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[AN EMPIRICAL ANALYSIS OF MACROECONOMIC FACTORS AND THE EFFECTS ON INSURANCE DEMAND AND PROFITABILITY]

Acknowledgements

Only occasionally do functional requirements overlap with ones interests. It has been as much a pleasure to gain new insights as it has been a professional need. I would like to thank my supervisor, Kalu Ojah, for his encouragement and guidance and most importantly providing a platform for growth.

Abstract

In any business it is critical to understand the key drivers of sales, costs and sustainability. This study aimed to understand whether macroeconomic indicators could be used to explain and predict insurance sales, cancellations and overall underwriting profitability in South Africa, and whether the drivers for insurance demand and profitability differed based on individual wealth. The significance of answering these questions is directly related to managing and running an insurance business in terms of which products to sell, and which consumer segments to target based on prevailing macroeconomic conditions. Regression analyses using Ordinary Least Squares were completed on both low income and high income consumer groups. Predictive models for sales (low income and high income groups) and profitability (low income group) were derived; however no model sufficiently explained cancellations in either income group. The explanatory variables for sales in the low and high income groups differed, suggesting that macroeconomic factors differentially influence buying behaviours in these groups. Sales and profitability in the low income group were explained by the same macroeconomic factors.

Table of contents

List of figures

List of tables

1. Introduction

1.1. Project context

1.1.1. Drivers of sustainable business profitability

In any business that involves selling a good or service, the short term drivers of profitability are the volume of sales and the cost of production and distribution. In the longer term, client retention drives business sustainability. Table 1 summarises some of the classic factors that influence sales, costs and customer retention. On a high level, it is thus logical that business strategic planning and decision making often focus on three dimensions: product characteristics, price, and market opportunity (Nattermann, 2000). Since consumer behaviours and demand as a function of income are generally beyond a company's control, much focus has been placed on product design and pricing.

More recently significant consideration has been placed on how to identify customer needs and then back solve what goods and services are relevant to them (Vandermerwe, 2004). This approach focuses on customer value and theoretically the resulting demand for a given good or service from consumers should ensure the long term sustainability of a business. Interestingly several studies have shown that longevity of a customer relationship is not the sole determinant of profitability (Reinartz & Kumar, 2000). Segmenting customers based on purchasing behaviours (such as value of purchase, number of purchases, frequency of purchases and cross buying) has allowed researchers to segment customer groups and measure profitability as a function of customer longevity (Mark, Niraj, & Dawar, 2012; Reinartz & Kumar, 2003).

These studies provide insights into both acquisition and retention strategies. Ultimately a balance between product innovation, pricing, cost of production and consumer loyalty is necessary for a business to thrive (i.e. be characterised by growth and profitability).

TABLE 1: BUSINESS DRIVERS OF SALES, COSTS AND RETENTION

Sales	Costs	Customer retention
Type of good or service	Level of mechanisation	Customer service levels
Product differentiation	Scale and volume of production	Perception of value / risk / need
Product price	Labour force skill level	Affordability
Competitors	Labour force size	Barriers to switching
Dedicated sales force	Supply chain management	Loyalty
Sales process	Advice vs non-advice sale	Brand
Geographic footprint of distributors	Process and workflow management	Customer relationship management

1.1.2. Theory of insurance demand and profitability

In the insurance industry the drivers of sales, costs and sustainability are common to those described above for all businesses. A great deal of research has explored both demographic and economic factors that drive insurance demand and thus influence its profitability (Zietz, 2003).

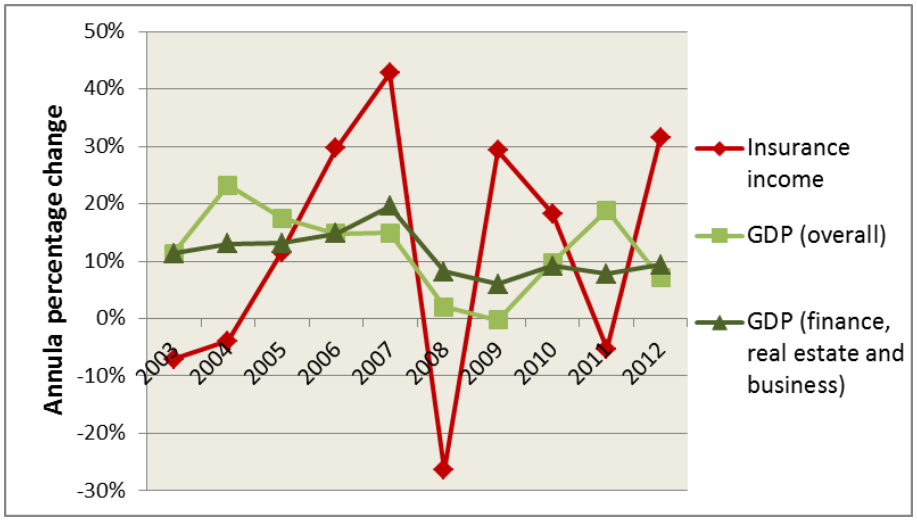
As a starting point most studies on insurance demand have attempted to characterise and relate how an individual's risk aversion influences product uptake. Early studies defined an equation for risk aversion as a utility function of wealth or net worth (Pratt, 1964). This framework is useful in suggesting purchasing behaviours and the notion that as an individual's wealth grows, his/her risk aversion will decrease and he/she will take on more risk (Mossin, 1968). Of great practical relevance is the predicated shape of these utility curves. Interestingly, in a scenario where a consumer is faced with multiple consumption opportunities the overall utility function that they follow to maximise their wealth across all consumption does not necessarily follow the underlying utility function of each individual consumption opportunity (Mossin, 1968).

Over and above this, there is a growing body of evidence that consumer behaviour is often anomalous to theoretical predictions: insurance is often bought unnecessarily, or not bought when theory suggests that it should be held, and worst of all, purchasing decisions are unduly influenced by irrelevant considerations (Schwarcz, 2010). Four common categories of deviation from theoretical risk aversion expectations are (i) bimodal demand for catastrophe (ignore high risk low frequency events such as earthquakes), (ii) favour small financial risk, (iii) non-pecuniary benefit preference, and (iv) low deductible preference (Schwarcz, 2010).

The use of panel data to explore household insurance demand, has highlighted the dynamic nature of buying behaviours, and emphasises the breadth of factors that can trigger shifts in demand (Liebenberg, Carson, & Dumm, 2012).

A detailed description of the economics of insurance is provided in Chapter 2. In the Life insurance industry there are three primary components to profit (underwriting performance, investment returns and fee income). Both the underwriting performance and investment returns are sensitive to macroeconomic changes and particularly fluctuations in inflation and interest rates (Doherty & Kang, 1988; Frey & Steinmann, 2012; Karl, Holzheu, & Laster, 2010).

Figure 1 shows the annual change in underwriting performance of the South African Life insurance industry relative to annual changes to GDP. GDP across all sectors as well as the finance, real estate and business sector on its own were obtained from Statistics South Africa and annual percentage changes calculated (StatsSA, 2014). Although the insurance returns show more volatility, the movements between GDP and underwriting performance do seem to track together. This suggests that insurance demand and performance (profitability), might be dependent on macroeconomic factors and this hypothesis forms the basis for this study.

