Dollar (US$) to South African rand at time *t*. Though Zimbabwe had no exchange rate during the period 2009-2014, most economic variables like inflation rate, poverty datum line, were highly correlated with the US$ to South African Rand exchange rate (ZEPARU, 2012). *X* are other region-specific explanatory variables at time *t*, including temperature and rainfall. *Y* includes regional specific indicator variables for rural/urban location, year and month among others. The key variable is $\Delta logtar_t$ with its coefficient β_1. This gives the percentage magnitude of changes in import tariffs that are passed on to domestic goods prices.

For the 'spatial model, a spatial weights matrix is added to equation 4.21 as in equation 4.22 (Long et al., 2016; Chen et al., 2017; Tsutsumia & Tamesuea, 2011; Wheeler et al., 2013).

$$\Delta logP_t = \beta_0 + \beta_1 \Delta logtar_t + \beta_2 logmon_t + \beta_3 \Delta logexc_t + \beta_4 \Delta x_t + \beta_5 y_t + \beta_4 W \Delta logP_t + \epsilon_t . [4.22]$$

Specifically, $\beta_4 W \Delta logP_t$ controls for the spatial distribution of domestic goods prices as per section 4.3. Equation 4.22 is a spatial lag model, however, the most appropriate spatial regression model and estimation technique is used following results for models in section 4.1.

4.6.3 Data Source and Descriptive Statistics

The ZIMRA documents integrated customs tariffs in a handbook which is updated after every 5-10 years. Small updates or changes to the tariffs are published in the Government Gazette. This study utilises the integrated tariffs handbook as the key source of import tariffs data, complemented by Government Gazette publications. Data on money supply and exchange rates are sourced from the RBZ's Monthly Economic Review (RBZ, 2009-2014). GIS Raster Files[28] were used to extract data on night light and temperature while Zimbabwe's Shape-files[29] were used to calculate distances across districts. In addition, the study utilises a nationally representative dataset from the monthly consumer goods prices surveys produced by the

[28] Sourced from https://www.diva-gis.org/datadown

[29]Sourced from https://www.diva-gis.org/datadown

Zimstat, covering 60[30] districts over the period 2009-2014. Noteworthy, the shape-files do not provide sub-district demarcations for some towns and cities e.g. Harare, Bulawayo, Gweru and Mutare. Hence, this study treats them as ‘composite’ districts. Using Harare as an example, the Zimstat price data has prices for Harare urban, Harare rural and Epworth sub-districts (excludes Chitungwiza district). In dealing with this limitation, the study proceeded by taking the average of goods prices for Harare urban, Harare rural and Epworth as the price for the Harare district. However, the extent to which this aggregation biases the study’s regional price distribution analysis remains an empirical question. Chances are that bias may (may not) occur if the aggregated sub-districts have statistically dissimilar (similar) prices; although the latter is highly likely.

Products covered by the prices survey can be grouped into Non-Alcohol Beverages, Alcohol Beverages, Cloth, Footwear, Fuel, Textiles, Vehicle Fluids and Furniture; as shown in Table 4-2[31].

Table 4-2: Product groups

Product Groups	Number of Products
Food	18
Non-Alcohol Beverages	7
Alcohol beverages	9
Clothes	50
Footwear	6
Fuels	9
Household textiles	7
Vehicle fluids	3
Furniture	8
others	2

Source: Stata output using price surveys from Zimstat 2009-2014.

Table 4-3 presents summary statistics for consumer goods prices (dependent variables) in US$ at the district level. These include the overall mean, and variation between districts and within time (years) of the product prices. The overall average yearly price of food items is US$4.26, the food prices also differ across the 60 districts and also within the six years of study, as given by the different standard deviations, minimum and maximum values.

[30] Originally the pricing surveys had 82 districts while shape-files had 60 districts. Thus, only 60 districts could be matched from the shape-files to the price surveys. There are fewer districts in the shape files as some cities and towns were presented as one district which masks the sub-districts.

[31] Less emphasis will be place on analysing product group “other” - it has only two products.

Table 4-3: Summary statistics of the product prices (2009-2014) US$

Variable		Mean	Standard deviation	Minimum	Maximum	Observations
All Food	overall	4.256	1.059	3.093	7.505	N = 360
	between		0.873	3.994	7.595	n = 60
	within		0.624	4.256	4.456	T = 6
Non-Alcohol Beverages	overall	2.240	1.053	0.861	5.188	N = 360
	between		0.781	0.619	5.832	n = 60
	within		0.713	2.740	2.940	T = 6
Alcohol Beverages	overall	2.574	0.537	1.762	3.857	N = 360
	between		0.425	1.245	3.704	n = 60
	within		0.346	2.574	2.874	T = 6
Cloth	overall	5.747	2.39	2.140	12.153	N = 360
	between		1.953	2.032	11.136	n = 60
	within		1.407	5.746	5.976	T = 6
Footwear	overall	6.968	3.508	1.453	14.987	N = 360
	between		3.097	1.367	1.857	n = 60
	within		1.694	6.967	6.997	T = 6
Fuel	overall	17.403	12.646	1.254	46.235	N = 360
	between		12.062	1.401	44.133	n = 60
	within		4.061	17.403	17.983	T = 6
Textiles	overall	6.609	2.655	2.389	13.234	N = 360
	between		1.965	2.952	12.261	n = 60
	within		1.817	6.609	6.691	T = 6
Vehicle Fluids	overall	6.270	3.089	1.746	13.797	N = 360
	between		2.793	1.881	12.754	n = 60
	within		1.375	6.270	6.750	T = 6
Furniture	overall	338.8943	50.451	132.57	457.452	N = 360
	between		28.734	134.59	433.612	n = 60
	within		41.615	338.894	339.984	T = 6
All goods	overall	29.452	4.890	0.861	457.452	N = 360
	between		3.956	0.8419	477.275	n = 60
	within		5.832	2.240	338.894	T = 6

Source: Stata output using price surveys from Zimstat 2009-2014.

A comparison of the average prices across products reveals some cross-product price differentials. For instance, Table 4-3 shows an overall mean price of US$2.24 for non-alcohol beverages, US$5.75 for cloth, US$6.97 for footwear, US$17.40 for fuel. Similar to the case for food, the product prices for the other goods in Table 4-3 also exhibit differences across districts and within the six years as shown by the standard deviation, minimum and maximum price columns. As an example, the standard deviation for non-alcohol beverages between districts (within periods) is 0.78 (0.71) while those for alcohol beverages and cloth are 0.42 (0.35) and 1.95 (1.41).

The price differentials distinguished across districts are further unpacked in Table 4-4. For brevity, Table 4-4 shows mean values for nine product prices across seven randomly chosen districts. In contradiction with the LOP, Table 4-4 attests to some price disparities across the districts. For instance, the average food price in Bulawayo is US$3.86; US$4.30 in Harare; US$6.24 in Mutasa. For cloth, the average price in Bulawayo is US$3.90; US$6.10 in Harare; US$9.02 in Mutare. Analogous to Figure 4-2, Table 4-4 also shows relatively low average prices in Bulawayo and Harare compared to districts such as Chimanimani, Chipinge, Makoni, among others. These regional price differences motivate our analysis of spatial price distribution.

Table 4-4: Average price for 8 randomly chosen districts (US$) (2009-2014)

	Bulawayo	Harare	Chimanimani	Chipinge	Makoni	Mutare	Mutasa
All Food	3.855	4.298	5.168	4.216	7.088	5.179	6.238
Non-Alcohol Beverages	2.068	3.460	4.646	4.567	3.976	3.843	4.429
Alcohol Beverages	2.276	2.434	3.514	2.496	3.479	2.452	3.392
Cloth	3.900	6.104	8.253	9.095	7.092	9.022	10.807
Footwear	4.246	7.410	10.680	9.519	12.509	10.427	12.207
Fuel	9.222	23.460	23.686	23.551	23.543	23.474	23.289
Textiles	4.618	6.717	10.987	9.826	11.817	8.734	10.514
Vehicle Fluids	3.668	8.002	11.362	9.147	9.134	10.024	11.732
Furniture	312.737	290.218	308.238	297.470	296.842	291.328	276.620
All goods	25.619	27.175	38.599	37.718	42.649	39.212	43.006

Source: Stata output using price surveys from Zimstat 2009-2014.

It can also be noted that furniture and fuel prices are generally high relative to other goods' prices. Hence, the study utilises log prices in the regression analysis.

Table 4-5 presents descriptive statistics for selected independent variables used in the following regression analysis; import tariffs, exchange rates, money supply, temperature and rainfall. Importantly, information on import tariffs rates was available in different types; ad valorem, specific and mixed (partly ad valorem and partly specific) import tariff rates. These were also specified for bilateral, general and multilateral trade agreements. For this study, non-ad valorem tariffs were converted to ad valorem, and for the different goods, an average ad valorem import tariff rate was calculated across the different trade regimes. That said, a cursory look at Table 4-5 reveals that the variables are not constant across time. For example, the overall and within standard deviations for import tariffs are 7.25 and 6.32, respectively. Notably, there is no between district variation for import tariffs, money supply and exchange rate as they are national-level variables.

Table 4-5: Descriptive statistics for covariates[32]

Variables		Mean	Standard Deviation	Minimum	Maximum	Observations
Imports Tariffs	overall	18.37	7.25	0	100	N = 360
(ad valorem)	within		6.32	5.97	33.29	T = 6
Exchange rates	overall	8.58	1.38	6.72	11.46	N = 360
(US$/rand)	within		1.36	6.63	11.11	T = 6
Money supply	overall	2867.61	1236.82	297.63	4457.26	N = 360
(million US$)	within		1222.45	571.67	4354.17	T = 6
Temperature	overall	29.47	14.24	0.005	34.25	N = 360
(degrees Celsius)	between		13.49	29.58	30.77	n = 60
	within		28.16	16.80	33.17	T = 6
Rainfall	overall	344.86	134.92	0.007	563.63	N = 360
(mm)	between		122.02	107.27	548.48	n = 60
	within		59.34	157.45	559.39	T = 6

Source: Stata output using price surveys from Zimstat 2009-2014.

However, temperature and rainfall vary across districts. Using the standard deviation for temperature and rainfall we observe the overall (14.24; 134.92), between (13.49; 122.02) and

[32] Summary statistics for remaining covariates are in Appendix 3-A2 in the appendix.

within (28.16; 59.34) tendencies of dispersion. This covariate distribution across time and space allows for our multivariate analysis of regional price distribution in Zimbabwe.

4.7 Tradable goods

The distinction between tradable and non-tradable goods is very important, mostly when product prices are collected. Non-tradable goods are products which cannot be traded internationally or across the country. Such goods include services where the producers and consumers of the product in question are all located in the same country. The prices surveys provided by Zimstat are limited in that they do not separate tradable from non-tradable components of the consumer goods used in this study (Table 4-4). That both tradable and non-tradable goods are affected by import tariffs implies that it would have been more accurate to separate the import tariffs effect on these two types of goods (Corden, 1966). Feenstra (1989; 2015) observed that prices of domestic non-tradable goods tended to increase as local producers took advantage of an increase in import tariffs to maximise profits. Given the lack of basis to disentangle tradable and non-tradeable portions of goods used in this study, the analysis proceeds on the assumption that all the goods are tradable. Appendix C-A3 in the appendix attempts to provide the rationale. However, this assumption is likely to overstate the ITPTE, hence the reader should be aware of this limitation.

4.7 Presentation of results

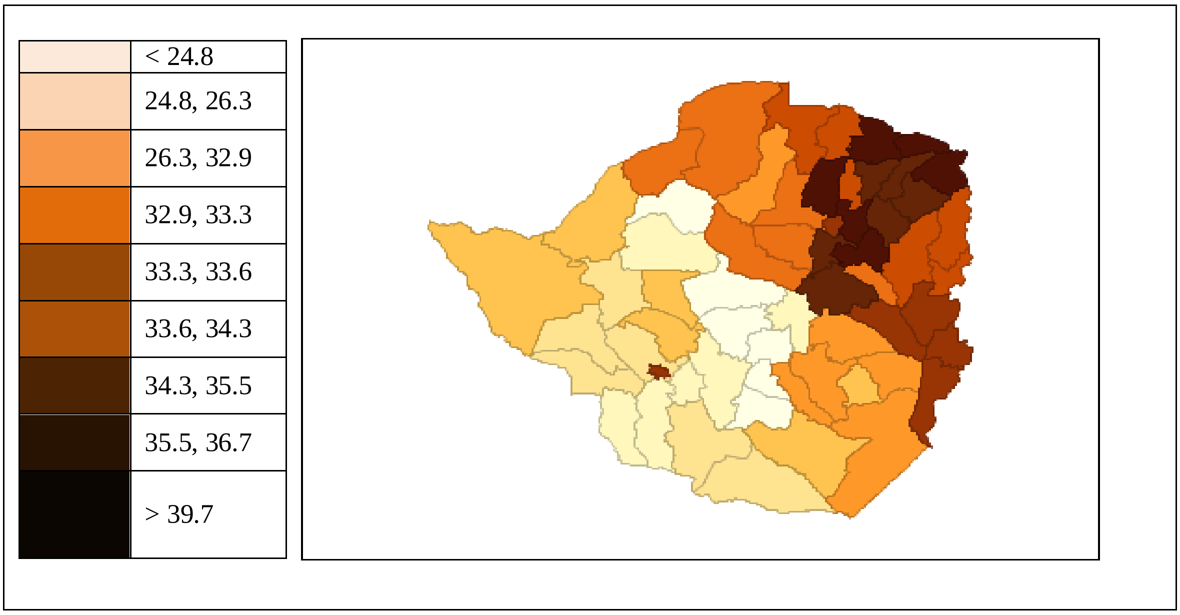
4.7.1 Spatial distribution of prices

This section discusses results for price distribution in Zimbabwe. Spatial maps are discussed first followed respectively by I, C and G tests of spatial autocorrelation and spatial regression models.

Spatial maps for price distribution in Zimbabwe

Figure 4-3 presents a spatial map for the average price of all goods across 60 districts in Zimbabwe for the period 2009-2014.

Figure 4-3: Spatial Map of Price Distribution in Zimbabwe for the period 2009-2014

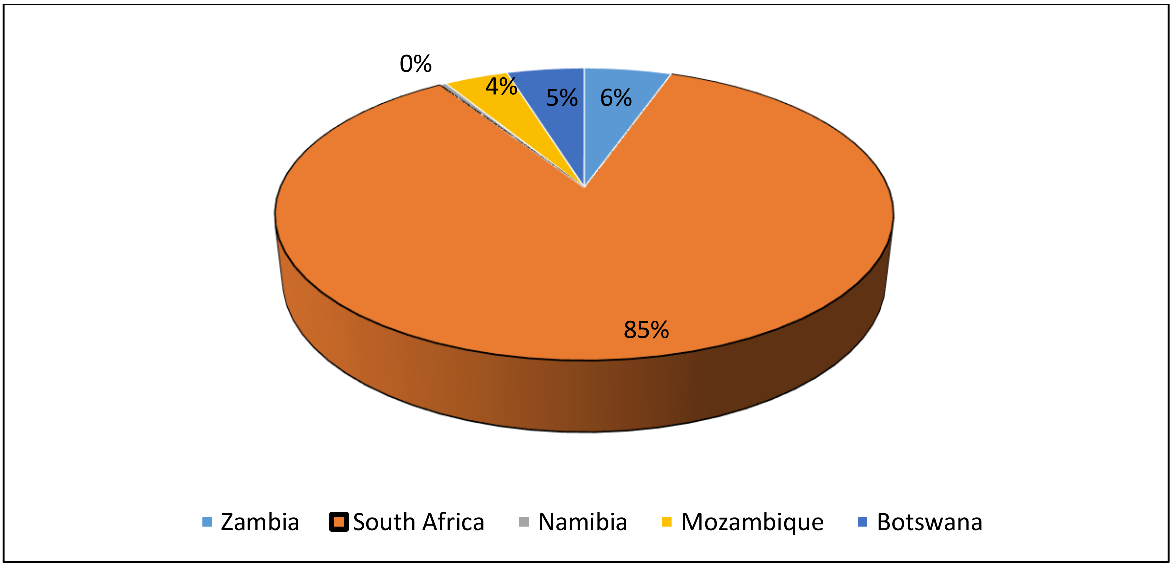


Source: Compilation in GeoDa software based on Zimstat data for 2009-2014.

In Figure 4-3, the darker the colour, the higher the average goods price, the map's key shows the district average prices in US$. Prices are relatively lower in districts to the western and south-west sides of Zimbabwe, while they are relatively higher in north-east districts. To the eastern side of the country, there is Mashonaland Central, Mashonaland East and Manicaland provinces. The cities in these provinces are Harare, Bindura, Marondera, and Mutare. These cities are closer to the Mozambican border but they are far away from the Beitbridge border and it seems as if they are not benefiting much from that. The eastern side of the country is rich in agriculture and the region is also an industrial hub with industries located in Harare and Mutare (CZI, 2014). However, these characteristics seem not helping in keeping prices lower.

Western and south-west parts of Zimbabwe house Matebeleland North, Matebeleland South and Masvingo provinces. Cities in these provinces are Beitbridge, Masvingo and Victoria Falls. These provinces do not receive good rainfall (Dube, 2008). They have dry and less fertile land for agriculture yet enjoy relatively lower prices. Most industries in western and south-west parts of Zimbabwe relocated to the capital city (Harare) following the economic crisis between 2000 and 2008 (Dube et al., 2013). These provinces are also relatively closer to the country's major borders which are Beitbridge, Plumtree, Pandamatenga, Kazungula and Chirundu border posts. These borders are between Zimbabwe and South Africa as well as Botswana. Figure 4-4 shows the share of goods imported from five countries surrounding Zimbabwe for the period 2009-2014; Botswana, Mozambique, Namibia, South Africa and Zambia. The pie chart shows that Zimbabwe imported much from South Africa (85 per cent) and Botswana (6 per cent). This helps to explain why provinces in western and south-western parts of Zimbabwe have relatively lower prices.

Figure 4-4: Share of Imports among 5 Countries surrounding Zimbabwe

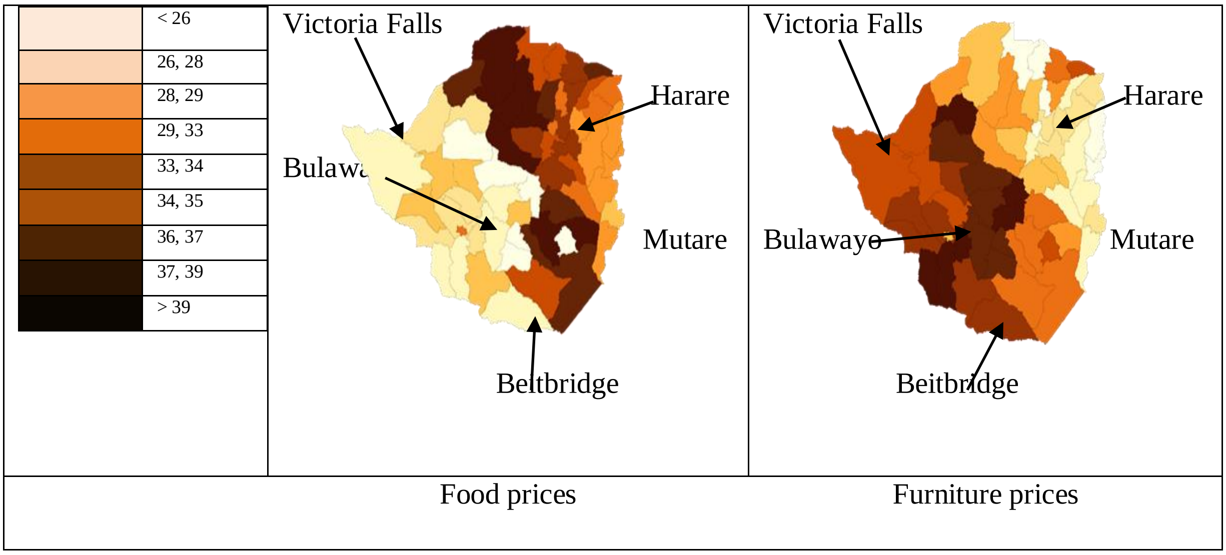


Source: Computation using data from WITS: https://wits.worldbank.org.

Figure 4-5 reveals some regional price differentials at the product level. This shows the spatial distribution of food and furniture prices, used as an example of spatial price differences across commodities. The spatial distribution of food prices is similar to that for the overall price as shown in Figure 4-3, while that for furniture prices is evidently different from that for food. This shows some cross-commodity dissimilarity in price distribution across regions. The spatial distribution of furniture prices seems to be highly influenced by vibrant furniture industries in the eastern side of Zimbabwe.

Zimbabwe's eastern highlands are endowed with multiple tree plantations and furniture industries which makes it the furniture industrial hub (Dube et al., 2013). Further analysis also shows that Manicaland province was the least affected by the 2000-2003 land reform programme as it had a low land take-up rate of 42 per cent compared to the national average of 66 per cent (Utete, 2003). Given the long life cycle of tree plantation compared to maize and other small grains, at a time when the average rainfall pattern was erratic, it made sense for the furniture industry to continue striving while other agriculture food products were repeatedly being imported from neighbouring countries.

Figure 4-5: Comparison of Food and Furniture Prices for the period 2009-2014



Source: Compilation in GeoDa software based on Zimstat data for 2009-2014.

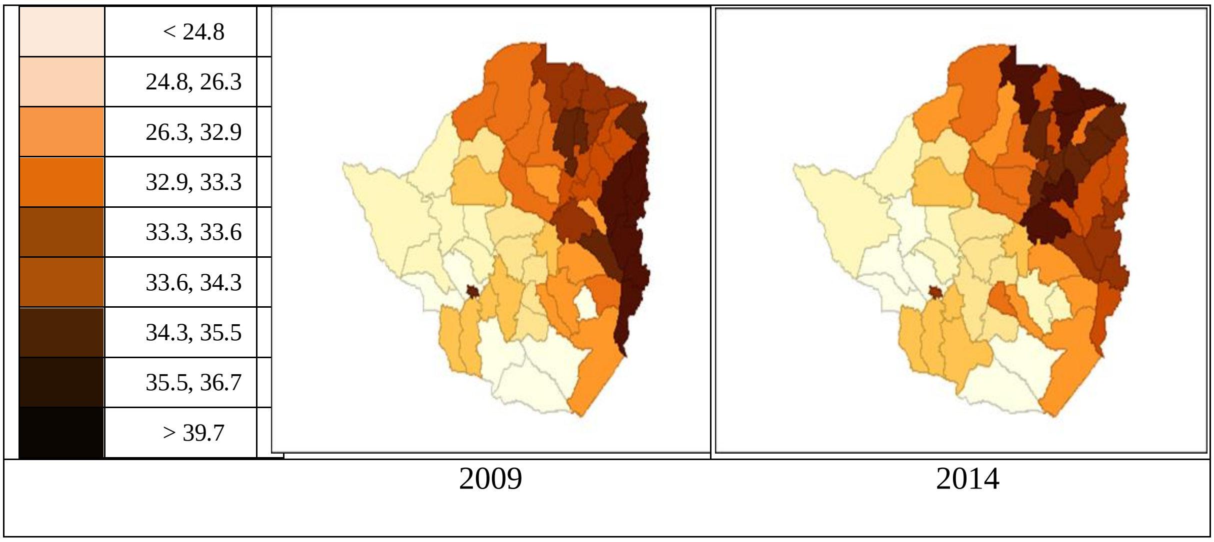
Hence furniture prices were lower in districts located in the eastern parts of Zimbabwe. More maps at the product level are shown in Appendix C-A4 in the appendix. However, the major lesson from these maps is that the spatial distribution of prices is different across products though some products show some similarities.