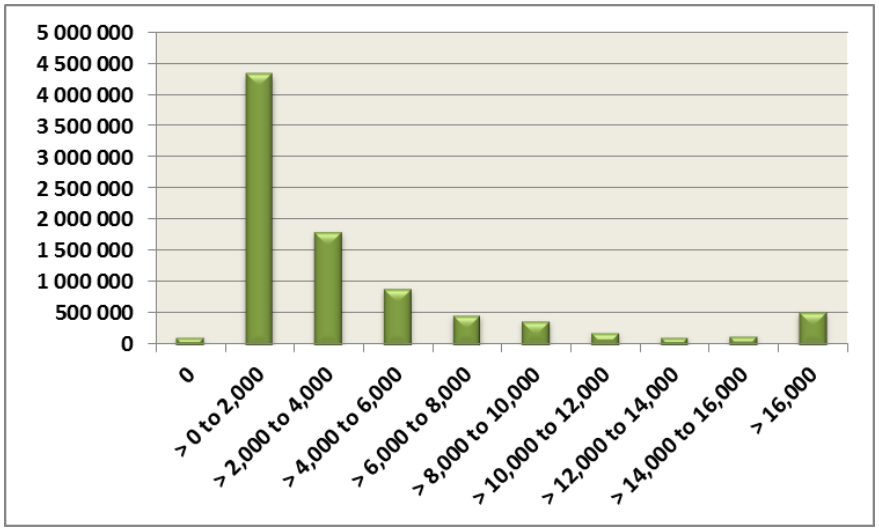


Source: FSB annual reports for Life and Short Term insurance, and Stats SA (FSB, 2014; StatsSA, 2014).

FIGURE 1: COMPARISON OF YEAR ON YEAR CHANGES IN GDP TO TOTAL INSURANCE INDUSTRY RETURNS IN SOUTH AFRICA

1.2. Problem statement and research objectives

South African Life insurance markets include customers across a broad range of earnings. Figure 2 shows the monthly earnings of employed individuals across South Africa and highlights the range of earnings, with the majority of individuals earning less than R 6 000 per month (Eighty20, 2014). It is thus likely that insurance demand in this segment of the market is very sensitive to macroeconomic factors, whereas demand from higher income individuals (> R 16 000 per month) may follow macro-economic trends less closely. However, the actual empirical evidence for this is unclear and this information seems vital, if not indispensable, for insurance companies to remain profitable and sustainable. The earlier background context relating to determinants of demand for insurance products makes this point strongly. These insights into demand would represent powerful lead indicators for business planning and sales strategies.



Source: Eighty20 database (Eighty20, 2014)

FIGURE 2: INDIVIDUAL HOUSEHOLD EARNINGS FROM STATSSA (2012)

The aim of this research is thus to determine whether:

I. insurance demand and profitability in South Africa can be explained using a macroeconomic model.

II. insurance demand in the low income market (individuals earning < R 6 000 per month) can be explained differently from insurance demand in the higher income market (individuals earning > R 16 000 per month) using macroeconomic factors.

1.3. Significance of study

By understanding the relationship between macroeconomic factors and insurance demand (across income segments), insurance businesses are able to build forecasts accurately as well as gain additional insights in terms of which business (products / customer segments) to promote or favour based on the prevailing economic conditions. Understanding profiles of disparate income (economic) groups and what differential products are most attractive to them would be a valuable knowledge.

1.4. Overview of methodology

1.4.1. Data

As discussed in the introduction, profitability is ultimately determined both by new business growth as well as customer loyalty and longevity. In order to understand insurance demand and

profitability it thus makes sense to track three key metrics (policy sales, policy cancellations and underwriting profit)

Sales data is an excellent proxy for insurance demand as it reflects buying behaviours of consumers. Cancellations reflect policy off movements and relate to a consumer's risk appetite, brand loyalty and product features (e.g., affordability, perceived value). The underwriting margin captures all of the above and is a good indicator of business sustainability.

Low income consumer data was collected from funeral policies, while the high net worth consumer data was collected from underwritten Life products. Numerous macroeconomic indicators are available to build the regression models (GDP, Repo Rate, CPI, Unemployment, Credit Standing of consumers, Consumer enquiries for credit, Civil cases of debt, Financial Services confidence index, Consumer Confidence). Their selection for this study is based on evidence within the literature that they may influence insurance demand (Chui & Kwok, 2009; Doherty & Kang, 1988; Lee & Chiu, 2012; Lee, Lee, & Chiu, 2013; Zietz, 2003).

1.4.2. Building the models

GRETL software was used to build all regressions and complete any relevant statistical analyses (GRETL, 2014). In order to test whether macroeconomic factors influence insurance demand, six different regression models have been determined. For each of the three insurance metrics (sales, cancellations and underwriting profit) data was drawn from Life insurance sales for low income and high net worth individuals. The best predictive model was then determined for each of these six dependent variables using a bottom up approach as outlined in Chapter 3.

Although the insurance data is available on a monthly basis, the majority of macroeconomic factors are published quarterly. Thus regression models using quarterly values of sales, cancellations and underwriting profit were constructed, so as to compile a data set of uniform quarterly frequency for the study.

1.5. Outline of research report

Following from this introduction is a detailed literature review, which provides an overview of the insurance industry and explores in more detail which factors (demographic and economic) influence insurance demand (Chapter 2). This leads to a description of the problem statement and research objectives in Chapter 3, where the approach to collecting data and building regression models to test the predictive power of macroeconomic factors on insurance demand is then outlined. All of the descriptive statistics and model estimation data are then provided together with an interpretation of the results in Chapter 4. Finally, the conclusions are presented and a list of references provided in Chapters 5 and 6.

2. Literature Review

2.1. Insurance industry overview

The aim of this study is to better understand which key external drivers influence the insurance industry and to then explore how they can be used in structuring and managing an insurance company. This section summarises the key features (size, class of business, competitive landscape and performance) of the insurance industry as a whole in South Africa and sets the context for a more detailed description of what drives insurance demand at the end of this chapter.

The first documented evidence of Life insurance forms part of the Hammurabi Code, which dates back to ancient Babylonian times (2500 BC). This code consists of 282 laws and includes reference to basic insurance in that a debtor did not have to pay back his loans if some personal catastrophe made it impossible to do so (Prince, 1904). Subsequently, stonemasons in Egypt are believed to have formed funeral cooperatives to support each other in the event of death and similar burial societies were common in India (1000 BC) and ancient Rome (Kirova & Steinmann, 2012).

Today the insurance industry is highly regulated and at the highest level distinction is made between insurance policies which are short term in nature (renewable on an annual basis (Inseta, 2014)) versus those that have long term horizons (Life policies). Short Term insurance is divided into seven classes of business (Property, Transportation, Motor, Accident & Health, Guarantee, Liability and Engineering) (FSB, 2014). The Life industry includes four main classes of business (Investments, Risk, Annuities and Universal Life).

A high level summary of typical insurance revenues and costs is summarised in Figure 3. Revenues are earned from the risk premium, asset fee income, inward reinsurance commissions and investment income from holding the earned premium. Typical insurance costs include commissions paid out to intermediaries such as brokers, policy administration costs, claims payments and other expenses related to policy acquisition and marketing.

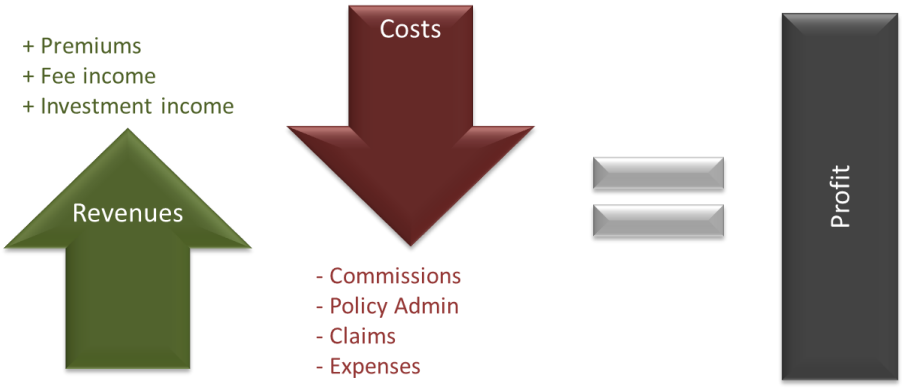
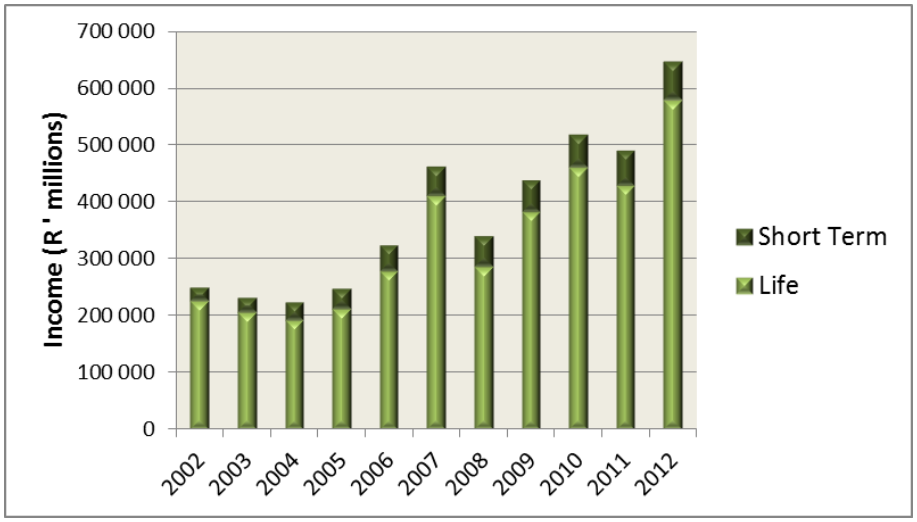


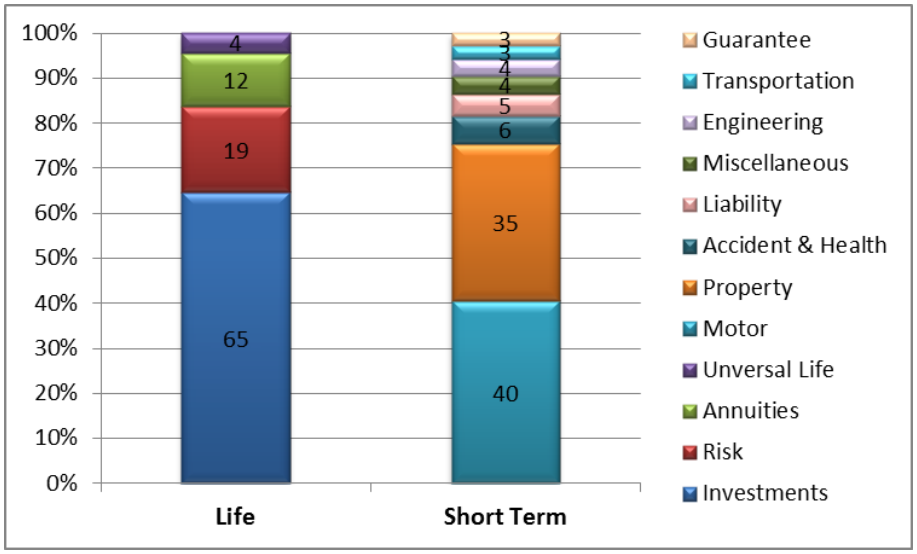
FIGURE 3: STYLISED SUMMARY OF AN INSURANCE INCOME STATEMENT

Figure 4 provides a 10 year history of total revenues earned between both Short Term and Life insurance in South Africa. These revenues include the premium earned (insurance policy premium) as well as the investment income earned through holding capital. In 2012, profit for Short Term insurance was R11.4bn, with a gross profit margin of 9% and the overall operating Income for Life insurance as a whole was approximately R580bn (FSB, 2014). Figure 5 summarises the relative sizes of the Short Term and Life business classes based on 2012 return figures. Under the Life licence, Investments form the largest grouping, with approximately 65% of premiums being earned for investment business. The focus of this study is on the risk category, which comprises approximately 19% of the Life insurance industry. The largest classes of business on the Short Term licence relate to motor and property insurance.



Source: FSB annual reports for Life and Short Term insurance (FSB, 2014).

FIGURE 4: HISTORIC INSURANCE INDUSTRY INCOME RETURNS



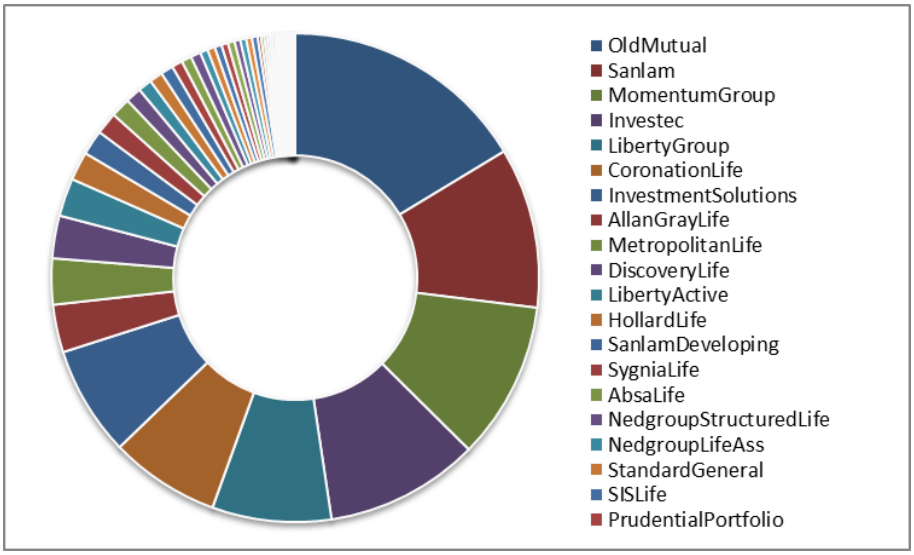
Source: FSB annual reports for Life and Short Term insurance (FSB, 2014).

FIGURE 5: CLASSES OF BUSINESS IN LIFE AND SHORT TERM INSURANCE (2012)

Over the last ten years, the Life industry has shown a compound annual growth rate of 9.9%, with the Short Term industry growing annually by 10.5% (FSB, 2014). The insurance industry is a highly competitive market, with 92 Short Term insurers and 73 long term insurers, all competing for a share. Table 2 provides a visual summary of the relative size / dominance of competitors and lists the top twenty insurers in each category (based on premium earned) (FSB, 2014).