A closer analysis of the annual maps also shows that the spatial distribution of the prices of the products varies across years. Figure 4-6 shows the spatial distribution of the average goods price for 2009 and 2014. Though there are some similarities, we can also observe slight distributional differences. For instance, districts in Manicaland province experienced higher prices in 2009 compared to 2014. This change is partly attributed to the influx of second-hand clothes from Mozambique, socioeconomic and political reasons, among others (CZI, 2013). However, districts to the west of Zimbabwe continued to experience relatively low prices in both 2009 and 2014. This might be driven by continued importation of products from South Africa and Botswana over the period under study (African Development Bank, 2013). Taken together, these maps indicate some cases where districts with low (high) prices are surrounded by districts with low (high) prices. This hints at some degree of price dependence across districts in Zimbabwe.

Moran's I, Geary's C and Getis and Ord's G tests of spatial dependence

Cressie and Chan (1981) highlighted that maps can be misleading in determining spatial dependence or randomness. Hence, we continue to discuss findings for global I, C and G tests of spatial dependence presented in Table 4-6. The Moran's I tests the null hypothesis of random price distribution against the alternative hypothesis of spatial dependence (Viton, 2010).

Figure 4-6: Comparison of Spatial Distribution across years



Source: Compilation in GeoDa software based on Zimstat data for 2009-2014.

Table 4-6 Panel A shows that I indices for all product groups are greater than their expected values. An example is a case for all goods combined (textiles) where the I-statistic of 0.207 (0.379) is greater than the expected value of -0.003. The p-values are significant for all the products at the 5 per cent significant value. Thus, all products exhibit a positive global spatial price dependence. Panels B and C show results for Geary' C and Getis and Ord's G, respectively. C indices for all products are less than 1, while G indices are all greater than the expectations values. This reinforces the finding of a general tendency towards positive price dependence across Zimbabwean districts that have been uncovered under Moran's I.

Results for local I, C and G indices for all goods combined for some districts are presented in Appendix C-A5.A to C–A5.C. Regions labelled L-L and H-H (H-L and L-H) represent positive (negative) spatial dependence. The results attest to local pockets of positive spatial price dependence in selected regions. Concerning the discussion in section 4.1, the local spatial autocorrelation shows a mixture of negative and positive spatial dependence. However, results are[33] skewed towards positive spatial price dependence, as is the case for the global indices.

[33] 37, 42 and 45 per cent of the districts show positive dependence under the local Moran's I, Geary's C and Getis & Ord's G respectively. 28, 27 and 20 per cent of the districts reported negative dependence while the remaining districts did not record a significant outcome at the 5 per cent level.

Overall, this implies that the price of good *x* in district *i* depends on the price of good *x* in proximate districts.

Table 4-6: Global I, C and G-Test statistics-domestic goods prices

	Panel A: Moran's I				
Variables	I	E(I)	Sd (I)	z	p-value*
All goods	0.207	-0.003	0.015	14.171	0.000
Furniture	0.090	-0.003	0.015	6.291	0.000
Vehicle fluids	0.628	-0.003	0.015	42.417	0.000
Textiles	0.379	-0.003	0.015	25.661	0.000
Fuels	0.616	-0.003	0.015	41.589	0.000
Footwear	0.456	-0.003	0.015	30.904	0.000
Cloth	0.534	-0.003	0.015	36.134	0.000
Alcohol beverages	0.391	-0.003	0.015	26.493	0.000
Non-Alcohol beverage	0.250	-0.003	0.015	17.047	0.000
Food	0.489	-0.003	0.015	33.190	0.000
	Panel B: Geary's C				
Variables	C	E(c)	Sd (c)	z	p-value*
All goods combined	0.839	1.000	0.037	-4.316	0.000
Furniture	0.873	1.000	0.060	-2.100	0.018
Vehicle fluids	0.408	1.000	0.022	-26.431	0.000
Textiles	0.689	1.000	0.027	-11.726	0.000
Fuels	0.422	1.000	0.023	-25.087	0.000
Footwear	0.573	1.000	0.027	-15.767	0.000
Cloth	0.592	1.000	0.031	-13.366	0.000
Alcohol beverages	0.733	1.000	0.029	-9.152	0.000
Non-Alcohol beverage	0.742	1.000	0.035	-7.318	0.000
Food	0.738	1.000	0.039	-6.716	0.000
	Panel C:Getis & Ord's G				
Variables	G	E(G)	sd(G)	z	p-value*
All goods	0.066	0.064	0.000	3.290	0.001
Furniture	0.065	0.064	0.000	0.320	0.013
Vehicle fluids	0.080	0.064	0.001	10.857	0.000
Textiles	0.072	0.064	0.001	6.900	0.000
Fuels	0.093	0.064	0.002	13.102	0.000
Footwear	0.075	0.064	0.002	7.014	0.000
Cloth	0.075	0.064	0.001	9.232	0.000
Alcohol beverages	0.068	0.064	0.001	6.010	0.000
Non-Alcohol beverage	0.070	0.064	0.001	4.146	0.000
Food	0.071	0.064	0.001	9.409	0.000

Source: Compilation using Stata output based on Zimstat data for 2009-2014.

Spatial regression models

Before discussing results in this section, the appropriate spatial model for this study is determined from outcomes for the five models specified in section 4.1. AIC, BIC and LM criteria are used for the purpose; the lower the AIC and BIC values and the greater the LM value, the better is the model. Table 4-7 shows the resultant three most appropriate spatial models for this study, the rest of the results are in Appendix C-A6 in the appendix. The SDM, SAR and SEM models which control for both individual and time effects are more appropriate than the other models. According to these models, rho (0.556, 0.609) and lambda (0.643) values show the presence of positive spatial price dependence. This result is consistent across all spatial models considered for the study, see findings in Tables C6-C9 in the appendix.

Table 4-7: Appropriate spatial model[34]

Variables	SDM both	SAR both	SEM both
Panel A : Using the Queen spatial weighted matrix			
rho-spatial dep	0.556***	0.609***	
LM	4.805***	5.630***	5.557***
lambda-spatial dep			0.643***
AIC	1708.49	1725.74	1725.89
BIC	1895.02	1822.89	1822.95
Observations	360	360	360
R-squared	0.465	0.532	0.424
Panel B : Using the Euclidean matric spatial weighted matrix			
rho-spatial dep	0.433***	0.759***	
LM	3.631***	4.544***	3.854***
lambda-spatial dep			0.453***
AIC	1698.49	1842.74	1826.89
BIC	1795.02	1877.89	1878.95
Observations	360	360	360
R-squared	0.365	0.432	0.524

Source: Computation using STATA, the dependent variable is average consumer goods price.

Results in Table 4-7 Panel A are based on the Queen spatial weights matrix while those in panel B utilised the Euclidean matrix. These are the two most different types of weights matrices given that the Queen matrix uses district boundaries while the Euclidean matrix uses the distance between the districts. For robustness checks, results in Appendix C-A7 to C-A9 are based on K-nearest neighbour, Rook, and Arc distance weights matrices, correspondingly. These still support the SDM, SAR and SEM models as appropriate for this study. In addition

[34] The regressions control for import tariffs, location (rural and urban), exchange rate, money supply, industrial hubs, distance to the borders, provincial dummies, rainfall), (*** p<0.01, ** p<0.05, * p<0.1). All the dummy variables are dropped in the fixed effects models.

to these models, results based on Rook and K-nearest neighbour also favour the GSPRE model. Although we observe some small variations depending on the spatial weights matrix used, overall the SDM, SAR and SEM emerge as the most appropriate models in this case.

The rest of the analysis utilises the Queen matrix as results above are consistent across the different types of spatial weights matrices. Appendix C-A10 presents details of the Queen matrix; two districts share two borders and only one district shares borders with nine other districts. Essentially, it is reassuring that the three different tests of regional price distribution attest to a positive spatial price dependence. Hence, this result is incorporated in the import tariff pass-through analysis.

4.7.2 Comparison between the 'traditional' and 'spatial' import tariffs pass-through models

This section carries out a comparative analysis of results in Table 4-8 which are based on equations 4.21 and 4.22. These are for the 'traditional' import tariffs pass-through model which does not control for regional price dependence compared to the SAR ('spatial') model which controls for the latter. The first four columns show results based on fixed-effects model; this drops all the static variables. The last six columns use the ordinary least squares (OLS) regression in which the static variables are added iteratively. In all regressions, the dependent variable is the average price of all goods. The most important explanatory variable is the coefficient of import tariffs. This shows the magnitude of import tariff changes passed on to domestic goods prices.

The coefficient for import tariffs is positive and statistically significant in all models. This is 0.289 in the traditional model and 0.085 in the SAR, which means 28.9 per cent and 8.5 per cent of import tariff changes are passed on to domestic prices following a 1 per cent increase in the import tariff rate. The observation that the 'traditional' ITPTE is larger than the one in the spatial model is consistent across the 10 regressions in Table 4-8. This finding confirms that the spatial distribution of domestic prices affects the ITPTE. Thus a failure to control for spatial price distribution biases the ITPTE.

In columns 4 and 5 we add money supply in both models, this captures the monetary policy effect on prices. The money supply is positively correlated with prices in both models, the coefficients are 0.002 and 0.013 for the traditional and SAR models, respectively. This small effect was attributable to ineffective monetary policy as the RBZ had limited control on money supply during this multi-currency era (CZI, 2014). Import tariffs and money supply results based on OLS models in Table 4-8 columns 6-11, are qualitatively similar to those for fixed-effects models. When location (rural/urban dummy) is added to the model in columns 10 and 11, we find that it is positive and statistically significant in both models. Results for traditional and SAR models imply that prices are 14.82 per cent and 30.56 per cent higher in rural than urban areas. This outcome is likely to be driven by poor rainfall over the period 2009-2014 which could have caused food shortages and rising prices in rural areas (World Bank Climate Data Portal, 2018). Poorer transport infrastructure in the rural areas could also have contributed to the relatively high prices.

Table 4-8: Comparison between the traditional and spatial import tariffs model

	Fixed Effects models				OLS regression models					
Variables	Traditional	SAR	Traditional	SAR	Traditional	SAR	Traditional	SAR	Traditional	SAR
Import tariffs	0.289**	0.085**	0.205**	0.051**	0.338**	0.017**	0.260***	0.040***	0.256***	0.049***
Money supply			0.002***	0.013**			0.001*	0.003*	0.022*	0.072*
location									1.482**	3.056**
rho		4.533***		4.765***		5.562***		4.754***		5.651***
R-squared	0.565	0.553	0.568	0.564	0.498	0.479	0.497	0.584	0.393	0.598

Source: Computation, the dependent variable is average consumer goods price (significant level *** p<0.01, ** p<0.05, * p<0.1). The model also controlled for location, provincial dummies, year dummies, and distance to major borders, distance to industrial hubs. The model uses the Queen spatial weights matrix.

Table 4-9 continues the analysis by focusing on the OLS regression model and adding more controls to the traditional and SAR models. In column 1-2, we add rainfall to both the traditional model and the SAR, there is a negative relationship between rainfall and domestic prices with the traditional model producing a rainfall coefficient of (-0.075) while the SAR has a coefficient of (-0.009). Thus, a 1 percent increase in rainfall is associated with a 7.5 per cent and 0.9 per cent decrease in domestic goods prices under the traditional and SAR models, respectively. The introduction of the rainfall variable is also affecting the location variable as it becomes smaller and less significant. Thus agriculture activities are of paramount importance in explaining rural/urban price variations.

Columns 4-5 introduce the nightlight variable which captures the level of economic activities in respective districts. The coefficients for nightlight are negative and statistically significant at the 5 per cent significant level; -0.091 in SAR model compared to -0.004 in the traditional model. Thus, districts which are in close proximity to economic activities tend to benefit more from relatively low prices than those that are not.

Table 4-9 also introduces other controls, namely, distance from Harare (column 6-7), Distance to Bulawayo (column 8-9), Distance to Beitbridge (column 10-11) and provincial dummies (column 14-15). Results show that the further away a district is from Harare and Beitbridge the higher are the district's prices. Distance from Harare captures the capital city effect and the relevance of industrial hubs. Following the economic crisis of 2008, most industries closed their branches in other cities like Bulawayo and only left their Harare branches open (Dube et al., 2013; CZI, 2013). Distance from Beitbridge captures the border effect. During 2009-2014 industrial capacity for Zimbabwe was low, most goods were being imported with 85 per cent of imports originating from South Africa (see Figure 4-4). Factoring in transport and other distribution costs, districts closer to Beitbridge benefited from relatively low prices. In all models, the Beitbridge border effect on prices outweighs that of Harare e.g., in column 11 the Harare coefficient is 0.048 compared to 0.064 for Beitbridge[35].

Appendix C-A11 extends the results in Table 4-9 as it includes all the provinces. For robustness check of outcomes for the spatial models, Appendix C-A12 presents estimates for empirical models in Table 4-9 but using SDM and SEM. Importantly, coefficients for import tariffs in these spatial models are also positive and statistically significant. Similar to the SAR model, the import tariff pass-through effects in SDM and SEM models are smaller than those from the traditional models.

[35] Table C-A8 in the appendix shows the complete set of regressions in Table C-12. The last two columns control for provincial effects on goods prices. Results are not robust across models. However, prices are shown to be relatively higher in Manicaland, Mashonaland East and Mashonaland West relative to Matabeleland North province. The opposite applies to prices in Masvingo, Midlands and Matabeleland South when compared to Matabeleland North.

Table 4-9: Comparison between the traditional and spatial import tariffs models

Variables	Traditional	SAR	Traditional	SAR	Traditional	SAR	Traditional	SAR	Traditional	SAR	Traditional	SAR	Traditional	SAR
Import tariffs	0.260***	0.040***	0.256***	0.049***	0.256***	0.049***	0.316***	0.059***	0.339***	0.062***	0.205**	0.071**	0.329**	0.084**
rho		4.805***		6.431***		5.458***		5.873***		5.643***		5.557***		5.668***
Exchange rates	0.056	-0.778	0.082	-0.978	0.008	-0.0948	0.017	-0.059	0.038	-0.093	0.098	-0.112	0.193	-0.142
Money supply	0.001*	0.002*	0.022*	0.072*	0.042*	0.067*	0.091*	0.092*	0.036*	0.074*	0.064	0.103	0.037	0.453
location	1.112*	2.956*	1.082*	2.056*	1.094**	2.068*	1.303**	1.602	1.205**	2.106**	1.250*	1.146	1.320**	1.146**
Rainfall	-0,075**	-0.009***	-0,035**	-0.014***	-0.002**	-0.023*	-0.0053**	-0.069**	-0.0047**	-0.058**	-0.002***	-0.013**	-0.012***	-0.024**
Nightlight			-0.004***	-0.091***	-0.006***	-0.101***	-0.011***	-0.081***	-0.014***	-0.171***	-0.041***	-0.171***	-0.004***	-0.091***
Distance to Harare					0.028	0.048**	0.038	0.068**	0.028	0.048**	0.014	0.019***	0.028	0.048**
Distance to Bulawayo							-0.015**	-0.006	-0.053**	-0.056	-0.053**	-0.082*	-0.015**	-0.006
Distance to Beitbridge									0.073***	0.064*	0.029*	0.023***	0.073***	0.054*
Distance to Mutare											0.015	0.010	0.015	0.010
Bulawayo prov dum													0.529	3.078
R-squared	0.424	0.532	0.365	0.584	0.265	0.558	0.424	0.465	0.365	0.465	0.373	0.507	0.436	0.545

Source: Computation using STATA, the dependent variable is the average price of all goods (significant level *** p<0.01, ** p<0.05, * p<0.1)

In Tables 4-8 and 4-9, the y-variable was the average price of all goods. Hence, we extended the spatial price dependence analysis from aggregate to product level as shown in Table 4-10. The key aim is to observe if the finding on import tariffs is persistent across product groups. That is, whether the 'traditional' model overestimates the import tariff effect on prices compared to spatial models (SDM, SAR and SEM). Notably, Table 4-10 only presents results for a few products, the full set of results is presented in Appendix C-A13 in the appendix. This follows as the results are qualitatively similar across products.

Table 4-10: Robustness checking (selected products)[36]

	Panel A: Food Prices			
Variables	Traditional	SDM	SAR	SEM
Import tariffs	0.171**	0.063***	0.048**	0.011*
rho		0.484***	0.501***	
LM		0.224***	0.257***	0.250***
lambda				0.552***
R-squared	0.602	0.593	0.420	0.405
	Panel B: Cloth prices			
Import tariffs	0.162**	0.056***	0.057**	0.025**
rho		0.526***	0.561***	
LM		0.789***	0.847***	0.843***
lambda				0.574***
R-squared	0.726	0.464	0.429	0.561
	Panel C : Beverage prices			
Import tariffs	0.143**	0.0428**	0.022**	0.011***
rho		0.373***	0.429***	
LM		0.047***	0.051***	0.053***
lambda				0.440***
R-squared	0.647	0.443	0.514	0.501

Source: Own computation using STATA, (the regressions control for import tariffs, location (rural and urban), exchange rate, money supply, industrial hubs, distance to the borders, provincial dummies, rainfall), (significant level *** p<0.01, ** p<0.05, * p<0.1)

In harmony with findings in Tables 4-8 and 4-9, food, cloth and beverage prices in Table 4-10 also face incomplete ITPTEs that tend to be larger in 'traditional' compared to spatial models; albeit with varying levels of statistical significance. Below, we proceed to rationalise this persistent finding of our study.

[36] Appendix A6 shows the full regression table of the regression estimates.

4.8 Explanation of the import tariffs pass through bias

This section is aimed at rationalising the wedge between the ITPTE from the 'traditional' and 'spatial' models. This hinges on the inclusion or non-inclusion of the spatial lag variable in the price model. The omission of the spatial lag in the 'traditional' model generates an omitted variable bias on regression outcomes, especially the ITPTE (Wooldridge, 2002; Green, 2012; Clark, 2005). For the problem to be valid, the omitted variable should exhibit a strong correlation with both the dependent and some independent variables in the model.

Appendix C-A14 shows a considerable correlation between the spatial weighted price and absolute prices, and some independent variables; for example, a correlation coefficient of 0.81 (0.49) with price (import tariffs). Thus, to some extent, controlling for spatial price dependence attenuates the import tariff effect in SDM, SAR and SEM models. The inherent spatial weights matrix captures the shortest paths relation between 60 districts' paring[37]. Events in one district will affect greatly closer districts relative to districts which are far away. If goods prices are decreasing in one district, then the decrease will be propagated to the surrounding districts. Also, the spatial weights matrix that captures the distance between districts, implies that the matrix controls for variations in the distributional cost, language, culture and information across districts (Haynes, 1984).

Section 4.2 showed mechanically that the ITPTE decreases as the magnitude of spatial dependence and the distributional cost increases. Firstly, distributional costs accrue when distributing goods from one region to another. They include transport cost, information asymmetry, packaging cost, the extent of competition, domestic taxes, regulatory costs, etc. (Winters, 2000b). Due to a general tendency of clustering across our districts, a decrease in the distribution cost will be propagated across districts factoring in distance. When such changes are factored in the final price, they corroborate our finding of highly interdependent goods prices across Zimbabwean districts - positive spatial dependence shown in section 4.7.

Secondly, the magnitude of spatial dependence is underpinned by the connectedness and networks among the districts. Section 4.1 alluded to the great connectedness between districts and markets in Zimbabwe brought by the relatively small size of the country, centralised markets, strong

[37] The matrix acknowledges that each district has an intrinsic degree of uniqueness due to its situation relative to the rest of the district spatial system.

networks in the forex market and strong market links which were harnessed by hyperinflation as firms were fighting to keep afloat of market forces.

Further support of attenuation of the ITPTE once we control for spatial price dependence in Zimbabwe hinges on adoption of the multiple currency system and the inflation rate for 2009-2014. The year-on-year inflation rate was -0.2 per cent in 2014, signifying a drop in prices (Zimbabwe National Statistics Agency, 2014). To some extent, this could have reduced some distribution costs of imported products, such as transport costs and domestic tax. Such deflation was immediately transmitted across districts due to aforesaid market linkages. Furthermore, an increase in import tariffs against deflation would partly absorb the ITPTE on domestic goods prices.

In addition to the above factors that dampen the ITPTE, McCulloch et al. (2001) pointed to the extent of domestic competition, the functioning of the market, infrastructure and domestic regulation. The policy of price control is popular in Zimbabwe, where the government controls the rising of prices through enforcing strong regulation against the price increase. This inevitably compromises the transmission of import tariff changes to domestic prices.

4.9 Conclusion

This chapter set out to achieve two key objectives: first to investigate the nature of spatial price distribution across Zimbabwean districts over the period 2009-2014; second to investigate whether a failure to control for the nature of spatial price distribution when estimating the ITPTE biases the estimates.

Firstly, the study finds a positive spatial dependence of domestic goods prices among Zimbabwean districts, over the period 2009-2014. This finding is based on several spatial econometrics techniques (Spatial maps; the Moran's I, Geary's C, Gertis and Ord's G statistics; Spatial Durbin model, Spatial Auto-Regressive model, Spatial Error model, Spatial Autoregressive with Spatially Autocorrelated Errors model and the Generalised Spatial Random-effects model). It broadly implies that precise estimates of price or demand models in Zimbabwe, and especially those on the ITPTE, require factoring in the distribution of domestic goods prices. Policymakers also need to be sensitive to polices or events that change (increase) goods prices in overall (e.g. import tariffs) or in one region (e.g. a cyclone) will be propagated across several districts which has a negative welfare effect.

Secondly, the study finds evidence of an incomplete tariff pass through in Zimbabwe; a positive and significant portion of import tariffs changes are passed on to domestic goods prices. This finding is consistent with the outcomes of Mallick and Marques (2007) and Hayakawa and Ito (2015) based on developed and developing countries. However, the import tariffs pass-through effects found in this study are relatively low. That is a maximum of 33.9 per cent for the traditional non-spatial model and 8 per cent for spatial price dependence models. In contrast, Feenstra (1989), Kreinin (1977) and Mallick and Marques (2007) found an import tariff pass-through of around 60 per cent. Districts links, networks, connectedness, and the high distribution cost justify the large disparities. Regardless, policymakers should be cautious of the import tariffs increase concerning household welfare and poverty reduction targets, since an increase in import tariffs translates into a non-trivial increase in domestic goods prices. Countries planning to adopt a multiple currency and cash budget system should thus be aware of the likely effects of implementing such policies since they require some discipline concerning import tariff changes.

Third and more importantly, the study found that 'traditional' import tariffs pass-through models which do not account for spatial correlation of domestic goods prices tend to overestimate the ITPTE. Thus the domestic spatial distribution of prices highly affects the ITPTE. This highlights the need to control for the spatial distribution of domestic goods prices when estimating the import tariffs pass-through effect. Especially, given that the results may be informative for national socio-economic development policies.

The major weakness of the study is the failure to separate tradable and non-tradable components of products used for the analysis. The dataset used for the study includes products where some portions were produced domestically and some were imported. However, due to the lack of a mechanism to distinguish such portions, all the products were assumed to have been imported. Depending on the degree of bias, our results should be interpreted with caution. We, however, recommend that where possible, future studies can benefit from separating tradable and non-tradable components of all products before embarking on a typical analysis. In addition, future studies should take note of the geographic demarcations of the districts since this might exacerbate the price dependence if there are some demarcation overlaps. This study encountered the limitation that not all districts from the price surveys were matched to the shapefiles, as the shapefiles presented some cities as a composite district. Such a move might influence the spatial price dependence due to averaging out prices of sub-districts to get a single price for the composite district.

Chapter 5: Investigating the Benefit Incidence of Import Tariffs changes among Zimbabwean Households (2009-2014)

5.1 Introduction

Prior to the 1990s, countries were more focused on economic growth rather than on the associated distribution of income and expenditure in society. This partly fueled income inequality as benefits of economic growth were being shared among a select few income groups (Cornes, 1995). Hence, international organisations such as the World Bank, Organisation for Economic Co-operation and Development (OECD) and the Department for International Development (DFID), among others, began championing for inclusive growth, also known as broad-based growth, shared-growth and pro-poor growth (World Bank, 1990; Department for International Development, 2004; OECD, 2008). This has been supported by various studies that assessed how governments' policies affected household welfare across the income distribution (c.f. Aaron & McGuire, 1970; Behrman & Deolalika, 1988; Bird & Miller, 1991; Messere, 1997; Lanjouw & Ravallion, 1999; Younger, 1999; Ke-Young et al., 2000; Daniels & Edwards, 2006).

Existing literature shows that government policies can be transmitted to household welfare, as proxied by consumption expenditure, in various ways. For instance, the government may embark on a redistributive tax-benefit policy which taxes the rich heavily and gives state subsidies and social grants to the poor (Chen et al., 2001). Apart from direct cash benefits, expansionary monetary and fiscal policies may, for instance, reduce direct and indirect taxes and interest rates which supposedly increase household purchasing power, ceteris paribus. A similar effect pertains to trade liberalisation, an example being an import tariff reduction for some goods. Based on consumption patterns, households which consume the affected goods with a price inelastic import elasticity of demand may gain some purchasing power, while those that do not are left out (Daniels, & Edwards, 2006; Selden & Wasylenko, 1992; Van de Walle, 1992). For elucidation, an import tariff reduction on luxury (basic) goods will benefit the welfare of the high (low) income group more than that of the low (high) income group. The concept that different income groups may benefit differently from government policies has popularised benefit incidence analyses of government policies/projects since Aaron and McGuire (1970), Brennan (1976) and Behrman and Deolalika (1988). This has been given more prominence by the growing importance of household welfare and equity in economic development.

An analysis of extant literature on benefit incidence analysis[38] of import tariff-related policies shows that this is more of a developing rather than developed countries' issue (Aaron & McGuire, 1970; Behrman & Deolalika, 1988; Cornes, 1992; Grosh & Larry, 1996; Devarajan & Hossain, 1995; Lanjouw & Ravallion, 1999). Some of the related studies, however, focus on tax in general rather than specific tax-types which brings ambiguity to policymakers when incorporating resultant findings (Devarajan & Hossain, 1998; Matinez-Vazquez, 2001; Refaquat, 2003; Chen et al., 2001; OECD, 2000). Other studies also compare the benefit of import tariffs between overall populations in imposing and receiving countries (Gorman, 1958; Johnson, 1953; Kennan & Riezman, 1988). While this is educational, it leaves us unaware of the intra-country distribution of benefits, which is crucial for studying household welfare. Furthermore, some of the studies are biased as they allow for temporal variations in import tariffs while holding constant household income and expenditure patterns over time (Daniels, 2005; Daniels & Edwards, 2006).

The assumption that household consumption patterns are non-responsive to price changes is because of limited availability of income and expenditure survey data. This constraint has also resulted in very few studies of benefit incidence analyses of import tariffs on household welfare in African countries; especially those in southern Africa (see Daniels & Edwards, 2006; Chitiga et al., 2007). Yet, such analyses will be crucial for initiatives to address inequity in household welfare which is pro-socio-economic development. Moreover, the region is endowed with some countries that encountered atypical political-economic phases such as Zimbabwe. Hence, it is unclear whether findings of current literature can be generalised to such countries.

In light of the above, this study intends to investigate the benefit incidence of import tariffs in the case of Zimbabwe over the period 2009-2014. This is achieved through satisfying three objectives, i) To investigate the benefit incidence of import tariffs on Zimbabwean households in general, through their consumption expenditure patterns, ii) To compare the benefit incidence of import tariffs between male- and female-headed households in Zimbabwe, iii) To compare the benefit incidence of import tariffs between households in rural and urban areas of Zimbabwe.

[38] Benefit incidence analysis considers who receive what benefit from a given policy change.

The analysis is crucial as, to the best of our knowledge, currently, no study has done a benefit incidence analysis of import tariffs in Zimbabwe. The only studies closest to the present study are Chitiga and Mabugu (2005) and Chitiga et al. (2007) which analysed the effect of import tariff changes on household poverty in Zimbabwe within a computable general equilibrium framework. The studies established that import tariff reduction had a welfare-enhancing effect which differed by household income level as well as geographic location, but did not distinguish the households by gender of headship. Notably, the studies' period of analysis was before the country's economic crisis, Zimbabwe still had its sovereign currency. The present study focuses on the period 2009-2014; post-economic crisis. This is a peculiar period in which Zimbabwe adopted a multiple-currency and a cash budget economic system (GoZ, 2009). These policies restricted fundraising options for the country which made import tariff increases attractive.

It is thus important to investigate the incidence of the import tariff burden across household income groups, considering gender differences in household headship and geo-spatial location. Moreover, the same period was characterised by deterioration in many households' welfare (Zimstat, 2014). Thus there is a need to determine whether the contemporaneous import tariffs contributed to the welfare decline i.e. were they progressive[39] or regressive. Apart from extending typical literature to southern African countries, results for this study are helpful for strategies to mitigate household poverty and inequality in Zimbabwe. They also serve as lessons for countries that may consider adopting multiple currencies and cash budget economic systems.

The rest of the chapter is structured as follows. Sections 5.0-5.1 present a succinct discussion of Zimbabwe's background on inequality and import tariffs. Sections 5.2-5.3 present theoretical and empirical literature surrounding the subject of interest. Section 5.4 discusses the research methodology and data. Section 5.5 discusses the findings of the study while section 5.5 concludes.

5.2 Inequality trends and poverty in Zimbabwe

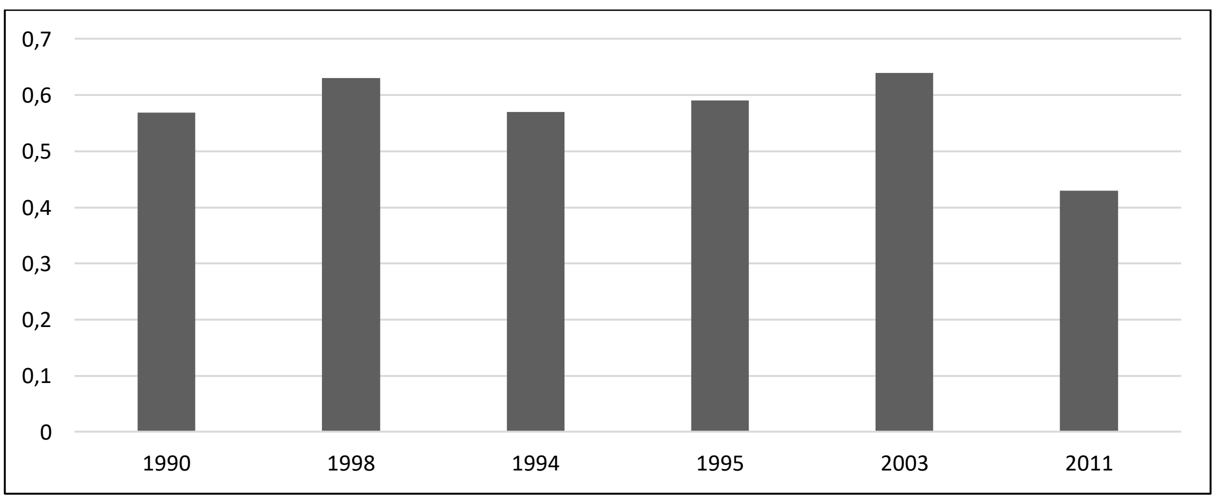
The aforementioned broad-spectrum reversal of trade liberalisation, in addition to hyperinflation and closure of manufacturing sector firms, might have contributed to inequality through driving a wedge between poor and non-poor households in Zimbabwe (Tekere, 2001; CZI, 2010, 2013). In

[39] Progressive import tariffs: the ratio of import tariffs paid to taxable income increases with taxable income.

the previous chapter, we observed a positive import tariff effect on domestic goods prices. This distortionary effect on domestic prices could have a worse household welfare effect if tariffs effects are also disproportionately incurred across household income groups and by geographic areas. As such, income inequality and poverty are non-trivial burdens in Zimbabwe; hence it is important to ascertain whether import tariffs are contributory to these problems.

Concerning income inequality, Figure 5-1 shows that the Gini coefficient ranged between 0.43 and 0.64 over the period 1990-2011. Inequality was highest in 2003 attributable to the economic crisis which started around 2000, and the lowest in 2011, thanks to some initiatives to contain the economic crisis. Such initiatives include the adoption of the multiple currency monetary system and the implementation of a fiscal cash budget in 2009. Though inequality exhibits a declining trend, the problem remains unignorable compared to its fellow African countries like Uganda (Gini coefficient of 39.5 in 2013), Malawi (Gini coefficient of 46.1 in 2010), Ghana (Gini coefficient of 42.3 in 2013) and Tanzania (Gini coefficient of 37.6 in 2010) (Central Intelligence Agency US website, 2018).

Figure 5-1: Gini coefficients of Zimbabwe for selected years



Source: Human development report (1998), Zimstat (2006) and CIA website

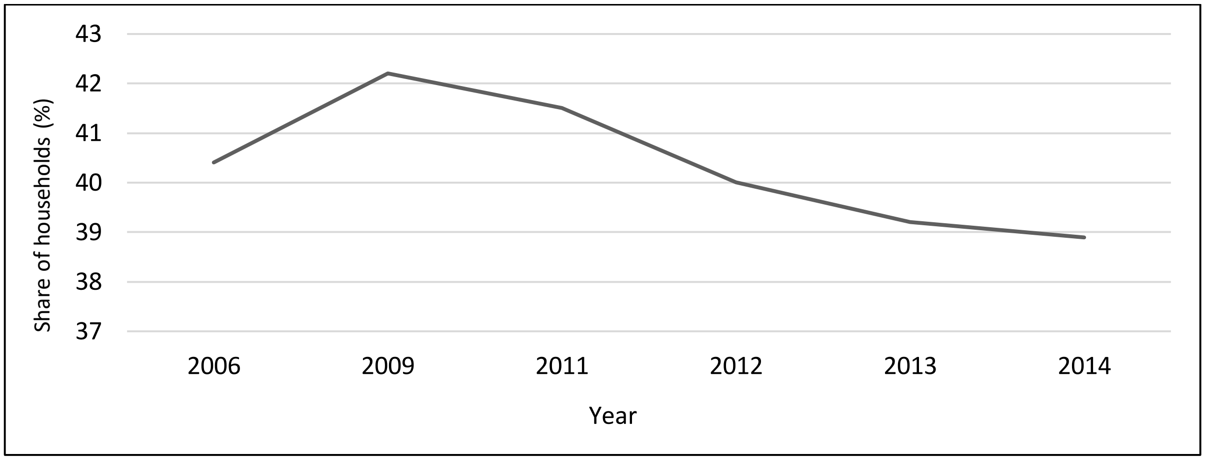
Zimbabwe became independent in 1980, hence income inequality in the 1990s was highly influenced by developments of the pre-independence colonial period. This was characterised by an uneven distribution of economic opportunities and outcomes along racial lines. Whites benefited at the expense of blacks in terms of education, employment opportunities and compensation thereof. The racial discrimination led to the liberation war which further increased inequality between rural and urban areas; rural areas were negatively affected by the war (Kereke, 2001). This later promoted rural to urban migration (Zimstat, 2010). Therefore, since Zimbabwe's political independence in 1980, the government has implemented a series of economic policies aimed at ameliorating inequality and poverty. For the first decade post-independence, these included Growth with Equity (1981), Zimbabwe Transitional National Development Plan (1982-3) and Zimbabwe first five years National Development Plan (1986 to 1990). The underlying policy measures included accelerated expansion of rural infrastructure in the form of the building of schools, hospitals, roads, housing, among others.

In pursuit of the abovementioned policy measures, central government expenditure grew from 35 per cent of GDP in 1980 to 47.4 per cent of GDP in 1990 (Kereke, 2001). At the same time, the gap between government revenue and expenditure also grew, leading to an increase in debt accumulation, swelling inflation and crowding out private investment (Sachikonye, 2011). Due to the pressure of subdued economic growth, high national debt accumulation, high unemployment rate, increased fiscal deficit, the Zimbabwean government was forced to abandon the pro-poor policy measures towards adopting market-oriented reforms. The Bretton Woods Institutions accelerated this transition through the ESAP (1991-1995). After the ESAP, Zimbabwe also implemented several national economic programmes from 1996-2015 as highlighted in Chapter 1[40]. Regardless, inequality remained high in the country, as shown by Gini coefficients in Figure 5-1.

More recently, i.e. about 38 years post-independence, the Zimbabwean government is still battling with inequality and poverty. According to the Zimstat (2014), during the period 2009-2013, about 62.6 per cent of resident Zimbabweans were living in poverty and 16.2 per cent were living in extreme poverty. The proportion was also higher for rural than urban households, 76 per cent versus 38.2 per cent. Also, 30.4 per cent of rural households were recorded as extremely poor compared to 5.6 per cent of their urban counterparts.

[40] Namely, ZIMPREST-1996-2000; MERP- 2000-2002; NERP-2003-2004; Macroeconomic Framework- 2005-2006; NEDPP- 2007-2009; STEP-2009-2010 and the MTP- 2011-2015.

Figure 5-2: Share of households in the poorest wealth quintiles



Source: UNICEF Zimbabwe (2016)

Figure 5-2 shows the share of households in the poorest wealth quintiles (quintiles 1 and 2) for 2006-2014. The period was distinguished by a general decrease in this group of Zimbabwean households. This can be taken as a sign of decreasing inequality which augurs with Figure 5-1. The downward inequality trends in Zimbabwe may be linked to the high migration which was experienced during the period 2000-2009 following the economic crisis[41]. For example, Zimbabwean migrants to Botswana increased from 746 212 in 2006 to 1 041 465 in 2009 (Kiwanuka, 2009).

5.3 Theoretical literature review

This discussion focuses on a few international trade theories which connect import tariff changes to price distribution and welfare. These include the basic Stolper Samuelson theorem (SST) (1914), the Specific Factor model (SFM), the Krugman (1981) love for variety approach and the Winters (2000b) conceptual framework. Notably, the latter underlies the study's methodological framework of benefit incidence analysis.

Situated within the Heckscher Ohlin model's two-sectors two-factors and two-countries inter-industry trade framework, the SST (1914) postulates what happens to factor prices following a change in goods prices due to variations in import tariffs. Theoretically, a tariff increase for a

[41] It is acknowledged that there is inconclusive evidence on the effect of migration on inequality (Adams, 1992; Barham and Boucher, 1995; McKenzie, 2004; Black et al. 2005; Barham and Boucher, 1995).

product results in a more than a proportionate increase (decrease) in the return of a factor which is intensely (not intensely) used to produce the good (Feenstra, 2002). For clarity, let us assume that footwear intensely uses unskilled labour and computers are skilled labour intensive. If import tariffs on footwear cause an increase in footwear price, this will increase returns for unskilled labour, by a bigger magnitude than that of the initial price change, and reduce those of skilled labour. This tends to reduce income inequality between skilled and unskilled labour. The model, nonetheless, implies that a change in a specific import tariff may eventually affect the distribution of household expenditure through changes in price distribution and factor returns.

Although critiquing the SST due to its strong assumption of perfect factor mobility across domestic industries, the SFM in Jones (1996) also links a specific import tariff change to household expenditure through factor returns. The SFM is premised on two-sectors two countries and three-factors - capital is specific to a given sector but labour is mobile across sectors. This could be a labour abundant country with two sectors, an exporting sector which intensely uses labour and an importing sector which intensely uses capital. The SPF suggests that a reduction in import tariffs will raise (reduce) the real income of capital specific to the exporting (importing) sector. Nominal wages will also increase as per increased demand in the exporting sector and also because of labour mobility across the two sectors. Hypothetically, the price of exported goods will increase more than the wage increase, thus the real wage will fall (rise) in the exporting (importing) sector. The net effect on income distribution and welfare will depend on the extent of labour mobility between the two sectors. While the SST and SFM attest that an import tariff change affects household welfare through an indirect link with factor returns, it is difficult for this study to operationalise them as we rely on cross-sectional household expenditure data which cannot capture factor returns' response to a tariff change.

Moreover, the SFM has been criticised for its failure to acknowledge intra-industry trade. Krugman (1981) extends the SFM by introducing intra-industry trade. The model assumes monopolistic competition and economies of scale in production and that consumers love variety. An import tariff reduction is postulated to increase available varieties which increase welfare as prices of some domestically produced goods fall. Let us assume two-countries which have two-industries and endowments of specific labour such that one country has a comparative advantage and comparative disadvantage in certain varieties. Due to economies of scale, the sectors can manage to produce a wide range of different varieties of goods using specific labour. A reciprocal reduction of import tariffs in both countries will increase varieties available to consumers. Similar to the SFM, the comparative advantage sector will gain while the comparative disadvantage sector will lose. Unlike in the SFM, consumer welfare improves due to the increase in variety associated with tariff reductions. In some cases, the gains in welfare might exceed the loss generated in the comparative disadvantage sector. If this happens then households may afford to spend their resources on a larger volume of the relatively cheaper goods than before which is welfare enhancing. However, our data precludes us from linking price and variety changes to household welfare which negates the usefulness of this approach for our empirical exercise.

Apart from the traditional approaches discussed above, McCulloch et al. (2001) provide an alternative understanding of the link between import tariffs, price distribution and consumer welfare. This follows Winters (2000c) who focuses on the government, households and firms. Three channels are postulated in which import tariff changes may affect price distribution and consumer welfare. First is the government channel which follows government income and expenditure. Second is the enterprise channel which affects output, wages and employment. Third is the distribution channel which directly links price transmission to household welfare.

Under the government channel, a reduction in import tariffs either decreases or increases government revenue. The increase follows an associated decline in chances of smuggling while a decrease may be associated with inelastic import volumes following the tariff reduction. An increase in government revenue may have a greater effect on the poor if government expenditure is inclined towards household welfare improvement. As for the drop in revenue, this may worsen the position of the poor if government compensates for it by increasing other taxes such as excise tax, income tax, corporate tax, and so forth (McCulloch et al., 2001).

The enterprise channel predicts that a general reduction in import tariffs can be met by either an increase or decrease in some firms' output. If the output is reduced (increased) then employment and wages will decline (increase). These effects, however, depend on the elasticity of labour supply. If labour supply is inelastic, then a general import tariff reduction will increase wages and consequently household welfare in developing countries. However, there is little to no effect on wages if labour supply is perfectly elastic, which calls for additional wage regulation procedures (McCulloch et al., 2001).

The distribution channel is more closely related to the concept of benefit incidence analysis. Under this channel, households are directly affected by price changes emanating from import tariff changes. Focusing on the importation of a single product, Winters (2000b) started at the international or world price of good x i.e. w_x. At the border, the effect of exchange rate Ex and import tariffs imp_x will be added to the world price w_x. From the border, good x will be transported to warehouses and wholesale at which more cost will be incurred in bringing good x to its sellable condition (Winters, 2000b). These costs include transport cost $trans_x$, packaging cost pak_x, legislation cost leg_x, and mark-up for the wholesalers mak_x. In a mathematical expression the price of good x at the wholesale level wh_x can be represented as;

$$wh_x = w_x + imp_x Ex + trans_x + pak_x + leg_x + mak_x \quad \text{………………} [5.1]$$

Retail shops will buy good x at the price wh_x from the wholesalers and sell it at price ret_x to the final consumers. Between the wholesale and the final consumer, good x will be subjected to additional costs which might include transport cost $\_trans_x$, re-packaging cost $repak_x$ etc. The final price to the consumer ret_x may thus be specified as;

$$ret_x = wh_x + ret\_trans_x + repak_x + ret\_mak_x \quad \text{……………………..} [5.2]$$

where ret_mak_x will be the mark-up by the retail seller, what can be observed from Winters (2000a), the distribution channel is that costs are passed on to the next distribution level as goods move towards the final consumer. Therefore, changes in import tariffs can be directly traced to the final price of the product. This means that increasing or decreasing import tariffs will affect the price of products. Reducing import tariffs usually causes the domestic price to decline thus benefiting the consumers. However, the effects depend on whether the domestic consumers are net producers or net consumers. Net consumers will benefit from an import tariff reduction while the net producers lose out as imports will be relatively cheaper than local goods.

Most Zimbabwean households live in rural areas and are highly involved in agricultural activities for livelihoods. They are net producers of agriculture products and net consumers of processed food products, in non-drought periods. Accordingly, an import tariff change which increases agriculture products' prices and reduces processed goods' prices is likely to benefit the rural population. On the contrary, urban households in Zimbabwe are on average net consumers of imported goods, hence they are more likely to benefit from an import tariff reduction. When considering the poor, the Poverty Research Unit at Sussex (2001) maintains that they are predominantly net buyers of imported goods, thus trade reforms are more likely to benefit the poor compared to the non-poor. This suggests that the tariff incidence is less likely to be proportional in Zimbabwe.

Winters (2000c) also suggests that the import tariff burden may differ across households depending on their economic activities and consumption choices i.e. the concept of "Farm Household". For instance, a change in import tariffs which isolates the agriculture market is more likely to affect rural more than urban households (Dodd & Cattaneo, 2006). Also supposing females are intensively employed in the textile industry, then the effect of a tariff change on textile products will differ by gender. This distinction calls our study to consider demographic and spatial differences in tariff effects.