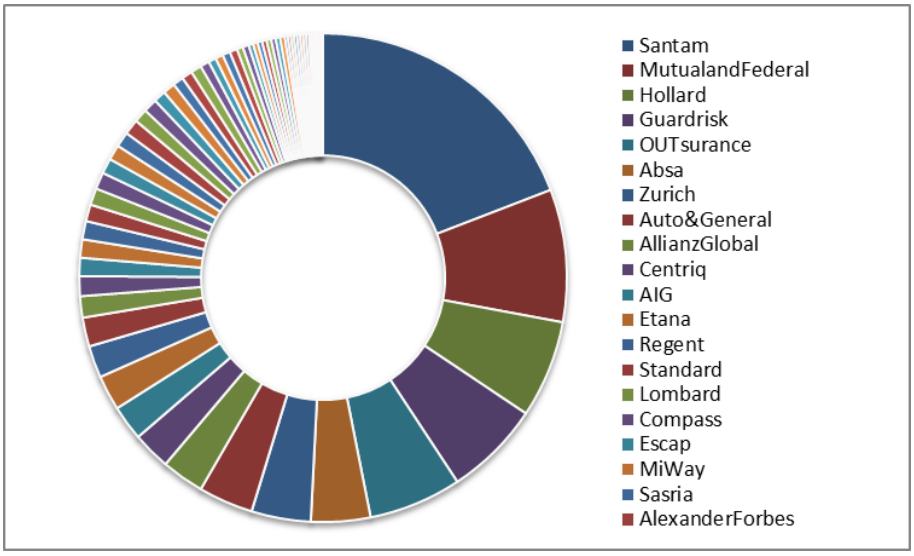
TABLE 2: DISTRIBUTION OF MARKET SHARE ACROSS LIFE AND SHORT TERM INSURERS (2012)

Top 20 Life insurers: Percentage of total net premiums



Total number of insurers: 73

Top 20 Short Term insurers: Percentage of gross premium written



Total number of insurers: 92

Source: FSB annual reports for Life and Short Term insurance (FSB, 2014).

2.1.1. Insurance profitability drivers and measures

In general, companies aim to understand and track both internal and external business drivers in order to maintain a competitive advantage in their respective markets. External business drivers include overall economic performance and stability (public perceptions of the government, institutional frameworks and governance) of the country in which you operate, labour resource constraints such as skills, costs and availability as well as the overall market maturity and competitive landscape (Barksdale & Lund, 2006). In emerging economies, such as South Africa, both 'housekeeping' (macro-policies, political environment, corporate governance and the maturity of financial markets) and 'plumbing' factors (legal and regulatory frameworks and execution thereof) are critical in establishing investor confidence (Ladekarl & Zervos, 2004). A strong understanding of these factors and their impacts on business operations is essential for existing companies. In addition to this, in emerging African economies capital structures often rely primarily on internal finance and short term debt, which also impacts on business growth potential and profits (Gwatidzo & Ojah, 2009).

External factors are often used as lead indicators to set or adjust business strategies and operating models. Internal business drivers such as technology development / acquisition and process design are often informed by external trends (Barksdale & Lund, 2006). Softer issues such a shareholder management and leadership organisation (shaping the culture and managing change) vary more across companies.

In the Life insurance industry there are three primary components to profit (underwriting performance, investment returns and fee income). Figure 6 summarises these components and links these to their respective key drivers and also provides economic indicators for each of these drivers. Overall, business profitability has generally been tracked using accounting based ratios and analyses such as total shareholder return, book value per share, price to book value, return on equity, operating margin, return on assets and net investment results (Kirova & Steinmann, 2012). Historic analyses have shown a close correlation between price to book ratios and earnings. This measure effectively incorporates the exposure of overall profitability to stock market fluctuations. Return on equity is more volatile than the price to book ratio, but is also a good proxy for performance and there is a close correlation between these two benchmarks of performance (R^2 = 0.727) (Kirova & Steinmann, 2012).

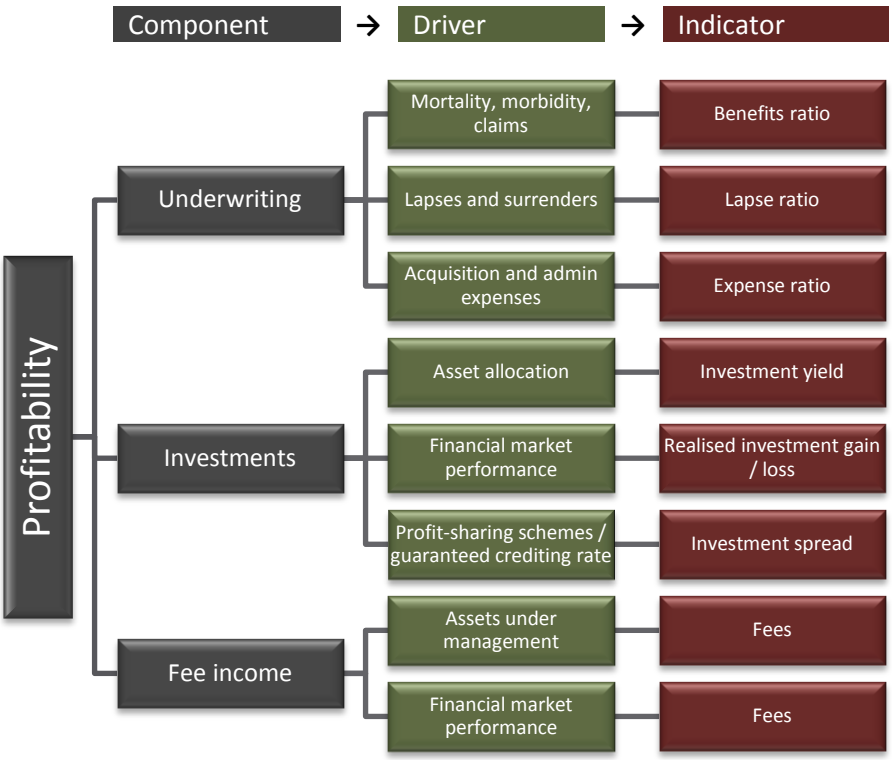
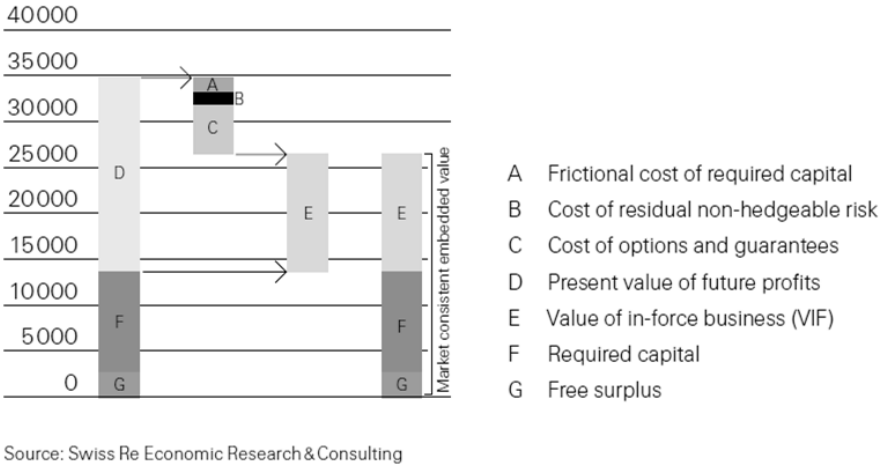


FIGURE 6: KEY COMPONENTS AND MEASURES OF PROFITABILITY FOR LIFE INSURANCE (KIROVA & STEINMANN, 2012)

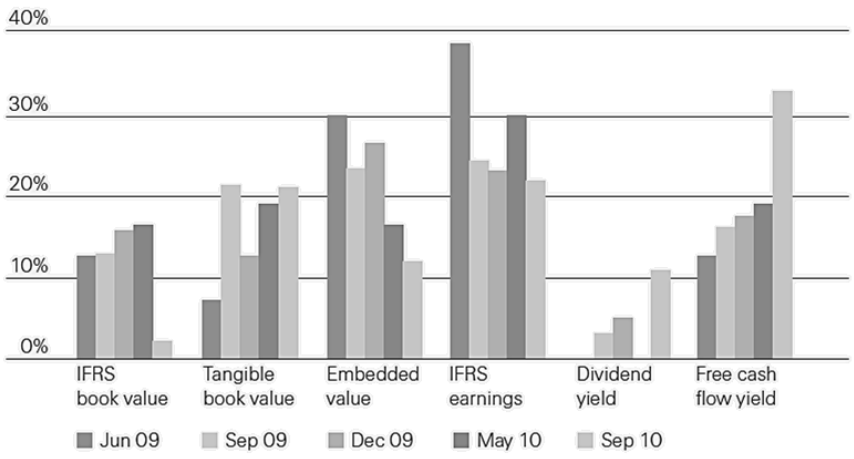
However, some controversy exists in tracking insurance performance. The majority of analyses tend to make use of accounting-based measures. The primary advantage of these is their transparency and comparability across countries and markets assuming GAAP / IFRS principles are followed. However, statutory regulations relating to capital solvency requirements (to ensure policy holder protection) do not allow / consider deferred acquisition costs over a policy life, for example. Thus insurers tend to track value over the expected life of their in force policies, using a Net Present Value (NPV) calculation. The NPV is referred to as Embedded Value (EV). An attempt to standardise EV calculations has been provided through creation of the Market Consistent Embedded Value (MCEV), which has gradually been adopted. Figure 7 illustrates how the MCEV is calculated. Unfortunately all EV calculations are highly sensitive to changing input assumptions such as policy lapse rates and interest rate changes / forecasts. Over time the EV of a company can fluctuate significantly, which does not encourage investor confidence. Furthermore, these fluctuations in value can be asymmetric. For example, a 100bp decrease in interest rates was shown to cause on average a decrease in EV of 9.2%, while the same increase in interest rates showed only a 3.3% increase in EV on average (Kirova & Steinmann, 2012). The reason behind this relates to the structure of returns from investments over and above guarantees, while insurers bear full downside exposure. Following the global financial crisis understanding the main components that drive changes in EV such as existing business vs. new business volumes and the economic variances has become essential. However, from an investor perspective Free Cash Flow Yield (FCFY) has grown in popularity as a performance indicator, Figure 8 (Kirova & Steinmann, 2012). FCFY is calculated as

free cash flow per share divided by the market price per share and is a measure of cash distributable to shareholders.



Source: Swiss Re Economic Research & Consulting

FIGURE 7: EXPLANATION OF MARKET CONSISTENT EMBEDDED VALUE CALCULATION (KIROVA & STEINMANN, 2012)



Source: Bank of America/Merrill Lynch, 12 January 2011

FIGURE 8: USE OF PROFITABILITY INDICATORS OVER TIME (KIROVA & STEINMANN, 2012)

2.1.2. The impact of inflation and interest rate changes on insurance profitability

Inflation and interest rate changes affect both Short Term and Life insurance. The effects are generally more far reaching for Life insurance policies since Short Term policies premiums are renewed annually and thus re-pricing of products is possible. The main constraints to re-pricing Short Term policies in response to economic changes are the prevailing competitive business market conditions and any regulatory conditions regarding premium changes.

Inflationary increases do affect the profitability of Short Term insurers based on the increased cost of claims relative to the expected costs used in pricing models and for long tail businesses the reserves set aside for paying claims may be insufficient (Karl et al., 2010). This is particularly true when inflation remains persistently high. In the case of Life insurers, inflationary increases often do not affect their liabilities as most mortality, wealth and longevity protection policies do not index for inflation (Karl et al., 2010). However, the consequence of this is that the value of the policies decreases and thus consumers often cancel policies and new business volumes decrease. In high inflationary environments the underlying cost structures (policy administration) also tend to rise and thus the overall profitability can decrease. This effect is reduced if the increase in inflation is matched by an increase in interest rates.

In fact deflation poses the greatest risk for Life insurers as in low inflationary environments, interest rates tend to drop and it is thus difficult to achieve the required investment returns (particularly for interest rate guarantee saving products) to meet their liabilities and cover their costs (Karl et al., 2010).

Interest rate impacts on insurer profitability are similar to those of inflation and the key factors in determining their significance relate to the dependence on investment returns of the particular product sold and secondly on the extent to which insurers can hedge or manage these risks using asset liability management (Frey & Steinmann, 2012). As described above, changes in inflation and interest rates not only affect the investment returns, but also influence policy holder behaviour. Research on how different companies model the dynamic behaviours of policy holders has been conducted (Clark, Kent, & Morgan, 2013), however, the relevance of the underlying models is most significantly influenced by the insurance product or asset portfolio under consideration. Furthermore, product features such as being able to withdraw money at any time or the addition of benefits under the original policy terms all influence the sensitivity to interest rate fluctuations (Frey & Steinmann, 2012). In general stable interest rates or mean reverting behaviours can be most easily absorbed by the industry. Volatility and unpredictability in interest rates are the cause of most threats to profitable underwriting.

2.2. State of the insurance industry in South Africa relative to Africa, emerging and developed economies

Table 3 provides a high level overview of the relative sizes of insurance in developed economies, emerging markets as a whole and Africa (SwissRe, 2014). The relative dominance in size of developed markets to both emerging economies and Africa is clear in panels A and C. Panel B shows insurance premium expressed as a percentage of GDP and reveals a more promising view of how the insurance industry has grown in the last 20 years in both emerging markets and Africa. This growth (panel D), was most significant between 2000 and 2010, with emerging economies share of the world's GDP increasing from 21% to 34%, and in parallel total insurance premiums grew by 11% annually in emerging economies, while insurance premiums only grew by 1.3% in industrialised economies over this period (Kalra & Futterknecht, 2011).

Despite a global trend towards consolidation of markets and expansion of larger global insurers into emerging economies, local insurers have outperformed their international counterparts in emerging economies. This is largely due to richer consumer insights, the development of innovative, tailored products (such as index-based weather insurance for agriculture) , control of distribution channels (particularly leverage of bancassurance), and stable economic environments (low inflation) (Kalra & Futterknecht, 2011).

Growth in insurance markets across Africa has been significant and is forecast to continue. Table 4 provides a snapshot of a few African countries and their historic growth rates and market composition. Although positive growth is forecast across most of these countries, the persistence of low interest rates and new regulations (solvency regimes) is likely to dampen growth forecasts (Kalra & Futterknecht, 2011).