5.4 Empirical literature review

Table 5-1 presents a summary of tax incidence studies - mostly for developing countries of the world. Panel A shows studies which did not delve into import tariffs but other taxes, public expenditure on education, health, water and sanitation, while Panel B shows studies which encompassed import tariff changes. Relatively less attention has been paid to the benefit incidence of trade liberalisation policies (import tariff) compared to fiscal policies. Studies of the tariff incidence are also very few in sub-Saharan Africa, especially southern Africa except for Daniels and Edwards (2006). Against this background, we discuss Prasad et al. (2005) for Sri Lanka, Tabi et al. (2006) for Cameroon and Daniels and Edwards (2007) for South Africa, as they are more relevant for motivating the current study.

Table 5-1: Summary of tax incidence studies

Panel A: Non-import tariff studies			
Author & country studied	**Taxies included**	**Methodology**	**Findings**
Woolard et al. (2015) **Country**: South Africa	Personal income tax, value-added tax, excise tax on alcohols, tobacco and fuel levy	Income distribution analysis	Personal income tax was found to be progressive while value-added, excise tax on alcohols, tobacco and fuel levy were found to be slightly regressive.
Younger (1996) **Country**: Ghana	Export tax, value-added tax, cocoa, tobacco, kerosene	Stochastic dominance, concentration curves, Gini coefficients	Export taxes on cocoa and kerosene were found to be regressive.
Shah and Whalley (1991) **Country**: Pakistan	Corporate tax, personal income tax	Nominal tax rates, tax to GDP ratios, non-tax regulation analysis	Non-tax regulation underestimate the progressivity of tax
Armstrong et al. (2017) **Country**: South Africa	Health Financing Health care services	Quintile analysis	Health financing was found to be pro-poor
Sahn and Younger (2000) **Country**: Cote d'lvoire, Ghana, Guinea, Madagascar, Mauritania, South Africa, Tanzania, Uganda	Health and education expenditure	Dominance tests, complemented by extended Gini and concentration coefficients	A mixture of progressive and regressive tax systems
OECD (2000) **Country**: OECD countries	Corporate tax, personal income tax	Nominal tax rates, tax to GDP ratios, average tax rate, marginal effective tax rate	Taxes were found to be ranging from neutral to progressive
Lanjouw and Ravallion (1999) **Country**: India	Public spending	Benefit incidence analysis impact evaluation	Tax reforms benefited the poor-progressive
Berg (2009) **Country**: South Africa	Social spending (spending on school and tertiary education, social grants, health clinics, hospitals, and subsidised housing)	Expenditure incidence analysis	Social spending was found to be highly progressive, with fiscal redistribution intensifying in 2000
Chen et al. (2001) **Country**: Uganda	Corporate and income tax	Marginal effective tax analysis	Tax was neutral to progressive but less progressive than before the reforms
Bird and Miller (1991) **Country**: Jamaica	Taxes on alcohol, tobacco, food, fuel and housing	Partial equilibrium, Lorenz curves, Gini coefficient	A mix of progressive and slightly regressive tax incidence
Devarajan and Hossain (1995) **Country**: Philippines	Benefit incidence of fiscal policy-government expenditure	Partial and general equilibrium, effective tax rates	Taxes were found to be neutral and slightly regressive
Martinez-Vazquez (2002) **Country**: Mexico	Government expenditure	Stochastic dominance, Lorenz curves	Fiscal policy was found to be broadly progressive tax
Messere (1997) **Country**: OECD countries	Corporate and personal income tax	Trend analysis	Personal and corporate taxes were proportional

Panel B: Import tariff studies			
Author & country studied	**Taxies included**	**Methodology**	**Findings**
Daniels (2005) **Country**: South Africa	Import tariffs	Quintile income distribution analysis Benefit incidence of import tariffs across gender	Male headed-households bear a higher import tariffs burden compared to female-headed households.
Younger et al. (1999) **Country**: Madagascar	Import tax, value-added tax, tax on kerosene, vanilla, petroleum, alcohol, tobacco	Stochastic dominance, concentration curves, Gini coefficients	Import tax was found to be regressive, while most taxes were progressive
Younger (1999) **Country**: Ecuador	Import tax, value-added tax, tax on kerosene,	Concentration curves, Gini coefficients	Most taxes including import tax were per capita progressive
Rajemison and Younger (2000) **Country**: Madagascar	Import tariffs, petroleum tax and VAT	Partial equilibrium	Import duties were found to be progressive
Martinez-Vazquez (2001) **Country**: Mexico	Import tax, value added tax, tax on kerosene, vanilla, petroleum, alcohol, tobacco	Literature review of papers	Results were mixed depending on methodology
Prasad et al. (2005) **Country**: Sri Lanka	Goods and services taxes and import tariff on fifty selected commodities	Welfare dominance, Lorenz and concentration curves	Evidence of both progressive and regressive import tariffs depending on commodity
Tabi et al. (2006) **Country**: Cameroon	Sales tax, import duties and excise duties	Indexes of progressivity and concentration curves	Import duties were regressive over time, 1984 to 2001, while other taxes were progressive
Daniels and Edwards (2006) **Country**: South Africa	Import tariffs	Stochastic dominance analysis	Import tariffs were progressive

Source: Various papers cited in the author column.

Prasad et al. (2005) found mixed evidence concerning the effect of commodity taxes, including import tariffs, on income distribution in Sri Lanka. The study used household survey data for 1999/2000 and welfare dominance, Lorenz and tax concentration curves as analytical tools. Results showed that 10.69 per cent of imported food and non-food items had progressive import tariffs while 14.43 per cent had regressive tariffs. Also, wide provincial variation was visible among commodities when the incidence of tax was considered. The study, however, only presents a snapshot analysis of the import/tax incidence, yet a trend analysis could be more effective for policy purposes. This caveat was however, addressed by Tabi et al. (2006).

Tabi et al. (2006) examined the distribution of expenditure tax (sales tax, import duties and excise duties) before and after the tax reform in Cameroon for the years 1983, 1996 and 2001. The analysis compared the Kakwani index, extended Gini coefficients and concentration curves computed from household survey data over the years. In general, taxies evolved from being regressive to progressive over time. Excise tax on alcohol and other special taxes on petroleum products, gasoline, and diesel were found to be highly progressive. The tax reforms of the 1990s seemed to have benefited the poor income groups as inequality levels were observed to be declining. However, import duty was found to be regressive over the years; the Gini coefficient showed a temporary increase. Although informative, this study does not educate us on whether the effect of the indirect taxes and tariffs on the expenditure distribution was sensitive to household characteristics. For instance, Younger (1996) maintains that the import tariff incidence depends on households' characteristics which include the gender of the household head.

Daniels and Edwards (2006) evaluated the benefit incidence of import tariffs reduction in South Africa for 1995, 2000 and 2004. Over this period, South Africa experienced great trade liberalisation which resulted in the reduction of import tariff rates. The average import tariff rates of 80 sectors declined from 16 per cent to 10 percent over the period 1995-2000, followed by a further 8 per cent decline in 2004. This import tariff reduction led to welfare improvements as prices went down. The objective of the paper was to evaluate if this consumer welfare improvement was uniform across different consumer groups. The study did a benefit incidence analysis using the 2000 income and expenditure survey. It employed a non-parametric estimation procedure where it compared the Lorenz expenditure curve and the cumulative tariff burden incidence calculated for 96 commodities. Results showed that during the period 1995-2000, richer households benefited relative to poor households whereas the opposite applied during 2000-2004. However, the study can be debunked for making a strong assumption that household consumption patterns were non-responsive to tariff changes over the given period. Also, it does not further analyse the import tariffs incidence by geographic location. It is hardly the case that the import tariffs incidence will be uniform for households in rural and urban areas of South Africa.

Daniels (2005) incorporated gender in the benefit incidence analysis for South Africa. The study established that male-headed households incurred a higher import tariffs burden than their female-headed counterparts. This was partly attributable to differences in socio-economic status across the households. In light of this review, this study analyses the import tariff burden by gender of household headship and geographic location. More importantly, it extends the literature on the benefit incidence of import tariffs to Zimbabwe where typical studies are currently non-existent. The method of analysis is discussed in the following section.

5.5 Methodology and data

Inspired by the distribution channel in Winters' (2000b) conceptual framework, this section discusses the methodology used to analyse the burden of import tariffs across the distribution of household expenditure in Zimbabwe for the period 2009-2014. The study is aware that import tariff transmission to domestic prices is not a smooth process as many agencies and regulations are involved; nevertheless, the study assumes that the transmission is smooth. This serves to lessen the burden of modelling all the variables which affect goods' prices from the port of entry to the retail shops for which data is not readily available. Such obstacles include packaging regulation, transport regulation, quality checks, and tax forms, other than the import tariffs (Winters, 2000b). Given this assumption, the methodology of this study closely follows Aaron and McGuire (1970); Demery et al., (1996) and Demery (2000).

In the model, total domestic expenditure on commodity, *i* can be specified as:

$$E_i^d \equiv p_i^d q_i = p_i^w (1 + t_i) q_i \qquad [5.3]$$

$$= p_i^w q_i + p^w t_i q_i \qquad [5.4]$$

where p_i^d is the domestic price of commodity *i*, q_i is the quantity of commodity *i*, p_i^w is the world price of commodity *i*, and t_i is the import tariff rate of commodity *i*.

Given that the study is focusing on a country using a multiple-currency economic system, equation 5.3 will not include the exchange rate component which will have a direct effect on prices and import tariffs. For the period 2009-2014, Zimbabwe was not using its currency thus, it did not have control over the exchange rates of the basket of foreign currencies that were employed as legal tender. For the sake of clarity, the period was marked by the populace's loss of confidence in the financial system such that most bank balances were kept at zero (CZI, 2010; ZEPARU, 2013). Most transactions were done on the informal market - making identification of a single currency which was used more problematic. Also, the Central Bank's value of money supply for this period is highly treacherous.

Focusing only on imported goods and setting $p_i^w = 1$ yields:

$$E_i^d = q_i(1+t_i) \text{ .... [5.5]}$$

Dividing both sides of equation 5.5 by $\frac{t_i}{(1+t_i)}$ and rearranging results in:

$$t_i q_i = \frac{t_i E_i^d}{(1+t_i)} \text{ .... [5.6]}$$

Equation 4.6 can be simplified to:

$$t_i q_i = E_i^d - \frac{E_i^d}{(1+t_i)} \text{ .... [5.7]}$$

where $t_i q_i$ is the total implicit import tariff paid by one household on commodity *i*. Summing this over all the households and commodity *i*, yields T_i which is implicit tariff expenditure over the total of commodity *i* consumed

It should be noted that T_i can be lower or greater than the actual tariff revenue collected by the government for the year *i*. Implicit tariffs expenditure is calculated using scheduled import tariffs which do not consider rebates and import tariffs holidays. Thus, the actual and implicit import tariffs expenditure will be different. This is because the estimations do not factor in the substitution effect, as consumers may shift to commodities whose import tariffs would have been reduced. The estimation also does not take into consideration household production due to data constraints. This omission is not likely to affect results given that local production was low during the period 2009-2014 and Zimbabwe was heavily reliant on imported products (Dube et al., 2013).

The import tariffs benefit incidence on poor and non-poor households hinges on the share of import tariffs expenditure paid by each group and the level of import tariffs on commodities. The incidence of import tariff will be higher on a certain income group if import tariffs are high on the goods mostly consumed by that particular group. Following Daniels and Edwards (2006), the group-specific expenditure on import tariffs X_j is specified as:

$$X_j = \sum_{i=1}^{I} E_{ij} \frac{T_i}{E_i} \equiv \sum_{i=1}^{I} \frac{E_{ij}}{E_i} T_i \text{ ....} [5.8]$$

where j represents a specific group (poor or non-poor, rural or urban, male- or female-headed household), thus X_j is the total expenditure on import tariffs incurred by income group *j* and E_{ij} is the total expenditure on the product *i* by income group *j*. As per the study's objectives, household expenditure patterns may be sensitive to geographic location e.g. rural and urban households. To include the location factor, equation 5.8 is modified to:

$$X_j = \sum_{k=1}^{K} \sum_{i=1}^{I} \frac{E_{ijk}}{E_J} T_{ik} \text{ ....} [5.9]$$

where k represents a location. Dividing equation [5.9] by $T = \sum_{K=1}^{k} \sum_{i=1}^{I} T_{ik}$ yields the incidence of import tariffs, which can be presented as;

$$x_j = \sum_{k=1}^{K} \sum_{i=1}^{I} e_{ijk} t_{ik} \text{ ....} [5.10]$$

where $e_{ijk} = \frac{E_{ijk}}{E_i}$ is the share of expenditure by households in group j at a location k, and $t_{ik} = \frac{T_{ik}}{T_i}$ the share of tariffs cost for each commodity *i* in a location k in total tariff cost of commodity *i*. The study will break x_j into deciles of total household expenditure to compare the tariff burden for poor and non-poor households. The cumulative distribution of x_j will be compared to the cumulative distribution of the expenditure across the deciles. Lorenz curves of the two distributions will be constructed to give a visual comparison of the distribution. If the Lorenz curve of the import tariffs incidence is above the Lorenz curve of household expenditure, it implies that import tariffs are regressive since a lower share of expenditure will be associated with a higher import tariffs incidence. Comparison of the behaviour of x_j will be done across gender of the household head and geographic location.

5.5.1 Data description

This study used data from two sources, Zimbabwe's import tariffs handbook produced by ZIMRA, and Household Income and Expenditure Surveys for 2011/12 and 2013/14 produced by FinScope in conjunction with the Zimstat. The latter consumer surveys are nationally representative and were designed to collect information on financial inclusion in Zimbabwe. Data were collected for 3 984 and 4 000 households in 2011 and 2013, respectively. The sample delimitation process is shown in Table 5-2 which presents sizes of the original and the final samples used in the analysis. A significant number of households reported a monthly income in the range $0 - $100. According to the Zimstat monthly price surveys, such income levels were exceptionally low, given the average prices of basic commodities[42]. Consequently, this study only kept households that had a minimum monthly income of at least US$100. This amounted to dropping 17 per cent (37 per cent) of households in the 2011/12 (2013/14) consumption surveys as their income fell below a minimum threshold. Thus, the original sample of 3 984 households in 2011/12 dropped to 3 300, while the 4 000 households in 2013/14 dropped to 2500. This data cleaning process is considered to not have brought non-trivial bias to our benefit incidence analysis as the dropped households could have erroneously reported their incomes, to begin with.

Table 5-2: Sample delimitation process

	2011 (before cleaning)	2011 (after cleaning)	2013 (before cleaning)	2013 (after cleaning)
Sample size	3984	3300	4000	2500
Male (percent)	40	45	43	46
Female (percent)	60	55	57	43
Rural (percent)	65	63	70	65
Urban (percent)	35	37	30	35

Source: Calculations using 2011/12 and 2013/14 FinScope consumer surveys.

[42] For instance, 2 kilogram of sugar cost $2.1, one loaf of bread $0.9, 2 litres cooking oil $2.5, 1 bar washing soap $1.50, one bar of bathing soap $0.9 on average, one kilogram of salt had an average price of $0.97 and 10 kilogram of maize meal $7.6. If we were to include transport cost, clothes, furniture, fuel, and other costs then a reasonable monthly income could have been close to $200 a month.

Table 5-3 shows descriptive statistics for the sample of analysis. The monthly income statistics show some variation between the two surveys.

Table 5-3: Summary statistics of the FinScope consumer surveys

	Variable	Observations	Mean/proportion	Std. Dev.	Minimum	Maximum
2011	Province:					
	Manicaland	3300	0.13	0.34	0	1
	Mashonaland Central	3300	0.09	0.28	0	1
	Mashonaland East	3300	0.11	0.31	0	1
	Mashonaland West	3300	0.11	0.32	0	1
	Matabeleland North	3300	0.05	0.22	0	1
	Matabeleland South	3300	0.05	0.22	0	1
	Midlands	3300	0.12	0.32	0	1
	Masvingo	3300	0.11	0.31	0	1
	Harare	3300	0.17	0.38	0	1
	Rural area	3300	0.65	0.48	0	1
	Monthly income	3300	242.35	469.60	100	5000
2013	Province:					
	Manicaland	2500	0.14	0.34	0	1
	Mashonaland Central	2500	0.08	0.27	0	1
	Mashonaland East	2500	0.10	0.30	0	1
	Mashonaland West	2500	0.11	0.31	0	1
	Matabeleland North	2500	0.05	0.21	0	1
	Matabeleland South	2500	0.05	0.22	0	1
	Midlands	2500	0.12	0.32	0	1
	Masvingo	2500	0.11	0.31	0	1
	Harare	2500	0.19	0.39	0	1
	Rural area	2500	0.62	0.49	0	1
	Monthly income	2300	270.91	375.45	100	7000

Source: Calculations using FinScope consumer surveys. Income is measured in US$

For instance, monthly income in 2013 was on average higher and less dispersed than that in 2011. The average income for 2011 was in the range US$100 - US$5 000 compared to US$100 - US$7 000 for 2013. This income distribution pattern is also supported by the Lorenz curve in Appendix D-A1.

The 2011/12 and 2013/14 household consumer surveys also captured detailed information on household expenditures on products used for the analysis. Specifically, respondents were asked about their expenses on preserved food, beverages, manufactured food, cloth materials, clothes and footwear. Table 5-4 presents the monthly summary statistics of these household expenditures in US$. The mean expenditure on preserved food products was $24.80 in 2011 compared to $28.45 in 2013. A temporary drop in the mean expenditure on manufactured food from $41.33 to $37.93 was also observed. A similar trend occurred for expenditure on wearing clothes, which dropped by $1.22 from $24.23 in 2011. Household monthly average expenditure on wearing clothes drastically declined from $24.23 in 2011 to $1.22 in 2013. Thus, there were notable variations in average monthly expenditures across products and time.

Table 5-4: Summary statistics of expenditure on food and cloth products (US$)

	Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
2011	Expenditure on preserved food	3300	24.80	40.83	7.5	375
	Expenditure on Beverages	3300	33.07	54.44	10	500
	Expenditure on manufactured food	3300	41.33	68.05	12.5	625
	Expenditure on cloth materials	3300	4.85	9.39	2	100
	Expenditure on wearing clothes	3300	24.23	46.96	10	500
	Expenditure on footwear	3300	20.13	36.46	8	300
2013	Expenditure on preserved food	2500	28.45	39.42	10.5	525
	Expenditure on Beverages	2500	47.41	65.70	17.5	875
	Expenditure on manufactured food	2500	37.93	52.56	14	700
	Expenditure on cloth materials	2500	4.08	6.28	1	90
	Expenditure on wearing clothes	2500	1.22	1.88	0.3	270
	Expenditure footwear	2500	1.14	1.09	4	230

Source: Calculations using FinScope consumer surveys.

Table 5-5 further unpacks percentages of household expenditure allotted to the five goods in question across deciles of total household expenditure – decile 1 (10) represents the lowest (highest) income households. We presume a positive correlation between the percentage of expenditure on a product, as per column headings in Table 5-5 and its consumption. This means we are equating expenditure to consumption. Panel A of Table 5-5 shows consumption patterns based on data for 2011/12 while those for 2013/14 are captured in Panel B.

Poor households (the first three deciles) spend relatively more of their income on preserved food, beverages and manufactured food compared to the non-poor (last three deciles). The latter tend to spend relatively more on clothes and footwear. Thus, pro-poor trade policy would be expected to charge relatively lower import tariffs on food and beverages than footwear and clothing. Panel B shows that the household expenditure distribution of 2013/14 is similar to that of 2011/14. However, poorer households allocated 11.7 per cent more on food and beverages in 2013 while the non-poor reduced their expenditure on clothes and footwear by about 23.7 per cent. Thus, on average, households' expenditure on food and beverage increased whilst the one on clothes and footwear decreased.

Table 5-5: Household consumption pattern for 2011 and 2013 (US$)

Decile	Expenditure on preserved food	Expenditure on Beverages	Expenditure on manufactured food	Expenditure on clothes materials	Expenditure on wearing clothes	Expenditure on footwear
Panel A – 2011/12						
1	31.02	15.17	21.06	5.64	14.38	12.74
2	30.13	17.95	20.48	6.15	14.97	10.97
3	29.37	13.92	21.02	7.39	15.07	13.23
4	26.19	12.75	20.34	8.21	17.85	14.98
5	22.91	10.98	16.39	8.98	24.76	16.08
6	19.58	9.75	13.34	10.01	31.05	16.92
7	18.37	7.64	11.74	10.25	34.88	17.12
8	15.89	3.88	10.28	10.49	41.77	17.69
9	14.02	2.66	8.04	11.25	46.24	17.79
10	13.44	2.49	6.69	13.59	45.75	18.04
Panel B – 2013/14						
1	35.85	13.35	26.97	3.64	12.33	7.91
2	34.96	13.67	26.62	5.65	12.94	6.17
3	31.02	13.92	27.22	7.39	13.02	7.74
4	31.02	16.73	30.49	8.21	15.80	10.15
5	25.74	12.55	26.64	8.18	16.71	10.25
6	25.61	11.06	25.23	9.01	19.00	10.09
7	19.20	11.93	20.03	9.25	29.33	10.29
8	17.72	8.52	21.14	10.49	31.12	11.06
9	16.85	6.47	19.34	11.35	33.19	12.96
10	15.67	5.86	18.90	12.59	33.79	13.21

Source: Calculation using FinScope Consumer surveys for 2011/12 and 2013/14.

The import tariffs related to the abovementioned expenditures are displayed in Table 5-6; as previously mentioned, these were sourced from the country's import tariffs handbook. The tariffs vary across months but yearly averages were constructed for 2009 to 2014. Changes in import tariffs over time were updated using the period's statutory instruments. To elucidate whether there were indeed any variations in import tariffs over the given time, Table 5-6 shows yearly averages of ad valorem import tariffs across product lines.

The import tariffs were different across products over the period 2009-2014. For instance, food products consistently had lower average tariffs than footwear products. Also, some product lines exhibited relatively larger temporary average import tariff changes than others; for example, the mean import tariffs for processing and preserving of food and fish products more than doubled from 2009 to 2010 then decreased in 2011 to 25.63 and increased again in 2012 before closing at 18.26 in 2014. Import tariffs for beverages and tobacco products increased from 27.14 in 2009 to 55.50 in 2012 then decreased from 32.10 and 27.78 in 2013 and 2014 respectively.

Table 5-6: Descriptive statistics for Ad Valorem import tariffs (2009-14)

Variable	Mean					
	2009	**2010**	**2011**	**2012**	**2013**	**2014**
Processing and preserving of food and fish products*	21.18	44.95	25.63	29.70	17.79	18.26
Food products*	14.60	22.12	25.11	27.72	21.67	23.20
Beverages and tobacco products*	27.14	31.15	41.37	55.50	32.10	27.78
Spinning, weaving and finishing of textiles; and other textiles*	20.93	37.99	26.96	31.92	18.92	21.87
Wearing apparel products*	20.41	37.72	26.70	31.42	18.10	19.97
Footwear products*	34.17	62.53	45.75	54.62	32.11	34.17

Source: Calculations using ZIMRA 2009-2014 dataset.

5.5.2 Descriptive statistics by spatial and demographic characteristics

The statistics described here serve to motivate whether there is expenditure inequality across rural and urban households as well as by gender of household headship before analysing the import tariffs incidence. Table 5-7 displays the share of household expenditure on food and cloth products in a merged dataset for 2011/12 and 2013/14 household surveys; for the sake of brevity.

Rural and male-headed household consume relatively higher shares of food and cloth products compared to urban and female-headed households respectively. The mean expenditure statistics also confirm that households in urban and rural areas spend more on clothes and food products respectively. This is correlated to population size; out of the 5800 households in our dataset 64 per cent are rural while 81.14 per cent are male-headed.

Table 5-7: The percentage share of household expenditure on food and cloth products

Group	Food	Clothes	Population
Urban	45%	48%	36%
Rural	55%	52%	64%
Urban area mean expenditure	US$138.75	US$206.6	
Rural area mean expenditure	US$41.56	US$25.63	
Male headed households	85%	84%	81%
Female-headed households	15%	16%	19%
Proportion of female-headed household in rural			53%

Source: Calculations using Finscope Income and expenditure surveys for 2011/12 and 2013/14

Regarding household head characteristics, statistics (not presented here) showed that there were no child-headed households as the ages ranged from 19 to 98 years and most of the heads were males. However, the share of male heads starts to decline at 45 years. There are fewer female heads with most of them aged between 56 and 60 years, their number increases with age up to 60 years where a decline starts. These gender differences rest on male (57.4 years) versus female life expectancy (64 years) in the country (Zimstat, 2014). Of the 19 per cent female-headed household, a large proportion is divorced (34.38 per cent) and widowed (26.61 percent) compared to the male-headed households. A significant proportion (53 per cent) of the female-headed households resides in rural areas.

Income inequality is also evident between male- and female-headed households - Table 5-8 shows the distribution of these households across income brackets. While proportions of both male- and female-headed households are lower in higher than lower-income brackets, there are some notable differences.

Table 5-8: Income brackets of male and female-headed households (percent)

Income Brackets	Male	Female
101US$ - US$200	55.5	60.4
US$201 - US$300	15.3	14.7
US$301 - US$400	10.6	8.9
US$401 - US$500	7.7	6.5
US$501 - US$600	5.5	4.9
US$601 - US$1200	5.4	4.6

Source: Calculations using Finscope Income and expenditure surveys for 2011/12 and 2013/14.

The percentage of female-headed households in higher (lower) income brackets is relatively lower (higher) than that of their male counterparts. This is consistent with Buvinic and Gupta's (1997) postulation that male-headed households earn more income compared to female-headed households.

In light of the inequalities characterised here, the study proceeds to the benefit incidence analysis as per the study's methodology in section 5.4.

5.6 Results

Results for the benefit incidence are discussed for the entire country, for rural versus urban households as well as for male-headed versus female-headed households.

5.6.1 Benefit incidence analysis – all households

This section presents and discusses results for the incidence of import tariffs across Zimbabwean households for the period 2011 and 2013 as per equation 5.8. Table 5-9 shows the mean import tariffs incidence by household income deciles, scaled up by 1000 for analysis purpose since they are initially very small figures. The discussion mainly focuses on relative sizes of mean tariff incidences across households. Table 5-9 reveals a positive monotonic relationship between household income levels and import tariffs incidence i.e. the tariff incidence increases with household income deciles, over the years.

Table 5-9: Mean import tariffs incidence across decile for 2011 and 2013[43]

Decile	2011	2013
1	0.023	0.022
2	0.024	0.023*
3	0.025*	0.024*
4	0.027	0.026*
5	0.028*	0.027*
6	0.032	0.028
7	0.033*	0.029
8	0.034	0.030*
9	0.035*	0.031
10	0.036	0.032*
All deciles	0.316**	0.307**

Source: Calculations using FinScope Consumer surveys for 2011 and 2013.

We also ran statistical difference tests for the incidences between income deciles. These showed mixed results when comparing the mean import tariff incidence of one decile group to the nearest higher-ranking group. An asterisk in Table 5-9 denotes the statistically significant difference between the respective decile and its higher neighbour, at the 10 per cent level. A cursory look at Table 5-9 also suggests that all households seemed to incur a relatively higher incidence in 2011 than in 2013. This is also corroborated by Lorenz curves in Figure 5-3.

The Lorenz curve of the import tariffs incidence for 2011 lies above that for 2013. This reinforces the earlier conclusion that households incurred higher import tariffs expenditure in 2011 compared to 2013. This is reassuring as the same pattern subsists in the national treasury's tariff revenue collections for the two periods[44].

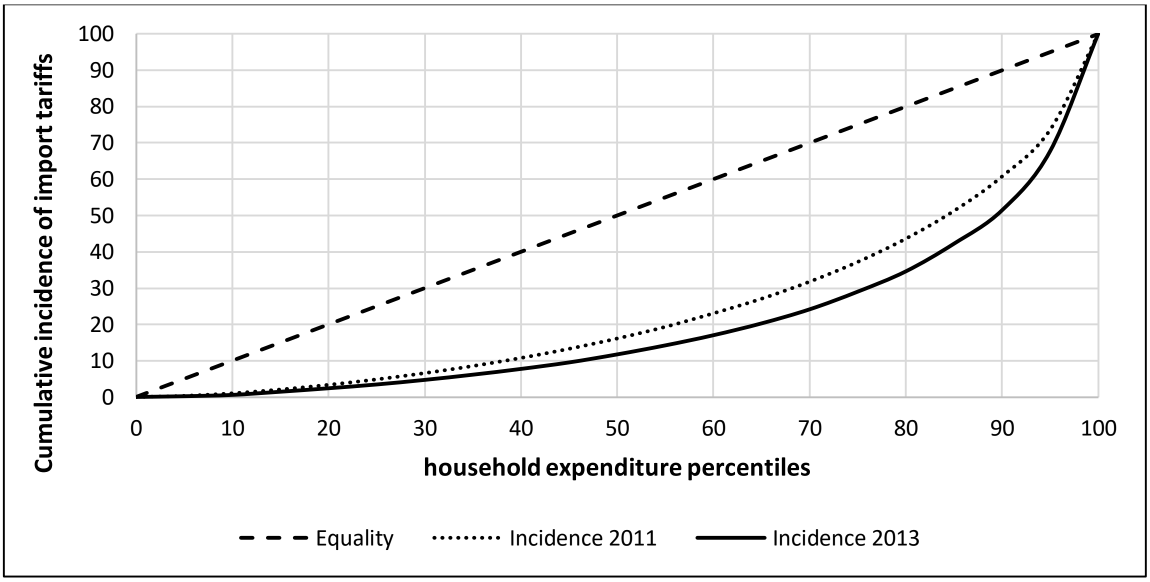
To further the analysis, we now compare households' import tariffs incidence against their share of expenditure, this enables us to conclude whether the import tariffs made the

[43] * shows 10% statistical difference between one decile and the next higher decile group, ** the average for all deciles is statistically different at 5 percent for 2011 and 2013.

[44] In 2011 total tariff revenue was US$ 85 992 510 while it dropped to US$ 77 041 780 in 2013.

households better off or worse off. Households are made worse-off if their cumulative share of import tariffs is greater than the cumulative share of expenditure, and better off if vice versa (Demery et al., 1996). The analysis can also help to determine if import tariffs are progressive or regressive.

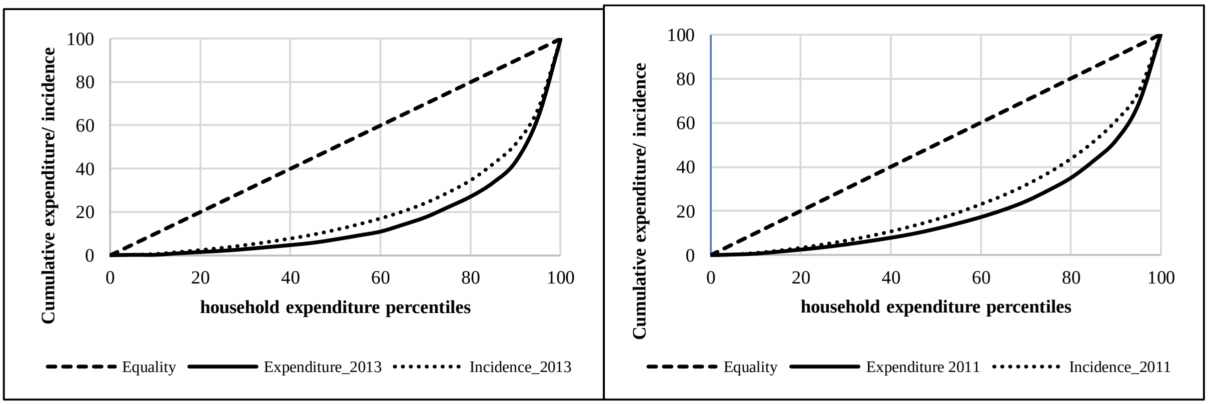
Figure 5-3: Comparing import tariffs incidence for 2011 and 2013



Source: Calculation using FinScope Consumer surveys for 2011 and 2013.

They are regressive if the import tariff burden for the poor households is greater than non-poor households' (Daniels, 2005). Establishing this entails comparing the change in import tariff burden from 2011 to 2013 along with income groups. Figure 5-4 depicts Lorenz curves for household expenditure and tariffs incidence for 2011 and 2013, while Table 5-10 presents the actual statistics for ease of discussion.

Figure 5-4: Incidence of import tariffs against expenditure for 2011 and 2013



Source: Calculation using FinScope Consumer surveys for 2011 and 2013.

Lorenz curves for the households' share of the import tariff burden lie above those for expenditure in 2011 and 2013. Numbers in Table 5-10 illuminate this pattern, apart from confirming aforementioned differences in 2011 and 2013 distributions for import tariffs and household expenditure.

Table 5-10: Comparison of cumulative shares of total expenditure and import tariffs

Percentile	2011 Cumulative share of expenditure	2011 Cumulative share of import tariffs incidence	2013 Cumulative share of expenditure	2013 Cumulative share of import tariffs incidence	2011 Incidence minus expenditure (¥)	2013 Incidence minus expenditure (ϒ)	2013 (ϒ) minus 2011 (¥)
5	0.31	0.32	0.17	0.23	0.01	0.06	0.05
10	0.68	1.01	0.18	0.57	0.33	0.39	0.06
15	1.57	2.06	0.88	1.45	0.49	0.57	0.08
20	2.53	3.35	1.48	2.41	0.82	0.93	0.11
25	3.59	4.85	2.07	3.45	1.26	1.38	0.12
30	4.86	6.58	2.85	4.71	1.72	1.86	0.14
35	6.30	8.53	3.75	6.14	2.23	2.39	0.16
40	7.90	10.75	4.7	7.73	2.85	3.03	0.18
45	9.70	13.27	5.75	9.52	3.57	3.77	0.20
50	11.92	16.11	7.32	11.73	4.19	4.41	0.22
55	14.43	19.31	9.08	14.21	4.88	5.13	0.25
60	17.23	23.04	10.94	17.01	5.81	6.07	0.26
65	20.49	27.06	14.11	20.27	6.57	6.16	-0.41
70	24.37	31.76	17.57	24.14	7.39	6.57	-0.82
75	29.34	37.21	22.22	29.01	7.87	6.79	-1.08
80	34.95	43.6	27.11	34.62	8.65	7.51	-1.14
85	42.61	51.25	33.55	42.21	8.64	8.66	0.02
90	51.83	60.72	43.25	51.42	8.89	8.17	-0.72
95	68.1	73.58	63.8	67.68	5.48	3.88	-1.6
100	100	100	100	100	0	0	0

Source: Calculation using 2011 and 2013 Income and Expenditure surveys.

Table 5-10 also shows a higher incidence of import tariffs in 2011 relative to 2013. For instance, in 2011, the poorest 10 per cent households had an expenditure share of 0.68 per cent but they suffered a 1.01 per cent of the import tariffs burden. In 2013, these households had a tariff burden of 0.57 per cent compared to 0.18 per cent for expenditure. The same pattern is also applicable to the poorest 45 per cent households, their 2011 (2013) import tariffs burden was 13.27 per cent (9.52 per cent) while they contributed an expenditure share of 9.70 per cent (5.75 per cent).

At the top of the distribution, households in the 90th percentile had a tariff incidence of 60.72 per cent in 2011 and 51.42 per cent for household expenditure; in 2013 these figures were 51.42 per cent and 43.25 per cent, respectively. To check whether it is the poor or the non-poor households that incurred a relatively larger tariff burden, compared to their expenditure from 2011 to 2013, column 8 of Table 5-10 presents the difference between the 2013 and 2011 gaps in households' shares of tariffs and expenditure. Evidently, the poor incurred a bigger tariff burden relative to their expenditure from 2011 to 2013 while the contrary applied to the non-poor. Taken together, these findings consistently confirm that import tariffs for Zimbabwe were regressive in 2011 and 2013.

5.6.2 Benefit incidence analysis - rural and urban areas

At the aggregate level, results show that import tariffs in Zimbabwe were generally regressive. This section disaggregates the analysis to examine if there is variation in the tariff benefit incidence for rural and urban areas. This is crucial as section 5.4 showed that households in rural areas have lower income and bear a larger proportion of total expenditure on food and clothes than their urban counterparts owing to their population size, among others. With these income and expenditure differences, the rural and urban households could have different extents of exposure to the import tariff burden, which warrants further interrogation. Table 5-11 shows the mean import tariffs incidence of rural and urban households in 2011 and 2013.

Similar to Table 5-9, Table 5-11 shows a monotonic relationship between the incidence of import tariffs and household income decile. The poor contributed relatively low on import tariffs compared to non-poor household income groups, regardless of the time and geographic region.

This monotonic relationship between import tariffs incidence and household income level might hypothetically be due to a marginal propensity to import where those with high household income might also be importing more. The last column shows that urban households have high import tariff incidence compared to rural households. A negative value means a higher mean import tariffs incidence for the urban area compared to rural areas. The reason for such findings could be life-style differences between households in rural and urban areas. Rural households benefit much from subsistence agriculture which somewhat attenuates their reliance on imported products. Households in urban areas depend more on purchased food products of which most of these were imports in lieu of the Zimbabwean situation during the period of analysis.

Table 5-11: Comparison of import tariffs incidence for rural and urban households[45]

Decile	Rural Area	Urban Area	Difference between rural and urban
	Panel A: 2011		
1	0.021	0.025	-0.004
2	0.024	0.027	-0.003
3	0.026	0.028	-0.002*
4	0.028	0.032	-0.004
5	0.031	0.033	-0.002
6	0.032	0.051	-0.019*
7	0.034	0.055	-0.021*
8	0.036	0.059	-0.023*
9	0.058	0.064	-0.006
10	0.069	0.072	-0.003
	Panel B: 2013		
1	0.020	0.023	-0.003
2	0.021	0.026	-0.005
3	0.025	0.029	-0.004*
4	0.026	0.031	-0.005
5	0.027	0.036	-0.009*
6	0.028	0.038	-0.010*
7	0.029	0.041	-0.012*
8	0.031	0.042	-0.011*
9	0.041	0.046	-0.005
10	0.063	0.071	-0.008*

Source: Calculation using 2011 and 2013 income and expenditure surveys.

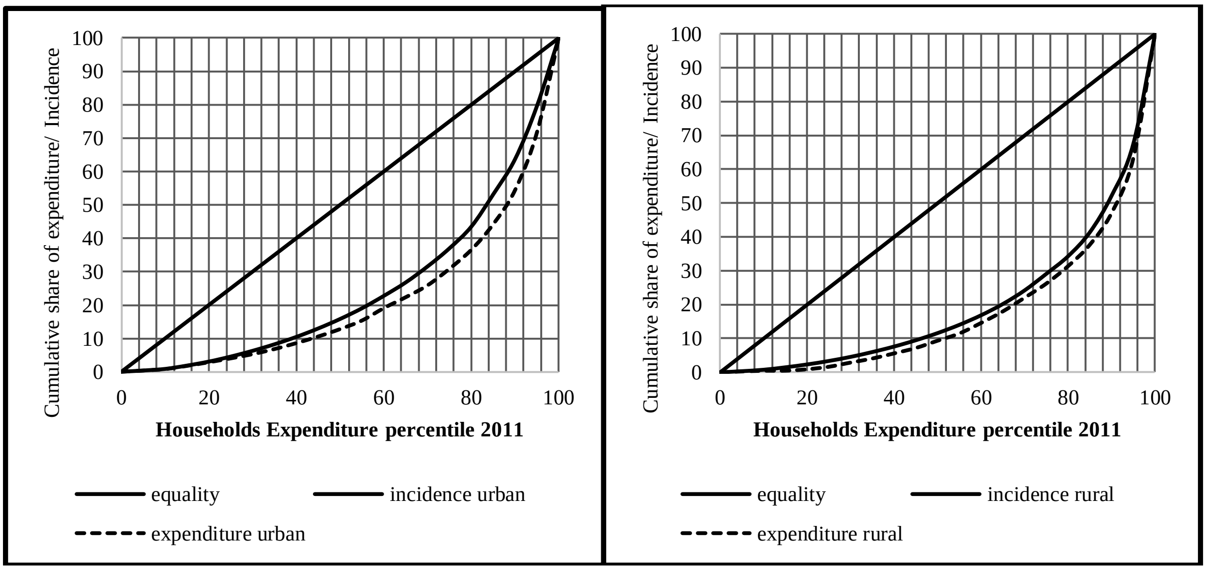
The magnitude of the rural-urban difference in import tariff incidence is heterogeneous across deciles of household income and is significant for some deciles. One of the likely causes of such mixed findings could have been a poor rainfall season. The World Bank Climate Data Portal pointed out that, for the period 2009 to 2015, Zimbabwe received a yearly average rainfall of 55 millimetres against a yearly-expected rainfall of 550 millimetres (World Bank Climate Data Portal 2018). The poor rainfall could have made both the rural and urban households depend more on imported products; explaining the erratic small differences in import tariffs incidence across income groups.

The comparison of import tariffs incidence for rural and urban areas confirms a generally higher incidence in urban relative to rural areas. In both rural and urban areas, import tariffs

[45] (*shows 10% statistical difference between rural and urban households in the same decile)

made households worse off, given that the import tariffs incidence curves are above the share of expenditure curves as shown in Figure 5-5. This compares import tariff incidence and expenditure curves for the rural and urban areas in 2011. Appendix D-A2 shows the corresponding curves for 2013 which exhibit the same pattern as those for 2011.

Figure 5-5: Incidence of import tariffs against expenditure for rural and urban areas



Source: Calculation using 2011 income expenditure survey

This means both rural and urban households are paying more in terms of import tariffs relative to their expenditure shares.

Table 5-12 shows the analogous import tariffs burden across the percentiles of household expenditure.[46] The import tariff incidence is higher than the expenditure shares for both rural and urban households in 2011 and 2013. In 2011, the import tariff burden is greater for urban than rural households in 5th to 35th percentiles and the converse applies to households in 40th to 95th percentiles. For 2013, there is no obvious pattern as neither the rural nor the urban households' tariff burden persistently dominates the other in magnitude across successive percentiles of household expenditure.

[46] The import tariff burden is the difference between the import tariffs incidence and the expenditure share for each percentile

Table 5-12: Comparison of mean share of total expenditure and share of import tariffs

Percentile	Rural tariff burden 2011	Urban tariff burden 2011	Rural tariff burden 2013	Urban tariff burden 2013	Rural (2011-2013 tariff burden difference)	Urban (2011-2013 tariff burden difference)
5	0.03	0.08	0.07	0.11	-0.04	-0.03
10	0.05	0.29	0.12	0.47	-0.07	-0.18
15	0.09	0.99	1.02	0.27	-0.93*	0.72*
20	0.19	1.43	1.34	0.72	-1.15*	0.71*
25	0.53	1.72	1.39	1.45	-0.86	0.27
30	1.01	1.68	2.05	1.97	-1.04*	-0.29*
35	1.43	1.92	1.46	1.84	-0.03	0.08
40	1.86	2.02	1.88	2.04	-0.02	-0.02
45	2.40	2.28	2.51	2.24	-0.11*	0.04
50	3.03	2.25	3.04	2.36	-0.01	-0.11
55	3.66	2.55	3.74	2.83	-0.08	-0.28*
60	3.67	2.27	3.50	3.28	0.17*	-1.01*
65	4.43	2.18	4.40	3.10	0.03	-0.92*
70	5.66	2.16	5.62	3.21	0.04	-1.05*
75	6.13	2.88	6.08	2.90	0.05	-0.02
80	6.94	2.92	6.88	3.21	0.06	-0.29
85	8.94	3.68	6.78	4.61	2.16*	-0.93
90	9.28	5.10	6.20	6.12	3.08*	-1.02*
95	7.91	4.28	4.82	5.30	3.09*	-1.02*

Source: Calculation using 2011 and 2013 income-expenditure surveys.

The last two columns in Table 5-12 show a change in the import tariff burden from 2011 to 2013. A positive value signifies a decrease in the import tariffs burden while a negative value means increased import tariffs burden from 2011 to 2013. Rural households in 5th to 55th percentiles experienced an increase in the import tariff burden while those in 60th to 95th percentiles encountered a decrease. There was a mixture of increases and decreases in the import tariff burden for urban households in 5th to 45th percentiles, while those in 50th to 95th percentiles experienced an increase in the import tariff burden. The rural area distribution of the import tariff burden shows some signs of a regressive tax system where the non-poor benefited from changes in import tariffs relative to the poor households. The urban non-poor income groups were made worse off following the import tariffs changes.

If we compare the incidence analysis in section 5.5.1 and 5.5.2, we observe that analysing import tariffs at an aggregate level veil some spatial disparities in the tariff burden. In section 5.5.1, there was a general conclusion of regressive import tariffs, while in section 5.5.2, we observe regressive import tariffs only among rural households. The non-poor urban households were made worse off while there is a mixture of benefits and setbacks among the poor urban households. In the subsequent section, the benefit incidence analysis focusses on male- versus female-headed households.

5.6.3 Benefit incidence analysis – male- and female-headed households

This section addresses the 3rd objective of this chapter which involves a comparison of the import tariffs incidence for male- and female-headed households. These households tend to differ in terms of their income and other socio-economic characteristics, as discussed in section 5.3. Hence, they could be affected differently by the import tariffs changes. Notably, this analysis is performed on a merged 2011 and 2013 dataset. This rests on the small number of female-headed households in each independent survey, for instance when we merge the 2011 and 2013 consumption surveys, the sample comprises of 580 female-headed and 2472 male-headed households. Due to prices differences between 2011 and 2013, the study used the Consumer Price Index rebasing 2013 to the 2011 price levels for a common base of analysis in the merged dataset.

Table 5-13 displays the import tariffs burden for male- and female-headed households, calculated as the difference between the households' mean tariff incidence and household expenditure share as presented in Table 5-A3 in the appendix.