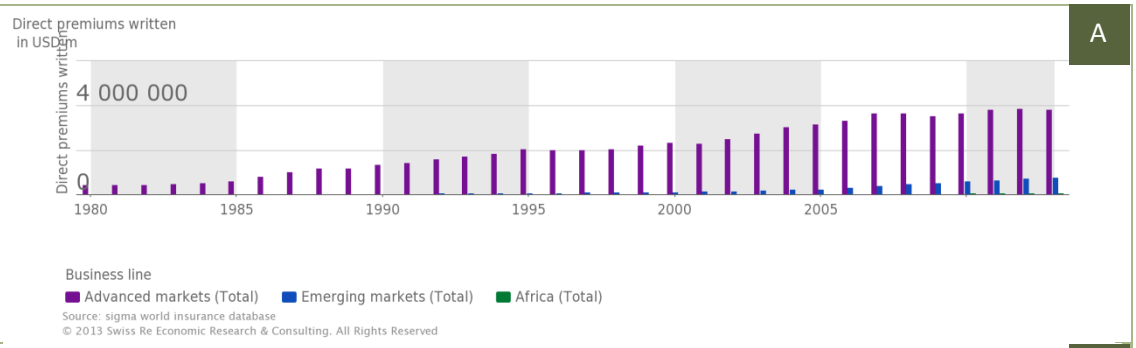
TABLE 4: COMPARISON OF INSURANCE COMPETITIVE MARKET SIZE AND GROWTH IN AFRICA

Country	Licence	Number of insurers ǂ	Historic growth 2008-2012 (CAGR %)
South Africa	Life	73	19.3
	Short Term	92	6.1
Nigeria	Life	16	10.1
	Short Term	30	32.8
Kenya	Life	11	17
	Short Term	24	17.7
Ghana	Life	18	19.1
	Short Term	23	38.1

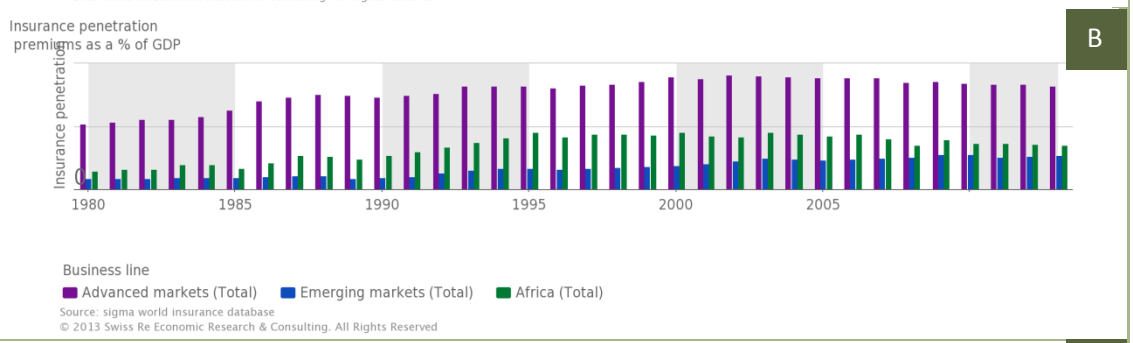
ǂ Excludes composite insurance licences in Nigeria, Kenya and Ghana

TABLE 3: OVERVIEW OF INSURANCE INDUSTRY SIZE IN ADVANCED MARKETS, EMERGING MARKETS AND AFRICA (SWISSRE, 2014)

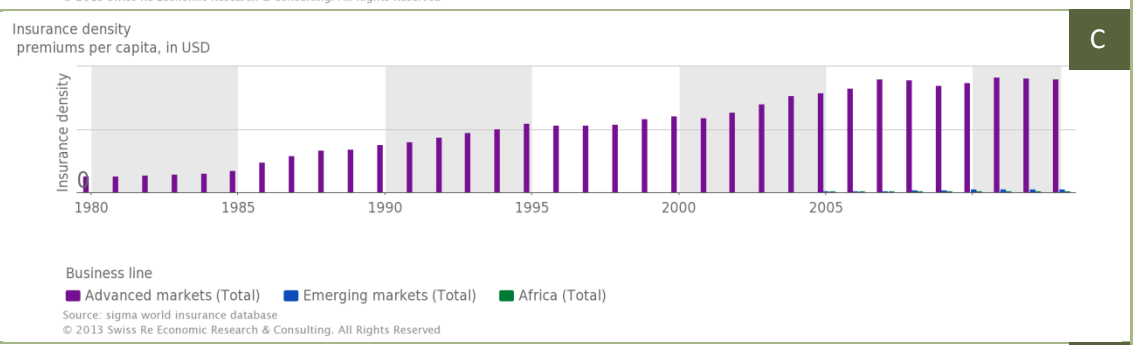
Total premium



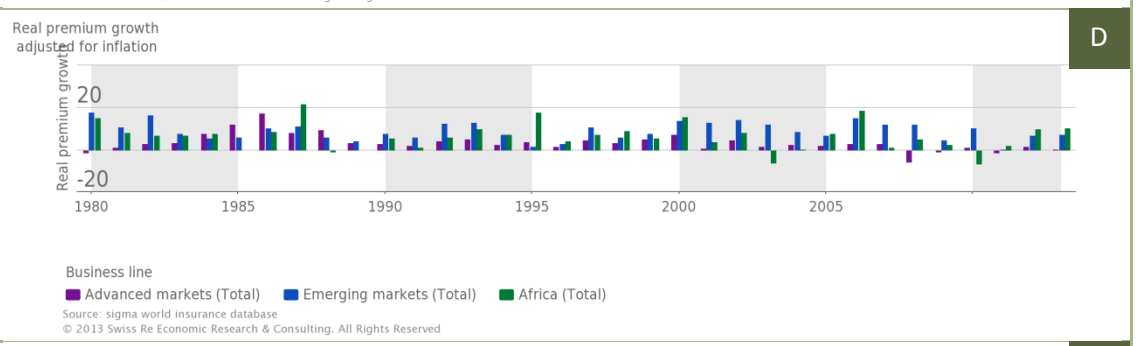
Premium as a percentage of GDP



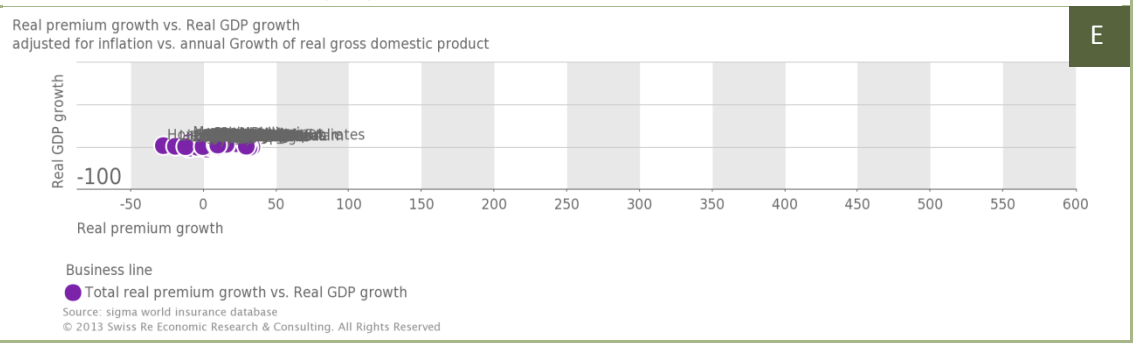
Premium per capita



Real premium growth



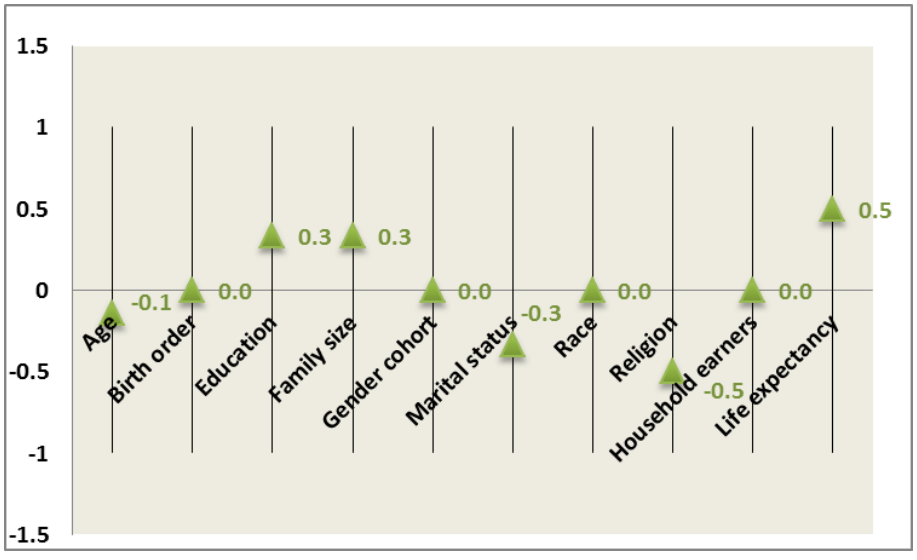
Premium growth vs GDP growth (2013)



2.3. Factors influencing insurance demand

As described in the introduction, a great deal of research has centred on developing models to predict insurance demand relative to various risk aversion proxies. As with any model of human behaviour it is not surprising that inconsistencies and deviations from expected or 'rational' behaviour are commonplace. Schwarcz (2010), describe four common categories of deviation from theoretical risk aversion expectations: (i) bimodal demand for catastrophe (ignore high risk low frequency events such as earthquakes), (ii) favour small financial risk, (iii) non-pecuniary benefit preference, and (iv) low deductible preference.

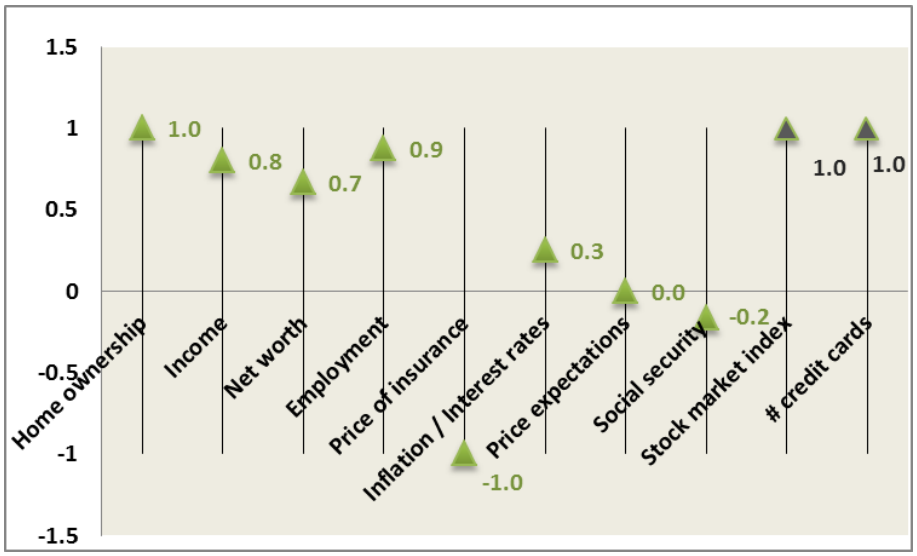
In order to try to understand these behavioural anomalies much research has centred on consumer demographics in order to try and predict insurance demand. Ten common demographic characteristics are summarised in Figure 9, which graphically indicates whether insurance demand is positively or negatively related to these factors. The figure was constructed by counting the number of supporting or refuting citations in Zietz (2003) and Liebenberg et al. (2012), where positive correlations were scored 1, negative correlations -1 and non-significant findings were given a score of 0. The green triangle represents the calculated average score across all literature. It is clear from the figure that almost all characteristics show mixed results and near zero averages. These findings (Liebenberg et al., 2012; Zietz, 2003) together with industry experience suggest that the type of product and distribution channel will differentially influence how deterministic a particular demographic characteristic is in influencing insurance demand. For example factors such as increasing family size and geographic mobility both tend to increase Life insurance demand (Burnett & Palmer, 1984), but not necessarily Short Term insurance products. While, in newly married couples, the wife's prior insurance purchasing behaviours strongly influence the type of Life insurance product that is purchased (Anderson & Nevin, 1975).



Source: (Liebenberg et al., 2012; Zietz, 2003)

FIGURE 9: PREDICTIVE POWER OF INDIVIDUAL DEMOGRAPHICS FOR INSURANCE DEMAND

Over and above the individual's risk aversion and demographic profiling, economic and financial indicators have also been used to predict insurance demand (Zietz, 2003). These are less ambiguous than demographic indicators as shown in Figure 10. The same analysis as for Figure 9 was followed to construct Figure 10.



Source: (Zietz, 2003); Δ Note: Stock market and credit card indices only include one reference each

FIGURE 10: PREDICTIVE POWER OF ECONOMIC AND FINANCIAL INDICATORS FOR INSURANCE DEMAND

The literature thus supports the contention that insurance demand is a function of individual risk aversion, demographic characteristics which influence consumer attitudes and behaviours as well as economic drivers. In running an insurance business, being able to plan and predict insurance demand and ultimately to know which customers to target (acquisition and retention strategies) are critical elements in structuring a profitable and sustainable business over time.

2.3.1. Key questions

It thus follows that it is of great interest and relevance to understand whether insurance demand and profitability in South Africa can be explained using a macroeconomic model. A detailed description and explanation of which factors are predictive of insurance demand (sales and cancellations) and long term profitability, would allow proactive business strategies to be enacted. A granular view of how individual consumer segments respond to macroeconomic changes would add further insight and allow insurers to develop and structure their marketing and sales campaigns based on both consumer needs and likely responsiveness.

3. Data and Methodology

3.1. Research objectives

The intention of this research study is to understand whether macroeconomic factors can explain and ultimately act as lead indicators to predict insurance demand. Three factors are used as proxies for insurance demand: i) new business sales, ii) policy cancellations and lapses and iii) profitability. The latter refers more to business sustainability. The study also separated low income consumers (individuals earning < R 6 000 per month) from the higher income market (individuals earning > R 16 000 per month). The premise for this separation is to test whether lower income consumers are more vulnerable / responsive to economic shifts.

3.2. Approach

3.2.1. Data

As discussed in the introduction, profitability is ultimately determined both by new business growth as well as customer loyalty and longevity. In order to understand insurance demand and profitability it thus makes sense to track three key metrics:

I. Policy sales
   Sales are defined as those policies which are taken up by a customer and where a first premium is collected
II. Policy cancellations
   Cancellations for the purpose of this study are defined as when a customer actively cancels a policy as well as when a policy lapses (and no premium is collected for three successive months)
III. Underwriting profit
   Underwriting profit refers to the insurance business profitability and represents income earned after all insurance claims, actuarial reserving, operating expenses and direct expenses are defrayed.

Sales data is an excellent proxy for insurance demand as it reflects buying behaviours of consumers. Cancellations reflect policy off movements and relate to a consumer's risk appetite, brand loyalty and product features (e.g., affordability, perceived value). The underwriting margin captures all of the above and is a good indicator of business sustainability.