Results show that the import tariffs burden is positive for both household types, and is surprisingly greater for female than male-headed households except for the 5th percentile. A negative value means male-headed households' import tariffs burden is less than that for female-headed households. This outcome is contrary to our a priori expectations, and the findings for South Africa in Daniels (2005). However, it can be broadly explained by the observation that female- and male-headed households tend to differ in the way they allocate and use resources (Daniels, 2005). For example, female-headed or maintained households are susceptible to a relatively higher dependency burden as was found for Botswana, Malawi, and Brazil (Buvinic & Gupta, 1997). Our data also shows that this holds for Zimbabwe, given that female-headed households have bigger households with 2 per cent having at least five members living together, compared to 1.4 per cent for male-headed households. This shows higher dependency in female-headed households relative to male-headed.

Table 5-13: Import tariffs burden for male and female-headed households

Percentiles	Male-headed import tariff burden	Female-headed import tariff burden	Difference between male-headed and female-headed tariff burden
5	0.04	0.01	0.03
10	0.26	0.61	-0.35
15	0.32	0.93	-0.61
20	0.54	1.40	-0.86*
25	0.88	1.84	-0.96*
30	1.35	2.20	-0.85*
35	1.76	2.25	-0.49
40	2.18	4.08	-1.90*
45	2.71	4.66	-1.95*
50	3.33	4.84	-1.51
55	3.95	6.03	-2.08*
60	4.96	7.30	-2.34*
65	4.01	6.88	-2.87*
70	4.70	7.72	-3.02*
75	4.99	8.86	-3.87*
80	5.59	7.95	-2.36*
85	5.78	10.55	-4.77*
90	5.25	10.22	-4.97*
95	3.94	8.19	-4.25*

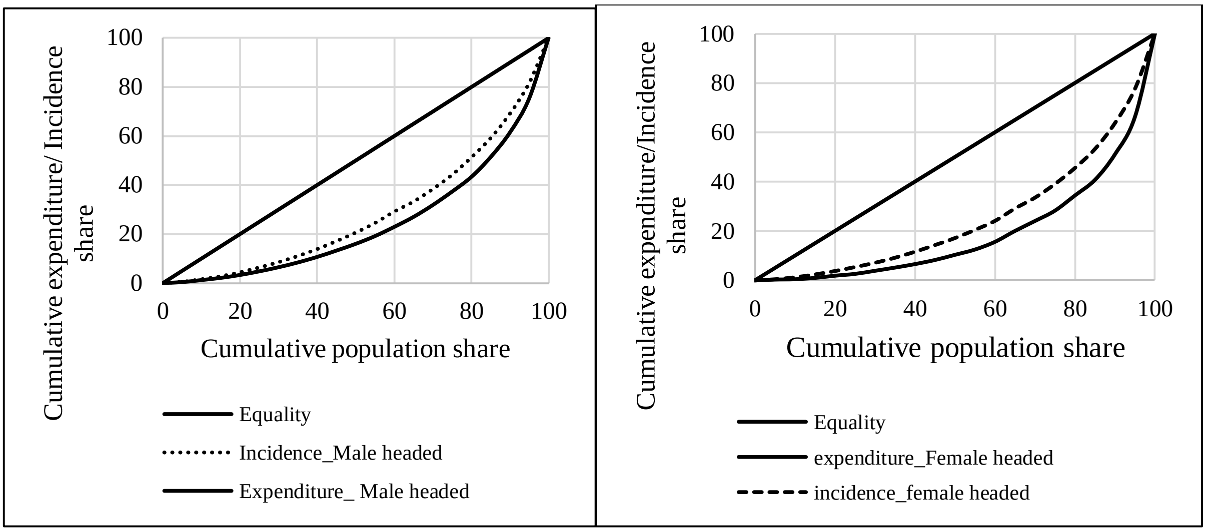
Source: Calculations after merging 2011 and 2013 consumer survey.

In section 5.5, we observed that female-headed households have lower income than male-headed households and they also have relatively lower expenditure shares on food and clothes. This means that male-headed households could have used their higher income to cushion themselves from future expected import tariffs change through bulk buying and stocking the affected goods. This will likely reduce the import tariff burden on male-headed households relative to female-headed households. High-income earners in female maintained households, on average, earn less than those in male-headed households (Gindling, 1993).

Another income shock to female-headed households emanates from their reliance on agriculture production. Our data shows that 66 per cent of female-headed households get their income from farming compared to 38.8 per cent for male-headed households. The adverse rain season between 2009 and 2014 might have significantly increased the vulnerability of female-headed households (World Bank Climate Data Portal, 2018). The agriculture income shock might have been exacerbated by agricultural productivity differences between males and females in Zimbabwe. Female farmers are generally less productive relative to male farmers. This is largely attributed to insufficient support and experience, lack of timely inputs procurement, and relatively poor quality input usage (Horrell & Krishnan, 2007; Toringepi, 2016). The disadvantage for female-headed households could also be associated with women's relatively low literacy rates (88.7 per cent versus 94.4 per cent) and information networks than men; crucial for knowledge on how to cushion their families from the import tariffs effects (Zimstat, 2014).

Consistent with Table 5-13, Figure 5-6 also shows a smaller import tariffs burden for male- relative to female-headed households. We thus conclude that male-headed households incur a relatively higher import tariffs incidence but female-headed households suffer a greater import tariffs burden. Such finding points to the importance of disaggregating import tariffs analysis along gender lines.

Figure 5-6: Incidence of import tariffs against expenditure for male and female-headed households



Source: Calculations using merged 2011 and 2013 consumer surveys.

5.7 Conclusion and suggestions for future studies

This chapter carried out a benefit incidence analysis of import tariff changes for select goods in Zimbabwe over the period 2009-2014. Results showed that Zimbabwean households incurred a higher import tariffs incidence in 2011 compared to 2013. The import tariff changes had a regressive effect amongst the households as the poor incurred a bigger import tariff burden relative to their expenditure from 2011 to 2013 while the contrary applied to the non-poor. Increasing the import tariffs burden of one group while reducing that of another makes the society worse off depending on the relative magnitudes of the groups' import tariffs burdens (Dowding, 2009). Sahn and Younger (2000) also found a regressive tax system for sub-Saharan countries. However, for this study, the regressive import tariffs are partly associated with the cash budgeting and multiple currency economic system that Zimbabwe adopted in 2009. The system prompted the government to increase taxes (import tariffs) to maximise revenue collection and fund government expenditure. For this purpose, the government focused on frequently imported goods, which also happened to be goods mostly consumed by the poor relative to non-poor income groups.

This study also established that an aggregated analysis masks rural-urban differences in the tariff burden, and those by gender of the household head. Specifically, urban households generally incurred a higher tariff burden than rural households. However, the import tariff changes were regressive among rural households. Non-poor urban households were also made worse-off while the effect was not robust among poor urban households. The results also showed that male- and female-headed households do not have a uniform import tariff burden in Zimbabwe. Female-headed households incurred a higher import tariff burden than male-headed households. We associated this result with female-headed households' relatively higher exposure to imports owing to limited means and knowledge on how to cushion themselves from the scarcity of domestically produced agricultural output.

Based on the above findings, a trade policy reform is necessary to combat poverty and inequality in the country, especially, reducing import tariffs for goods that are highly consumed by the poor, although increasing import tariffs for popularly imported goods seems attractive for increasing government revenue. However, the argument for revenue collection could be challenged if the increased revenue does not support government initiatives on poverty and inequality reduction. Instead, there ought to be a balance between revenue collection and poverty/inequality reduction.

This study maintains that the slow implementation of regional and bilateral trade agreements for the country partly explains the regressive import tariffs. Regional agreements entail reducing or eliminating import tariffs between trading partners; lack of their implementation is associated with high import tariffs. This problem applies, for instance, to the Common Market for Eastern and Southern Africa which aimed for a single market and a monetary union (Rajemison & Younger, 2000; Mudenda, 2016). Hence, it is recommended that Zimbabwe should fully implement regional and bilateral trade agreements to partly solve the repressiveness of import tariffs.

Findings of this study also serve as lessons for countries that would consider adopting a fiscal cash budget and a multiple currency economic system. Inasmuch as the government should raise revenue, policies must be sensitive to welfare implications on the poor. In some cases, this requires reducing import tariffs on necessary goods that are disproportionately consumed by the poor. For instance, female-headed households suffer worse welfare challenges than male-headed households. Hence, there is a need for specific poverty and inequality policies to cushion such households from its source of livelihood's exposure to tariff changes, for instance. Government support in the form of quality inputs, provision of market information, education and mentoring of female farmers would generally go a long way in improving income generation and availing strategies for female-headed households to reduce their reliance on imports. As for the disadvantaged urban households, the creation of small business with funding and training will help improve their flow of income. Above all, improving industry capacity utilisation is crucial for reducing the country's over-reliance on imports.

This study is not without limitations. The analysis is limited to selected goods due to data issues. Goods which were selected are those whose expenditures and tariffs could be identified in the data. Future studies can benefit from perfectly matching product lines in the import tariffs data to the expenditure in the consumer surveys, should the data be available. It is important to match all the product lines since this will improve the implicit tariff expenditure calculations, thus reducing the gap between the implicit and actual expenditure incurred on import tariffs. Apart from improving the generalisability of the study's findings, the estimates will be more precise.

Chapter 6: Conclusion and Policy Implications

6.1 Introduction

This study set out to investigate the broad theme of the economic effects of import tariff changes on welfare in Zimbabwe over the period 1996-2014. This was achieved by addressing three key objectives in separate empirical chapters. First, chapter 3 investigated the trend in domestic industry protection in Zimbabwe's manufacturing sector over the period 1996-2014, using effective tariff rates, for the overall economy and at an industry level. Second, chapter 4 assessed the import tariff pass-through effect to domestic goods prices in Zimbabwe over the period 2009-2014, factoring the spatial distribution of goods prices. Third, chapter 5 analysed the benefit incidence of import tariffs on households in different income groups, overall and by gender of household headship and geographic location. The section below narrates the specific findings of each chapter before drawing the implications of the study.

6.2 Key Insights

Regarding the effects of import tariffs on domestic protection in chapter 3, the study found episodes of industrial protection reduction which later led to some industries being negatively disadvantaged by the import tariff policy. Before 1996-2007, domestic industries experienced some form of protection from the import tariffs policy. During this period, the overall effective protection rates were positive. This trend extended to individual industries although the magnitude of the effective protection rate varied across industries. 2007-2014 was characterised by a reduction in industrial protection to the extent that negative effective protection rates were observed in most industries. This finding implies that the manufacturing industries experienced higher import tariffs when importing intermediate products than when importing the finished goods. This meant the country was better off importing the final products than producing domestically. One reason for this outcome was that the government was inclined towards raising revenue as the country was using multi-currencies and a cash budget system. Further analysis of the effective protection rate components - tariffs on intermediate inputs, tariffs on finished goods and input-output coefficient - showed that tariffs on intermediate inputs were the dominant component. This finding points to the importance of adjusting the tariffs policy to boost industrialisation in Zimbabwe.

Findings for the second objective in chapter 4 showed that there is positive domestic price dependence among Zimbabwean districts. This autocorrelation of domestic goods' prices highly influenced the import tariff pass-through effect. A failure to control for the spatial distribution of domestic goods prices has an upward bias on the import tariffs pass-through effect. The reasons for the spatial price dependence were cited as the strong price networks among the districts, with most markets being centralised and also the fact that Zimbabwe is a relatively geographically small country with districts that are situated close to each other. However, the pass-through effect purged of domestic price dependence also shows that a significant portion of tariff changes is propagated to domestic goods prices in Zimbabwe.

Results for the benefit incidence of import tariffs in chapter 4 showed that the 2009-2014 import tariff policy for Zimbabwe was regressive. Poor households tended to bear much of the import tariff burden when compared to non-poor households. Female-headed households also bore a higher import tariff burden compared to male-headed households. Thus the import tariffs burden in Zimbabwe exhibited a demographic and spatial heterogeneity. The import tariff burden was also observed to differ across products with the poor enduring much of the import tariffs on food compared to clothes.

6.3 General conclusion

The general conclusion from the study is that a country using multiple currencies and a fiscal cash budget tends to have limited fiscal space. Hence the country is likely to increase its revenue by raising domestic taxes, such as import tariffs rates. While higher import tariffs may generate additional government revenue, ceteris paribus, there is a need for closely monitoring relative changes between tariffs on finished goods and those on intermediate goods. If it so happens that import tariffs on intermediate goods are relatively higher than those on finished goods, such a scenario exposes domestic industries to external competition. This could promote the importation of finished goods and suppress domestic production of those goods. Hence, this study found evidence of negative effective protection of key manufacturing industries. This is counterproductive for a country seeking industrialisation and increasing the contribution of the manufacturing industry to the economy.

Existing studies on domestic industry protection also find negative effective protection but customarily on the service industries and a few peripheral manufacturing industries (Balassa, 1965; Basevi, 1966; Kusum, 2003; Pandey, 2004; WTO, 2000). Studies on fellow African countries also found selected but few industries with negative protection (USAID, 2008; Edwards, 2005; Rangasamy & Harmse, 2003; Fedderke & Vaze, 2001). This resulting trend puts a spotlight on the adoption of a multiple currency and cash budget economic system. No comparison study on domestic protection is yet available for a country adopting multiple currencies and a cash budget, but we can observe the limiting conditions of such policies which can exert pressure on a country to disadvantage its domestic industries.

Once domestic industries were exposed, we also observed the negative effects being propagated to households. This claim became evident when part of the import tariffs was transmitted to domestic goods prices, as highlighted in chapter 4. Further, we have unearthed a disproportionate benefit incidence of import tariffs among Zimbabwean households, in chapter 5. Thus, the changes in tariffs did not negatively affect manufacturing industries only, but they also tended to increase income inequality among Zimbabwean households. Taken together, these findings attest that no extant study has managed to extensively research the effects of import tariffs for a single country in this way.

6.4 Policy Relevance

A country adopting a cash budget and a multiple currency economic policy needs to constantly monitor its tariffs policy such that domestic production will not be harmed by imported goods. Findings of this study showed that Zimbabwe's tariff policies turned a blind eye on the required balance between import tariffs on finished and intermediate goods. This culminated in a decline in industrial protection over time until the effective protection rates became negative.

When increasing import tariffs, the policymakers should be aware that part of the tariffs is transmitted to domestic goods prices which may worsen the plight of poor households. The tariffs policy should also not widen inequality. Increasing tariffs more on goods mostly consumed by the poor relative to tariffs on goods mostly consumed by the non-poor would increase inequality. The benefit incidence analysis showed a disproportionate effect of tariffs. Thus, policy should not have a blanket tariffs system on all the goods but should rather have specific product tariffs system which should also be continuously monitored to reduce inequality. Subject to availability of funds, another policy measure would be to introduce subsidies or increase transfers to assist marginalised income groups.

This study is however compromised by some limitations. In several areas, the study wanted to compare its findings on themes investigated herein with those for other countries that adopted a cash budget and a multiple currency economic system at some point in time. However, currently, such studies do not exist. Thus future studies should aim at doing a cross country study which would help separate the country-specific effects from the general effects of tariffs. Targeting countries which have also used cash budgeting and multiple currencies would be highly recommended to analyse if findings of this study are unique to Zimbabwe only or can be generalised across countries. In addition to the above limitation is the unavailability of datasets which are better suited for the current analysis. Hence, we recommend the Zimbabwean Statistical Agency to produce relevant data e.g. on IOT.

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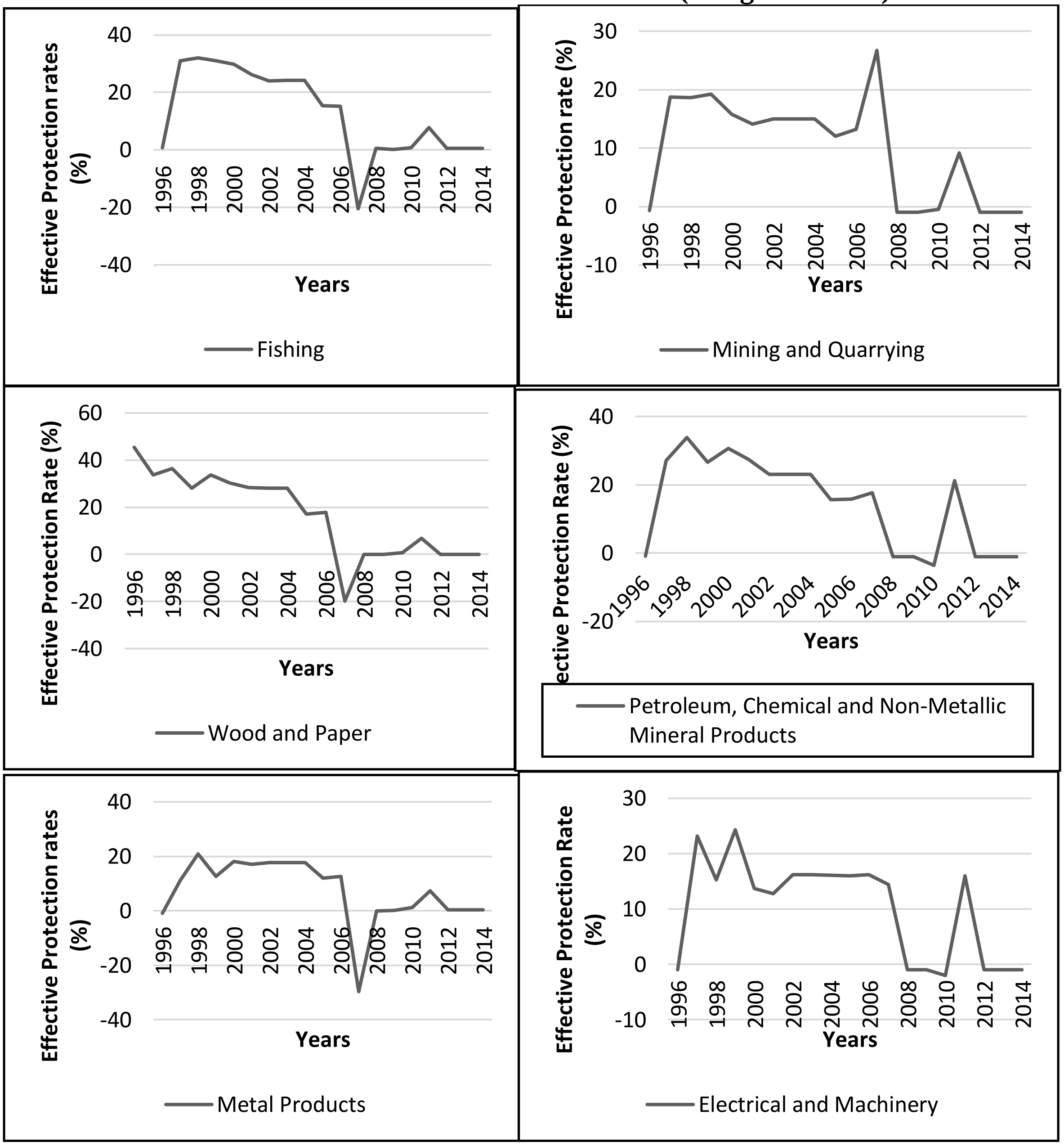
Appendix A

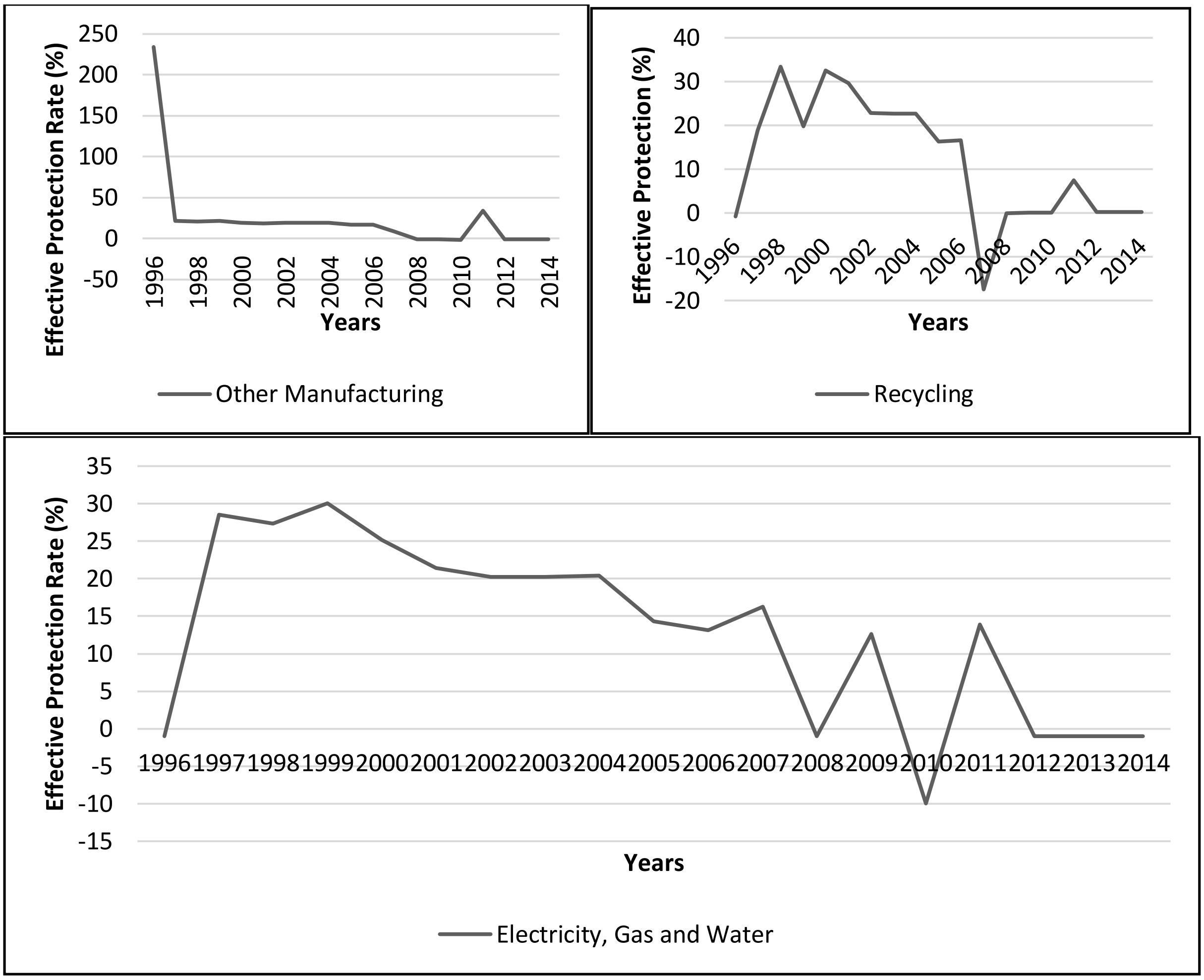
Table A- A1: Sample of Countries that once dollarized their economies

Country	Currency used	Year
Guatemala	Quetzal and the American dollar	Since 2001
Ecuador	US dollar	Since 2000
Liberia	Liberian dollar and American dollar	Since 1945
Monaco	Euro and French franc	Euro since 2002, French franc since 1865
Micronesia	US dollar	Since 1944
Andorra	French Franc, Euro and Spanish peseta	Euro since 2002, French franc and Spanish peseta since 1278

Appendix B

B-A1: Effective Protection rates for selected industries (using Eora IOT)





Source: Computation using the Eora and Zimbabwe Revenue Authority datasets

Appendix C

C-A1: Description of the variable used for the analysis

Variable-description	Measurements	Expected relationship with goods prices	Source
Food prices	average prices of all food items per liter/per kilogram in US dollars		Zimstat (2009-2014)
Non-alcohol beverage prices	average price per unit (750 ml/350ml) of all non-alcohol beverages in US dollars		Zimstat (2009-2014)
Alcohol beverage prices	average price per unit of alcohol 750ml/350ml) in US dollars		Zimstat (2009-2014)
Cloth prices	average price per unit of cloth items in US dollars		Zimstat (2009-2014)
Footwear prices	average per unit price of footwear in dollars		Zimstat (2009-2014)
Fuel prices	average price per liter of fuel in US dollars		Zimstat (2009-2014)
Vehicle fluids	average price per liter of vehicle fluid (engine oil, brake fluid and grease) price in US dollars		Zimstat (2009-2014)
Furniture prices	average price per unit of furniture products in US dollars		Zimstat (2009-2014)
Night light	average amount of light intensity or lumens measured in lux (lx)		GIS raster files (2009-2014)
Temperature	Average temperature levels measured in degrees Celsius		GIS raster files (2009-2014)
Location	rural dummy, 1=rural and 0= urban	High price in the rural areas relative to urban area	Zimstat (2009-2014)
Exchange rate	average US$ to South African ZAR exchange rate	Positive relation between exchange rates and prices	Reserve bank of Zimbabwe (2009-2014)
Money supply	average official money supply in millions of US$ as reported by the Central bank	Positive relation between money supply and prices	Reserve bank of Zimbabwe (2009-2014)
Distance	average distance between districts in kilometers	We expect lower price in districts which are closer to borders	calculations from the shapefile collected from the ArcGIS website
Import tariffs	average ad-valorem/ converted ad-valorem tariffs rate – percent of absolute price. All import tariffs were converted to ad valorem since we originally had ad valorem, specific import and mixed (partly ad valorem and partly specific) import tariff rates types. The study is using average import tariff rate, that average of bilateral, general and multilateral import tariffs rates	Positive relation between import tariffs and prices	Zimbabwe Revenue Authorities (2009-2014)
Rainfall	average rainfall received in milliliters	High prices in areas which receive low rainfall	Rasta file collected from ArcGIS website

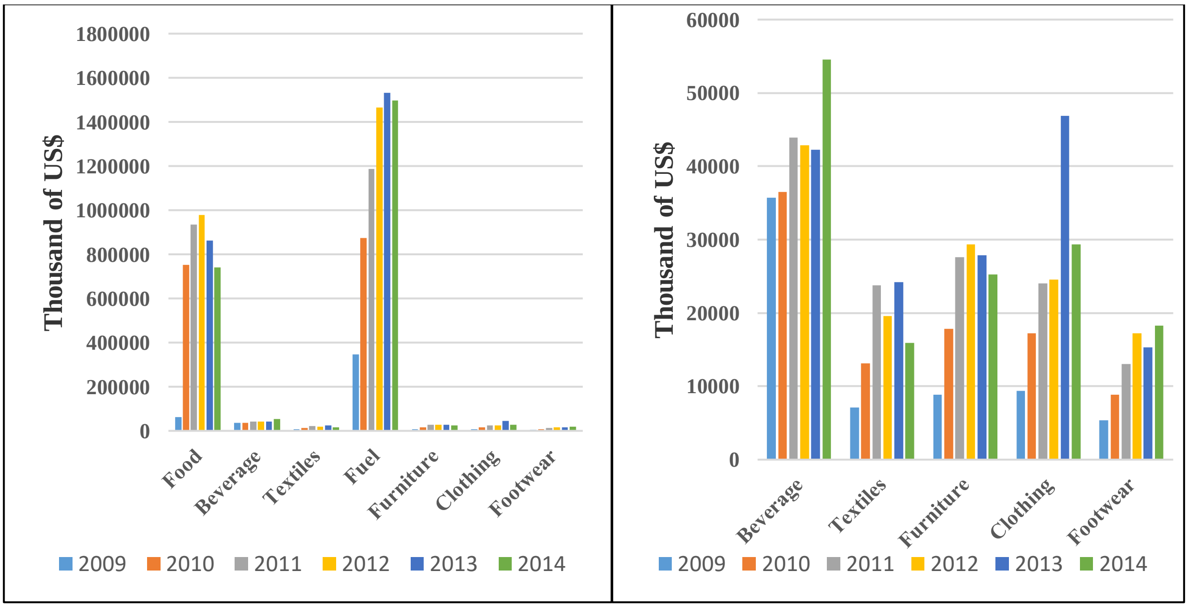
C-A2: Summary statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
Location (rural/urban dummy)	overall	0.3972	0.48	0	1	N = 360
	between		0.490	0	1	n = 60
Distance to Harare	overall	225.028	120.3872	0.0004	876	N = 360
	between		120.3872	0.0004	876	n = 60
Distance to Bulawayo	overall	294.7058	142.429	0.0005	810	N = 360
	between		142.429	0.0005	810	n = 60
Exchange rate	overall	8.578021	1.384093	6.7198	11.4568	N = 360
	between		1.384093	6.7198	11.4568	n = 60
	within		0	8.578021	8.578021	T = 6
Distance to Mutare	overall	283.9555	146.9314	0.0002	1016	N = 360
	between		146.9314	0.0002	1016	n = 60
Distance to Beitbridge	overall	344.8577	134.9184	0.000571	759	N = 360
	between		134.91	0.0005	759	n = 60
Bulawayo Province	overall	0,016	0.128	0	1	N = 360
	between		0.128	0	1	n = 60
Harare province	overall	0,016	0.128	0	1	N = 360
	between		0.128	0	1	n = 60
Manicaland province	overall	0,116	0.321	0	1	N = 360
	between		0.321	0	1	n = 60
Mashonaland central	overall	0,116	0.321	0	1	N = 360
	between		0.321	0	1	n = 60
Mashonaland east	overall	0,15	0.357	0	1	N = 360
	between		0.357	0	1	n = 60
Mashonaland west	overall	0,11	0.300	0	1	N = 360
	between		0.300	0	1	n = 60
Matabeleland North	overall	0,133	0	0	0	N = 360
	between		0	0	0	n = 60

Variable		Mean	Std. Dev.	Min	Max	Observations
Matabeleland South	overall	0,116	0.3214	0	1	N = 360
	between		0.321	0	1	n = 60
Midlands province	overall	0,133	0.3404	0	1	N = 360
	between		0.3404	0	1	n = 60

Source: Stata output using price surveys from ZIMSTAT 2009-2014.

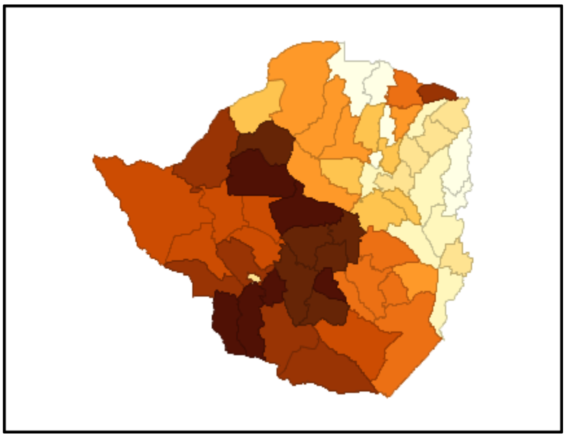
C-A0: Volume of Imports by Products



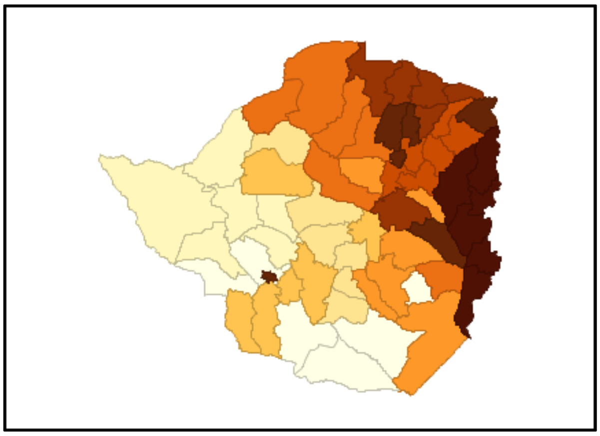
Source: Own computation using (WITS database)

C-A.3 serves to depict that the goods used in this study are indeed tradable. It shows Zimbabwe's imports by product groups. The figure to the left (C-A.3A) includes food and fuels while the one to the right (C-A.3B) excludes the two product groups. Food and fuel have high values thus they overshadow other imports as shown in C-A.3A hence C-A.3B removes food and fuel. From 2009-2014 Zimbabwe was significantly importing all the products depicted above. However, food (36 percent) and fuels (57.7 percent) occupied the highest share of imports. This was partly attributed to poor harvest and increased demand for fuel linked to an influx of vehicle imports that were dominated by second-hand Japanese cars (CZI, 2013). Thus the products groups in our study (see Table 4-6 can arguably be treated as tradable over the period 2009-2014.

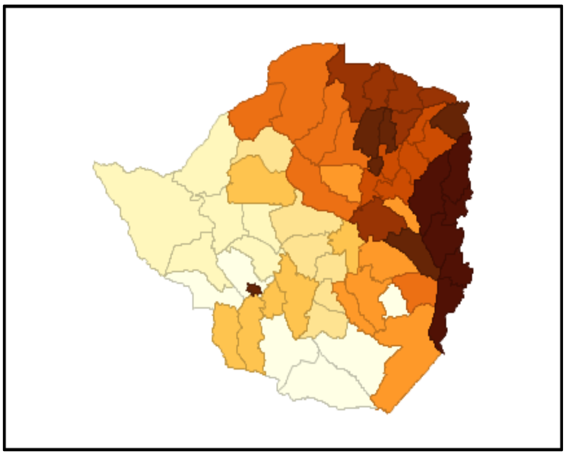
C-A4: Spatial maps of domestic prices in Zimbabwe (2009-2014)



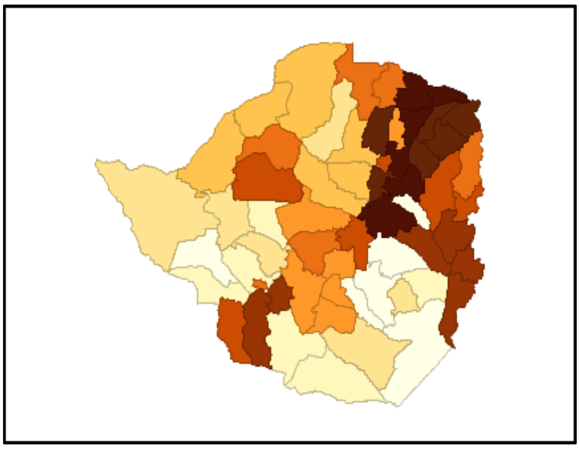
non-Alcohol beverages



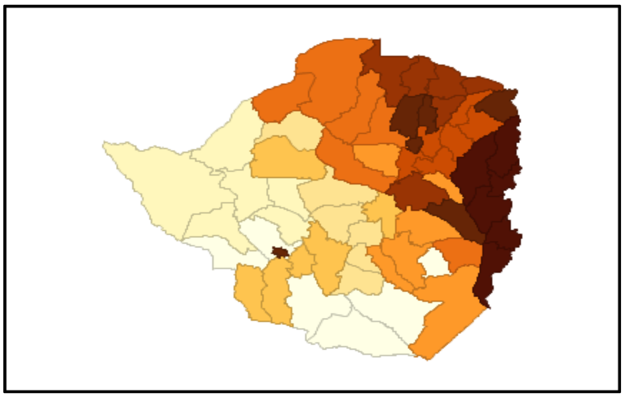
Clothes



Footwear



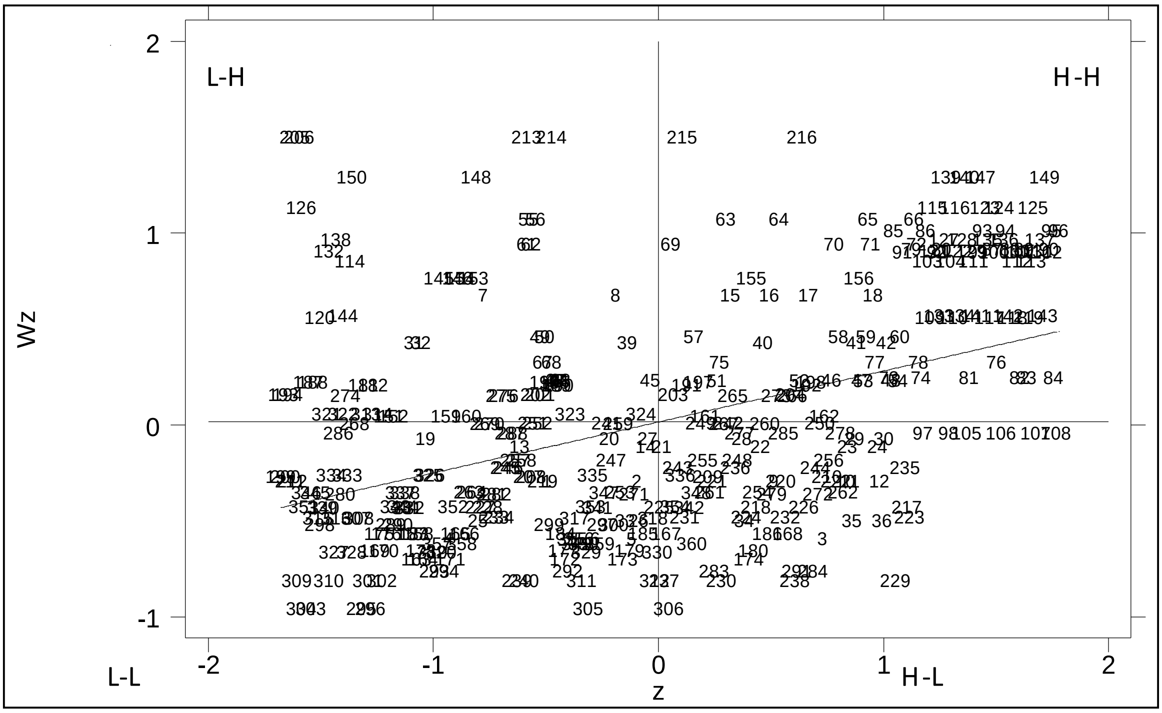
Household textiles



Fuels

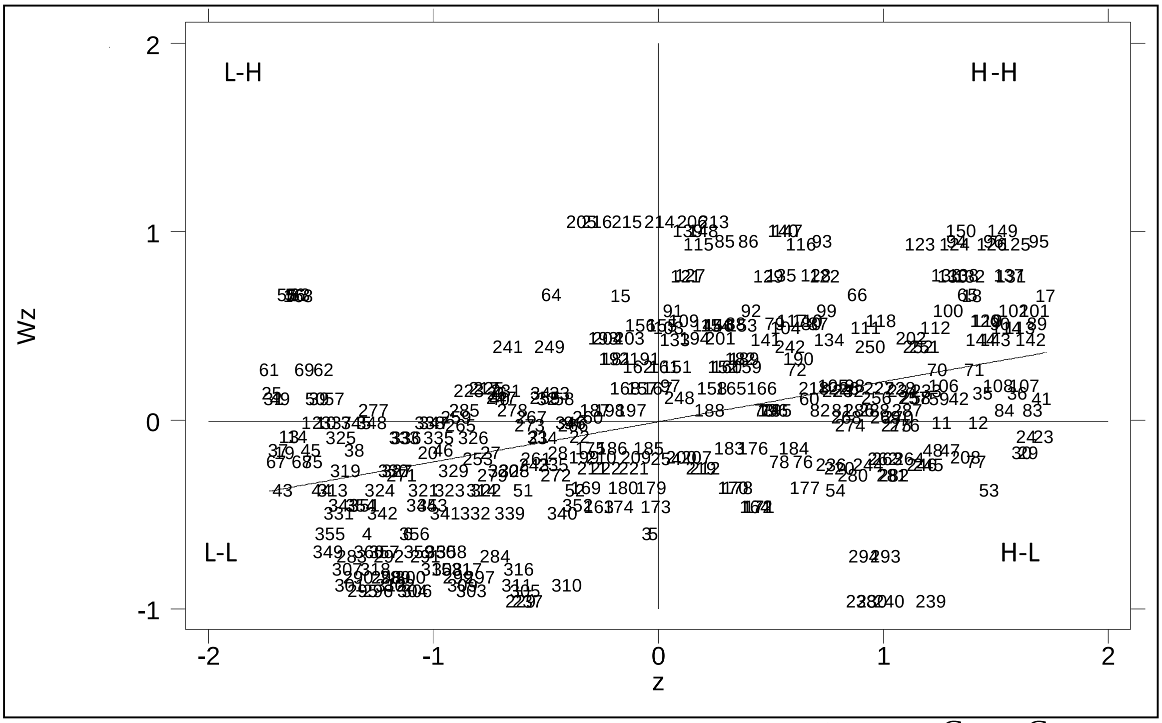
Source: STATA output using Zimstat price surveys data and ArcGIS shapefiles.

C-A5-A: Local Moran's



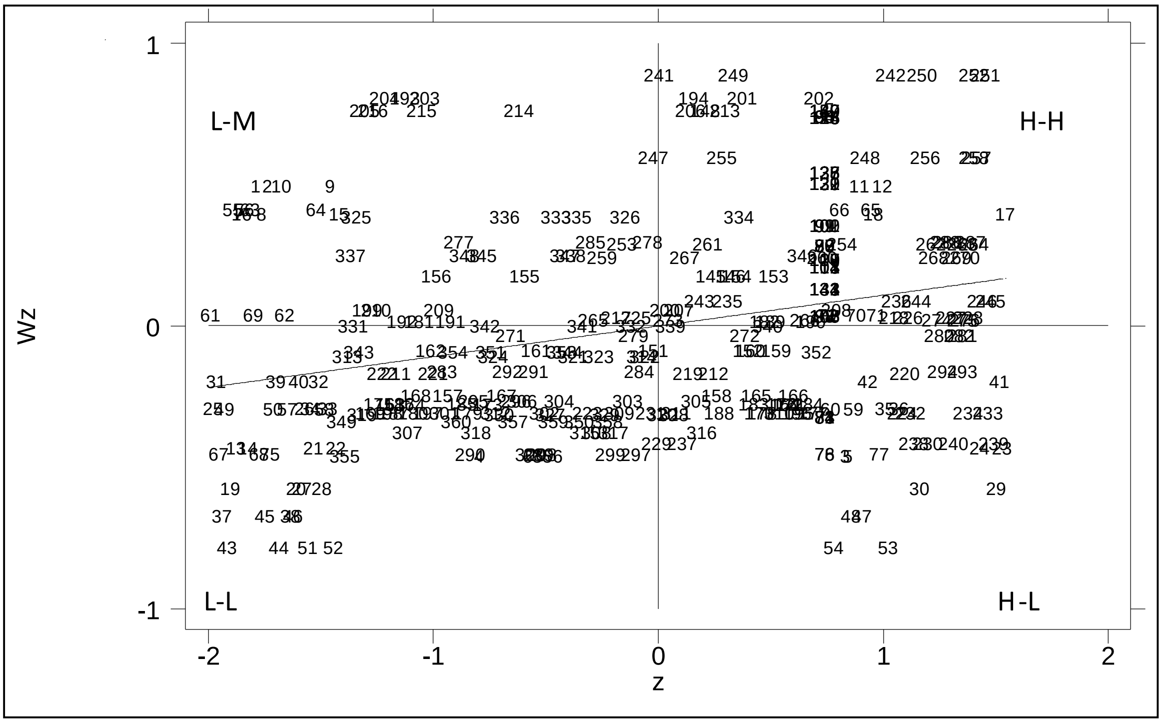
Source: STATA output using Zimstat price surveys data and ArcGIS shapefiles Local Moran's

C-A5 –B: Local Geary C,



Source: STATA output using Zimstat price surveys data and ArcGIS shape files Local Geary C

C-A5-C: Local Getis & Ord's G



Source: STATA output using Zimstat price surveys data and ArcGIS shapefiles - Local Getis & Ord's G

C-A6: Appropriate spatial model (queen weights matrix)

	Appropriate spatial model				
Variables	SDM_ind_fxd_effects	SDM_fxd_time_effects	SDM_re_effects	SDM_both_fxd_effects	SDM_without_effects
rho	0.832***	0.392***	0.359***	0.865***	0.842***
LM	4.852***	7.322***	8.327***	**4.805*** **	4.852***
AIC	1716,27	1856,52	1879,936	**1708,49**	1716,27
BIC	1902,79	2043,05	1988,75	**1895,02**	1902,79
Observations	360	360	360	360	360
R-squared	0.439	0.434	0.265	**0.465**	0.039
Variables	SAR_fxd_ind_effects	SAR_re_effects	SAR_fxd_time_effects	SAR_fxd_both_effects	SAR_without_effects
rho	0.528***	0.526***	0.564***	0.591***	0.651***
LM	5.719***	8.380***	8.634***	**5.630*** **	4.852***
AIC	1736,41	1882,61	1865,12	**1725,74**	1716,27
BIC	1833,56	1987,54	1962,27	**1822,89**	1902,79
Observations	360	360	360	360	360

	Appropriate spatial model				
Variables	SDM_ind_fxd_effects	SDM_fxd_time_effects	SDM_re_effects	SDM_both_fxd_effects	SDM_without_effects
R-squared	0.067	0.509	0.001	**0.532**	0.039
Variables	SEM_fe__ind_effects	SEM_re_effects	SEM_fe_time_effects	SEM_both_effects	SEM_without_effects
rho	0.534	0.471***	0.619***	0.591***	0.534
LM	5.726***	8.048***	8.083***	**5.557*** **	8.048***
AIC	1741,46	1874,26	1852,16	**1725,59**	1874,26
BIC	1838,61	1979,18	1949,31	**1822,75**	1979,18
Observations	360	360	360	360	360
R-squared	0.032	0.484	0.081	**0.424**	0.484
Variables	SAC_fxd_ind_effects	SAC_fxd_time_effects	SAC_both_effects	SAC_without_effects	GSPRE_re_effects
Rho/lambda	0.591***	0.526***	0.564***	0.591***	0.649***
LM	4.852***	7.322***	4.805***	7.328***	4.526***
AIC	1716,27	1856,52	1798,49	1865,71	1875,81
BIC	1902,79	2043,05	1895,02	2060,01	1984,62
Observations	360	360	360	360	360
R-squared	0.039	0.034	0.565	0.580	0.486

Source: STATA output using Zimstat price surveys data and ArcGIS shapefiles, the dependent variable is average consumer goods price

C-A7: Appropriate spatial model (K-nearest distance weights matrix)

VARIABLES	SDM_re_effects	SDM_fxd_time_effects	SDM_both_fxd_effects	SDM_without_effects	SAR_fxd_ind_effects
rho	0.522	0.471***	0.517***	0.531***	0.731***
LM	4.528***	5.526***	**7.704*** **	5.594***	4.651***
AIC	2232.828	2379.103	**1924.387**	2366.186	2222.242
BIC	2337.753	2487.914	**2024.389**	2467.224	2323.281
Observations	360	360	360	360	360
R-squared	0.519	0.018	0.264	0.042	0.064
	SAR_re_effects	SAR_fxd_time_effects	SAR_fxd_both_effects	SAR_without_effects	SEM_re_effects
Rho/lambda	0.423***	0.624***	0.663***	0.694***	0.648***
LM	4.534	5.471***	**6.669*** **	4.594***	5.647***
AIC	2210.355	2363.421	**1913.851**	2363.421	2365.357
BIC	2408.546	2472.231	**2023.181**	2472.231	2336.303
Observations	360	360	360	360	360

VARIABLES	SDM_re_effects	SDM_fxd_time_effects	SDM_both_fxd_effects	SDM_without_effects	SAR_fxd_ind_effects
R-squared	0.513	0.001	0.212	0.042	0.493
	SEM_fe__ind_effects	SEM_re_effects	SEM_fe_time_effects	SEM_both_effects	SEM_without_effects
lambda	0.547***	0.604***	0.547***	0.681***	0.559***
LM	5.504***	5.647***	4.581***	4.649***	5.647***
AIC	2352.735	2220.843	2363.421	2210.355	2213.851
BIC	2453.774	2321.881	2472.231	2408.546	2551.89
Observations	360	360	360	360	360
R-squared	0.015	0.493	0.137	0.195	0.493
	SAC_fxd_ind_effects	SAC_time_ind_effects	SAC_both_effects	GSPRE_re_effects	GSPRE_without_effects
lambda	0.649***	0.649***	0.619***	0.647***	0.522***
LM	4.594***	5.526***	5.564***	5.649***	**6.659*****
AIC	2357.409	2201.174	2364.708	2364.708	**1923.178**
BIC	2551.714	2395.479	2477.405	2477.405	**2102.744**
Observations	360	360	360	360	360
R-squared	0.042	0.018	0.264	0.494	0.494

Source: STATA output using Zimstat price surveys data and ArcGIS shapefiles, the dependent variable is average consumer goods price.

C-A8: Appropriate spatial model (rook weights matrix)

VARIABLES	SDM_re_effects	SDM_fxd_time_effects	SDM_both_fxd_effects	SDM_without_effects	SAR_fxd_ind_effects
rho	0.661***	0.544	0.481***	0.627***	0.563***
LM	4.528***	4.526***	**6.692*****	4.564***	5.451***
AIC	2592.479	2524.763	**2167.666**	2671.038	2658.121
BIC	2700.67	2629.688	**2257.668**	2779.849	2759.159
Observations	360	360	360	360	360
R-squared	0.519	0.018	0.264	0.041	0.064
VARIABLES	SAR_re_effects	SAR_fxd_time_effects	SAR_fxd_both_effects	SAR_without_effects	SEM_re_effects
Rho/lambda	0.664***	0.491***	0.551***	0.434	0.371***
LM	4.534	4.471***	**7.749*****	5.592***	4.547***
AIC	2514.177	2655.355	**2502.479**	2523.313	2655.355
BIC	2764.166	2700.67	**2615.216**	2628.238	2764.166
Observations	360	360	360	360	360
R-squared	0.513	0.001	0.212	0.041	0.493

VARIABLES	SDM_re_effects	SDM_fxd_time_effects	SDM_both_fxd_effects	SDM_without_effects	SAR_fxd_ind_effects
VARIABLES	SEM_fe__ind_effects	SEM_re_effects	SEM_fe_time_effects	SEM_both_effects	SEM_without_effects
lambda	0.604***	0.547***	0.481***	0.559***	0.547***
LM	5.259***	5.447***	4.531***	**7.704*** **	5.647***
AIC	2655.355	2644.67	2512.777	**2166.458**	2582.479
BIC	2764.166	2745.709	2693.816	**2266.46**	2700.67
Observations	360	360	360	360	360
R-squared	0.015	0.493	0.137	0.195	0.493
VARIABLES	SAC_fxd_ind_effects	SAC_time_ind_effects	SAC_both_effects	GSPRE_re_effects	GSPRE_fe_effects
Rho/lambda	0.571***	0.515***	0.554***	0.591***	0.541***
LM	4.592***	5.526***	4.564***	**6.634*** **	5.634***
AIC	2156.796	2649.344	2493.109	**2256.874**	2256.874
BIC	2745.689	2843.649	2687.414	**2619.571**	2619.571
Observations	360	360	360	360	360
R-squared	0.041	0.018	0.264	0.498	0.498

Source: STATA output using Zimstat price surveys data and ArcGIS shapefiles, the dependent variable is the average consumer goods price.

C-A9 Appropriate spatial model (Arc distance weights matrix)

VARIABLES	SDM_re_effects	SDM_fxd_time_effects	DSM_both_fxd_effects	SDM_without_effects	SAR_fxd_ind_effects
rho	0.528***	0.526***	0.691***	0.564***	0.651***
LM	5.558***	4.326***	**6.772*** **	5.824***	4.811***
AIC	2709.64	2731.894	**2340.275**	2878.169	2865.252
BIC	2907.831	2836.819	**2440.277**	2986.98	2966.29
Observations	360	360	360	360	360
R-squared	0.519	0.018	0.264	0.041	0.064
VARIABLES	SAR_re_effects	SAR_fxd_time_effects	SAR_fxd_both_effects	SAR_without_effects	SEM_re_effects
rho	0.534	0.471***	0.689***	0.591***	0.647***
LM	5.392	5.391***	**6.579*** **	5.521***	5.837***
AIC	2721.308	2709.64	**2652.487**	2730.444	2862.487
BIC	2822.347	2907.831	**2571.297**	2835.369	2971.297
Observations	360	360	360	360	360
R-squared	0.513	0.001	0.212	0.041	0.493
VARIABLES	SEM_fe__ind_effects	SEM_re_effects	SEM_fe_time_effects	SEM_both_effects	SEM_without_effects
rho	0.659***	0.647***	0.581***	0.704***	0.647***

VARIABLES	SDM_re_effects	SDM_fxd_time_effects	DSM_both_fxd_effects	SDM_without_effects	SAR_fxd_ind_effects
LM	4.539***	3.691***	4.211***	**7.704*** **	4.327***
AIC	2339.067	2851.801	2719.908	**2702.487**	2709.64
BIC	2639.069	2952.84	2820.947	**2607.297**	2907.831
Observations	360	360	360	360	360
R-squared	0.015	0.493	0.137	0.195	0.493
VARIABLES	SAC_fxd_ind_effects	SAC_time_ind_effects	SAC_both_effects	GSPRE_re_effects	GSPRE_without_effects
rho	0.591***	0.526***	0.564***	0.649***	0.649***
LM	3.943***	3.446***	4.744***	5.059***	4.618***
AIC	2829.739	2856.475	2700.24	2863.774	2863.774
BIC	2718.632	3050.78	2894.545	2976.471	2976.471
Observations	360	360	360	360	360
R-squared	0.041	0.018	0.264	0.494	0.494

Source: STATA output using Zimstat price surveys data and ArcGIS shapefiles, the dependent variable is average consumer goods price

C-A10: Details of the Queen weighted matrix

Number of borders shared	Observation
2	2
3	8
4	11
5	12
6	13
7	9
8	4
9	1
Sum	60

Source: Stata output using the shapefile from https://www.arcgis.com

C-A11: Comparison between the traditional and spatial import tariffs models (Queen spatial weighted matrix)[47]

Variables	Traditional	SAR	Traditional	SAR	Traditional	SAR	Traditional	SAR
Import tariffs	0.260***	0.040***	0.256***	0.049***	0.256***	0.049***	0.316***	0.059***
rho		4.805***		6.431***		5.458***		5.873***
Exchange rates	0.056	-0.778	0.082	-0.978	0.008	-0.0948	0.017	-0.059
Money supply	0.001*	0.002*	0.022*	0.072*	0.042*	0.067*	0.091*	0.092*
location	1.112*	2.956*	1.082*	2.056*	1.094**	2.068*	1.303**	1.602

[47] Some models have been removed to reduce the crowding and make viewing clear. The models are available on demand from the author.

Variables	Traditional	SAR	Traditional	SAR	Traditional	SAR	Traditional	SAR
Rainfall	-0,075**	-0.009***	-0,035**	-0.014***	-0.002**	-0.023*	-0.0053**	-0.069**
Nightlight			-0.004***	-0.091***	-0.006***	-0.101***	-0.011***	-0.081***
Distance to Harare					0.028	0.048**	0.038	0.068**
Distance to Bulawayo							-0.015**	-0.006
Distance to Beitbridge								
Distance to Mutare								
Bulawayo prov dum								
Harare province dum								
Manicaland prov dum								
Mashonaland central prov dum								
Mashonaland east prov dum								
Mashonaland west prov dum								
Masvingo prov dum								
Matabeleland south dum								
Midlands prov dum								
R-squared	0.424	0.532	0.365	0.584	0.265	0.558	0.424	0.465

Source: STATA output using Zimstat price surveys data and ArcGIS shape files, the depend variable is average consumer goods (significant level *** $p<0.01$, ** $p<0.05$, * $p<0.1$)

Variables	SDM	SEM	SDM	SEM	SDM	SEM	SDM	SEM	SDM	SEM	SDM	SEM	SDM	SEM
Import tariffs	0.0166***	0.091***	0.014***	0.087***	0.013***	0.097***	0.017***	0.059***	0.083***	0.062***	0.0905**	0.071**	0.012**	0.084**
rho	5.427***	4.668***	5.841***	4.431***	5.838***	5.458***	4.433***	5.873***	4.759***	5.643***	4.867***	5.537***	5.436***	5.668***
Exchange rates	0.056	-0.778	0.082	-0.978	0.008	-0.0948	0.017	-0.059	0.038	-0.093	0.098	-0.112	0.193	-0.142
Money supply	0.001*	0.002*	0.022*	0.072*	0.042*	0.067*	0.091*	0.092*	0.036*	0.074*	0.064	0.103	0.037	0.453
location	1.112*	2.956*	1.082*	2.056*	1.094**	2.068*	1.303**	1.602	1.205**	2.106**	1.250*	1.146	1.320**	1.146**
Rainfall	-0,075**	-0.009***	-0,035**	-0.014***	-0.002**	-0.023*	-0.0053**	-0.069**	-0.0047**	-0.058**	-0.002***	-0.013**	-0.012***	-0.024**
Nightlight			-0.004***	-0.091***	-0.006***	-0.101***	-0.011***	-0.081***	-0.014***	-0.171***	-0.041***	-0.171***	-0.004***	-0.091***
Distance to Harare					0.028	0.048**	0.038	0.068**	0.028	0.048**	0.014	0.019***	0.028	0.048**
Distance to Bulawayo							-0.015**	-0.006	-0.053**	-0.056	-0.053**	-0.082*	-0.015**	-0.006
Distance to Beitbridge									0.073***	0.064*	0.029*	0.023***	0.073***	0.054*
Distance to Mutare											0.015	0.010	0.015	0.010
Bulawayo prov dummy													0.529	3.078
Harare province dum													-4.585*	2.122
Manicaland prov dum													1.914***	2.520
Mashonaland central prov dum													0.237	4.62**
Mashonaland east prov dum													0.824	3.50**
Mashonaland west prov dum													-0.294	-2.755*
Masvingo prov dum													-2.911*	-3.453
Matabeleland south dum													-2.811***	-1.823
Midlands prov dum													-3.105***	3.255
R-squared	0.424	0.532	0.365	0.584	0.265	0.558	0.424	0.465	0.365	0.465	0.373	0.507	0.436	0.545

C-A12: SDM and SEM spatial price distribution models[48]

Source: STATA output using Zimstat price surveys data and ArcGIS shapefiles., the dependent variable is average goods price (significant level *** p<0.01, ** p<0.05, * p<0.1.

[48] Some models have been removed to reduce the crowding and make viewing clear. The models are available on demand from the author.

C-A13: Regression estimates

	Panel A: Food Prices			
Variables	**Traditional**	**SDM**	**SAR**	**SEM**
Import tariffs	0.271**	0.063***	0.048**	0.011*
exchange rate	0.0176	0.0416*	0.126**	0.00985***
money supply	0.0192**	0.0123***	0.0219**	0.0128***
rainfall	-0.032***	-0.020***	-0.004**	-0.008***
rho		0.484***	0.501***	
LM		0.224***	0.257***	0.250***
lambda				0.552***
R-squared	0.602	0.593	0.420	0.405
	Panel B: Cloth prices			
Import tariffs	0.362**	0.056***	0.057**	0.025**
exchange rate	0.0347	-0.0471	0.202*	0.219**
money supply	0.00952**	-0.0100	-0.00130	-9.71e-05
rainfall	-0.033***	-0.0135***	-0.00232	-0.00237
rho		0.526***	0.561***	
LM		0.789***	0.847***	0.843***
lambda				0.574***
R-squared	0.726	0.464	0.429	0.561
	Panel C : Alcohol Beverage			
Import tariffs	0.432**	0.0428**	0.022**	0.011***
exchange rate	0.0132	0.116**	0.00885	
money supply	0.00161***	0.00197	-0.00132	
rainfall	-0.031***	-0.0044***	-0.0078	
rho		0.373***	0.429***	
LM		0.047***	0.051***	0.053***

	Panel A: Food Prices			
Variables	**Traditional**	**SDM**	**SAR**	**SEM**
lambda				0.440***
R-squared	0.647	0.443	0.514	0.501
	Panel D : Furniture			
Import tariffs	0.390**	0.0336***	0.140***	0.0529***
exchange rate	6.911*	12.89*	3.808	1.568
money supply	-0.00760	-0.0284	-0.0186	-0.0160
rainfall	-0.011***	-0.196	0.00155	0.00688
rho		0.582***	0.650***	
LM		0.035***	0.057***	0.032***
lambda				0.702***
R-squared	0.362	0.316	0.431	0.610
	Panel E : Vehicle Fluids			
Import tariffs	0.208**	0.095***	0.061***	0.049***
exchange rate	0.103	0.433	0.101	0.161
money supply	0.00875**	-0.022	0.0136	0.0242
rainfall	-0.065	-0.00369	2.59e-05	-0.00346
rho		0.490***	0.499***	
LM		0.962***	1.039***	1.031***
lambda				0.520***
R-squared	0.480	0.523	0.461	0.482
	Pane F : Household Textile			
Import tariffs	0.251***	0.032***	0.081***	0.047***
exchange rate	0.0891	0.0633	0.229*	0.238*
money supply	0.0131**	-0.00692	-0.00272	-0.0282
rainfall	-0.098*	-0.0226***	-0.00531*	-0.00467
rho		0.496***	0.523***	
LM		1.426***	1.524***	1.521***
lambda				0.533***
R-squared	0.345	0.516	0.479	0.499

	Panel A: Food Prices			
Variables	**Traditional**	**SDM**	**SAR**	**SEM**
	Panel G : Fuel			
Import tariffs	0.277***	0.062*	0.043***	0.08***
exchange rate	0.378	1.262*	0.751**	0.675***
money supply	0.00125	-0.00720	-0.00219	-0.00106
rainfall	-0.074	-0.0126	0.00388	-0.000883
rho		0.507***	0.614***	
LM		5.553***	6.861***	6.748***
lambda				0.648***
R-squared	0.363	0.409	0.562	0.501
	Panel H : Footwear			
Import tariffs	0.331**	0.033***	0.065***	0.032***
exchange rate	0.0913	0.229	0.249*	0.252**
money supply	0.0108**	-0.00965	-0.00179	-0.00129
rainfall	-0.034	-0.0133**	-0.00854	-0.00153
rho		0.481***	0.532***	
LM		1.100***	1.234***	1.226***
lambda				0.550***
R-squared	0.489	0.528	0.552	0.551
	Panel I : Non-alcohol Beverage			
Import tariffs	0.695**	0.061***	0.027***	0.014***
exchange rate	-0.0134	-0.128	0.0529	0.0898**
money supply	0.00270	-0.00180	-0.00201	-0.00194
rainfall	-0.029	-0.00618**	-0.00113	-0.000688
rho		0.574***	0.627***	
LM		0.153***	0.171***	0.167***
lambda				0.662***
R-squared	0.452	0.471	0.487	0.359

Source: STATA output using Zimstat price surveys data and ArcGIS shapefiles. , the depend variable is average consumer goods (significant level *** p<0.01, ** p<0.05, * p<0.1)

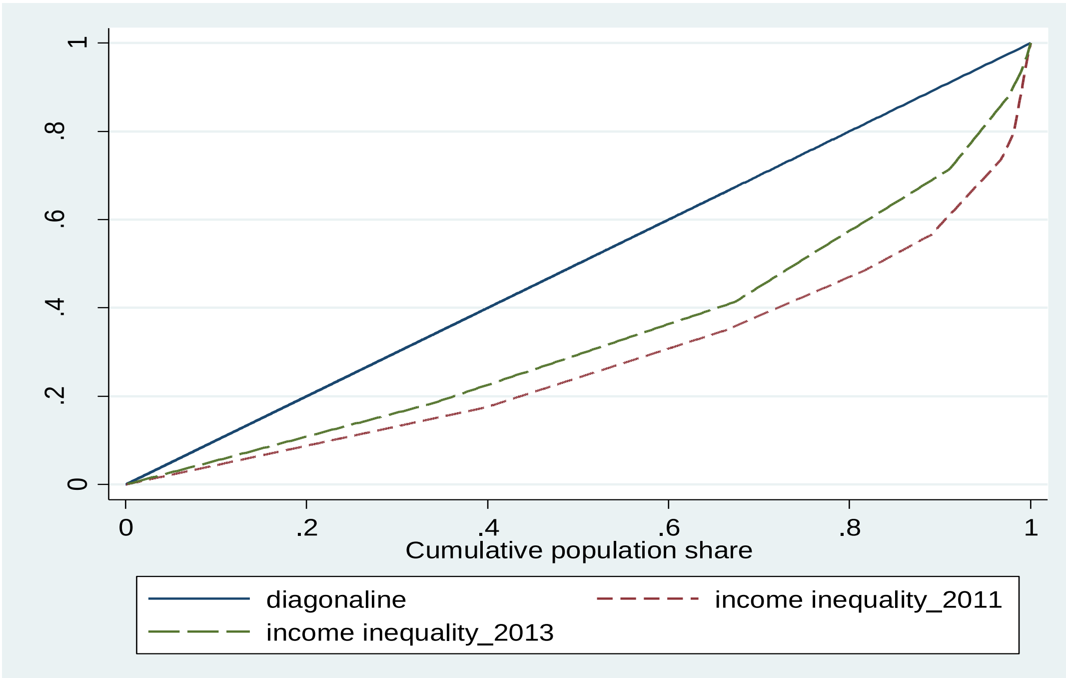
C-A14: Correlation matrix

	Prices	Tariffs	Money supply	Spatial weighted price	Rainfall	Distance to Beitbridge	Location
Prices	1.0000						
Tariffs	0.4438	1.0000					
Money supply	0.4013	0.8857	1.0000				
Spatial weighted price	0.8173	0.4912	0.4672	1.0000			
Rainfall	-0.1935	0.0018	0.0041	-0.3858	1.0000		
Distance to Beitbridge	0.2366	-0.0006	-0.0040	0.4563	-0.4430	1.0000	
Location	0.0325	0.0007	0.0041	0.0470	-0.2201	0.0475	1.0000

Source: STATA output using Zimstat 2009-2014 price surveys data and ArcGIS shapefiles.

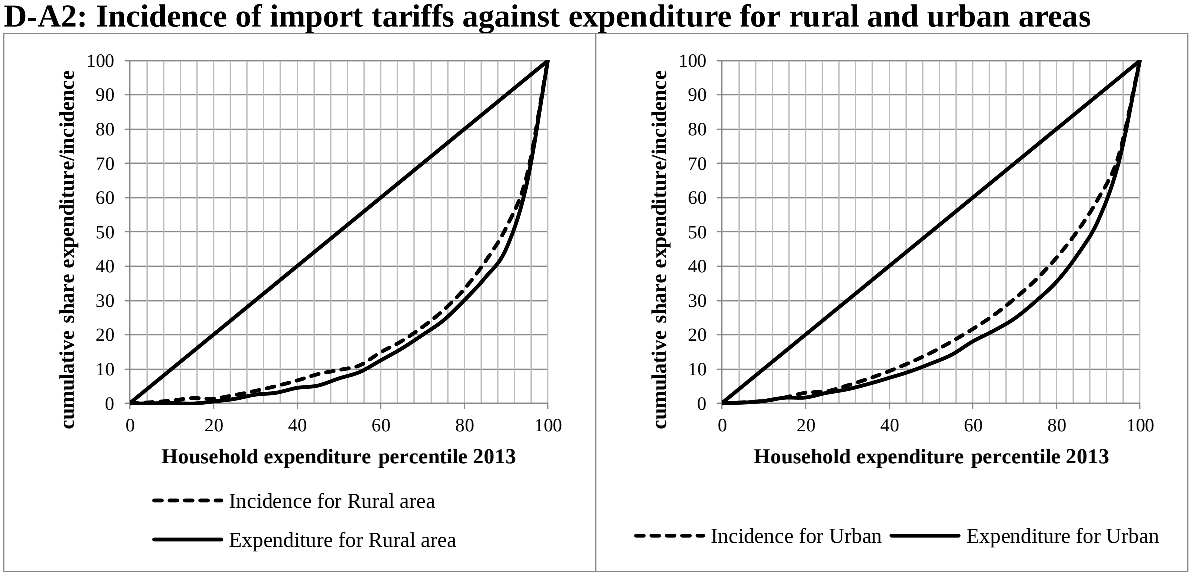
Appendix D

D-A1: Comparing income inequality between 2011 and 2013



Source: Calculations using 2011/12 and 2013/14 household income and expenditure survey

D-A2: Incidence of import tariffs against expenditure for rural and urban areas



Source: Calculation using 2011 income expenditure survey

D-A3: Mean import tariffs incidence for male- and female-headed households

Percentile	Incidence of Male-headed	Expenditure Male- headed	Incidence Female-headed	Expenditure Female-headed
5	0.51	0.47	0.37	0.36
10	1.54	1.28	1.21	0.60
15	2.76	2.44	2.10	1.17
20	4.39	3.85	3.29	1.89
25	6.34	5.46	4.77	2.93
30	8.54	7.19	6.45	4.25
35	11.01	9.25	8.41	6.16
40	13.86	11.68	10.65	6.57
45	17.11	14.40	13.24	8.58
50	20.58	17.25	15.99	11.15
55	24.51	20.56	19.15	13.12
60	29.17	24.21	22.91	15.61
65	33.25	29.24	26.99	20.11
70	38.35	33.65	31.84	24.12
75	44.18	39.19	37.32	28.46
80	51.29	45.70	43.32	35.37
85	59.18	53.40	51.44	40.89
90	69.15	63.90	61.47	51.25
95	81.71	77.77	75.41	67.22
100	100	100	100	100

Source: Calculation using 2011 and 2013 income expenditure survey.