All insurance data was collected from a single insurance company. Although the data was available on a monthly basis, only quarterly data was collected to match the frequency of the

macroeconomic data set. Unfortunately, several changes to policy administrative systems across the various books of business made collecting policy information earlier than January 2008 impossible. Low income consumer data was collected from funeral policies sold through two direct to market channels (non-advice), while the high net worth consumer data was collected from underwritten Life products sold through brokers (advice). Although the distribution channels differ between the low and high income consumers, the proposed study is only concerned with relative trends and not absolute numbers of sales, cancellations and profitability, and so this is not deemed a material difference.

Numerous macroeconomic indicators are available to build explanatory regression models. Based on the literature review twelve indicators were identified and sourced for the purpose of this study (Table 5) and their influence on insurance demand explored (Chui & Kwok, 2009; Doherty & Kang, 1988; Lee & Chiu, 2012; Lee et al., 2013; Zietz, 2003).

TABLE 5: SUMMARY OF SOURCED ECONOMIC INDICATORS

Indicator	Available data	Frequency	Source
GDP - Total at 2005 prices	Jan 1993 – Jun 2014	Quarterly	Stats SA
GDP-Finance, Real Estate, Bus Services at 2005 prices	Jan 1993 – Jun 2014	Quarterly	Stats SA
Repo rate	Jan 1982 – Jun 2014	Daily	SARB
CPI00000 (Overall - 2012=100)	Jan 2002 – Jun 2014	Monthly	Stats SA
CPI12500 (Insurance - 2012=100)	Jan 2002 – Jun 2014	Monthly	Stats SA
Unemployment	Jan 2008 – Jun 2014	Quarterly	Stats SA
Civil cases recorded and summonses issued for debt (S1100000)	Jan 2000 – Jun 2014	Monthly	Stats SA
Num Consumers with good credit standing	Jun 2007 – Jun 2014	Quarterly	NCR
Num Consumers with impaired records	Jun 2007 – Jun 2014	Quarterly	NCR
EY Financial Index (unweighted)	Jan 2002 – Mar 2014	Quarterly	Ernst & Young
EY Life Insurance index	Jan 2002 – Mar 2014	Quarterly	Ernst & Young
FNB-BER consumer confidence index	Sep 1983 – Mar 2014	Quarterly	BER / FNB

3.2.2. Building an explanatory model

Figure 11 provides a high level summary of the approach used to determine the most descriptive regression model for each of the six dependent variables (Low and High income: sales, cancellations and profits). Since the majority of macroeconomic variables are reported on a quarterly basis, the models were built using quarterly data and in order to ensure that all variables had similar units they were converted to quarterly change format [($Value_t$ - $Value_{t-1}$)/ $Value_{t-1}$]. Summary statistics were determined and the assumption that the data was normally distributed was tested. Any independent variables showing high degrees of cross correlation were then rationalised and only uncorrelated variables were used to build the subsequent regression models. Individual regressions for each of these variables were calculated using the Ordinary Least Squares methodology with GRETL software (GRETL, 2014). In each regression a constant plus one independent variable was regressed against each of the six dependent variables. Since the intention

of the analysis was to build a predictive model, lags (zero to four) for each variable were also tested individually and R^2 values calculated.

Finally, a step wise approach was adopted to determine which combination of independent variables best predicts each of the six dependent variables. The three variables with the highest R^2 values were selected, combined sequentially and adjusted R^2 values were calculated. The adjusted R^2 is used as this approach ensures that only regressors which add to the explanatory power of the model increase the R^2 value (spurious regressors are excluded). The combination with the highest adjusted R^2 value was then noted as the optimal model.

Diagnostic tests, to ensure the underlying assumptions of the ordinary least squares approach were not violated, were conducted. Initially all independent variables were tested for outliers and whether they followed a normal distribution using the Grubbs and Doornik-Hansen tests, respectively (Brooks, 2014; GraphPad Software, 2014). Once the proposed models were established the residual error terms were tested for normality, heteroscedasticity (White's test) and autocorrelation (Bresch-Godfrey test). The overall robustness of each proposed model was also tested by comparing the final outputs to an OLS regression, for each of the three dependent variables (sales, cancellations and profits), which included all twelve original macroeconomic variables.

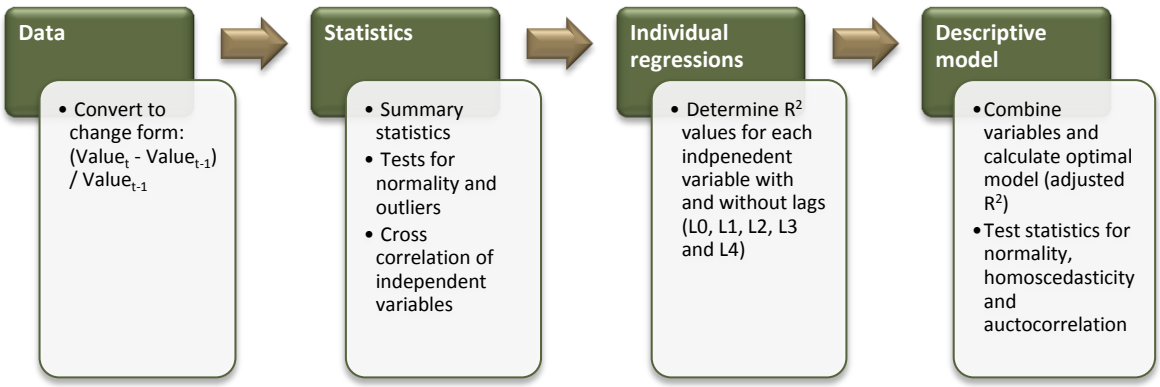


FIGURE 11: APPROACH TO DETERMINING EXPLANATORY REGRESSION MODELS

4. Results and Discussion

4.1. Descriptive statistics and diagnostic tests

The core data used for this study is graphed in Figure 12 and summarised in Table 6. The quarterly data was expressed in change format [($Value_t$ - $Value_{t-1}$)/ $Value_{t-1}$] to ensure that all variables had similar units. Summary statistics for the test sample of regressors are provided in Table 7. All of the regressors have a mean close to zero and six are normally distributed based on the Doornik-Hansen test (highlighted in green). The Grubbs' test for sample outliers was also completed, with three variables (repo rate, number of consumers with good credit standing and the FNB-BER consumer confidence index) having statistically significant outliers, Figure 13 (GraphPad Software, 2014). Although outliers can skew OLS estimates, they do generally represent real events. For example a spike in repo rate is not a spurious event and if it is in fact a valid predictor in a regression model an outlier should not be excluded from an analysis. For this reason initial analyses included all data from the independent variables even if an outlier was present.

In completing an ordinary least squares analysis five core assumptions of the underlying regressors and residual error terms exist (Brooks, 2014):

1. Average value of error terms is zero
2. Variance of the error terms is constant (errors are homoscedastic)
3. Error terms are uncorrelated with each other (zero covariance)
4. Error terms are uncorrelated with the regressors
5. Error terms are normally distributed

In this study a constant term was included in all regressions, thus assumption 1 above was not violated. In the final regression models several tests were used to test the other assumptions: White's test for heteroscedasticity, the Bresch-Godfrey test for autocorrelation of residuals (with up to four lags) and the Doornik-Hansen test for normality.

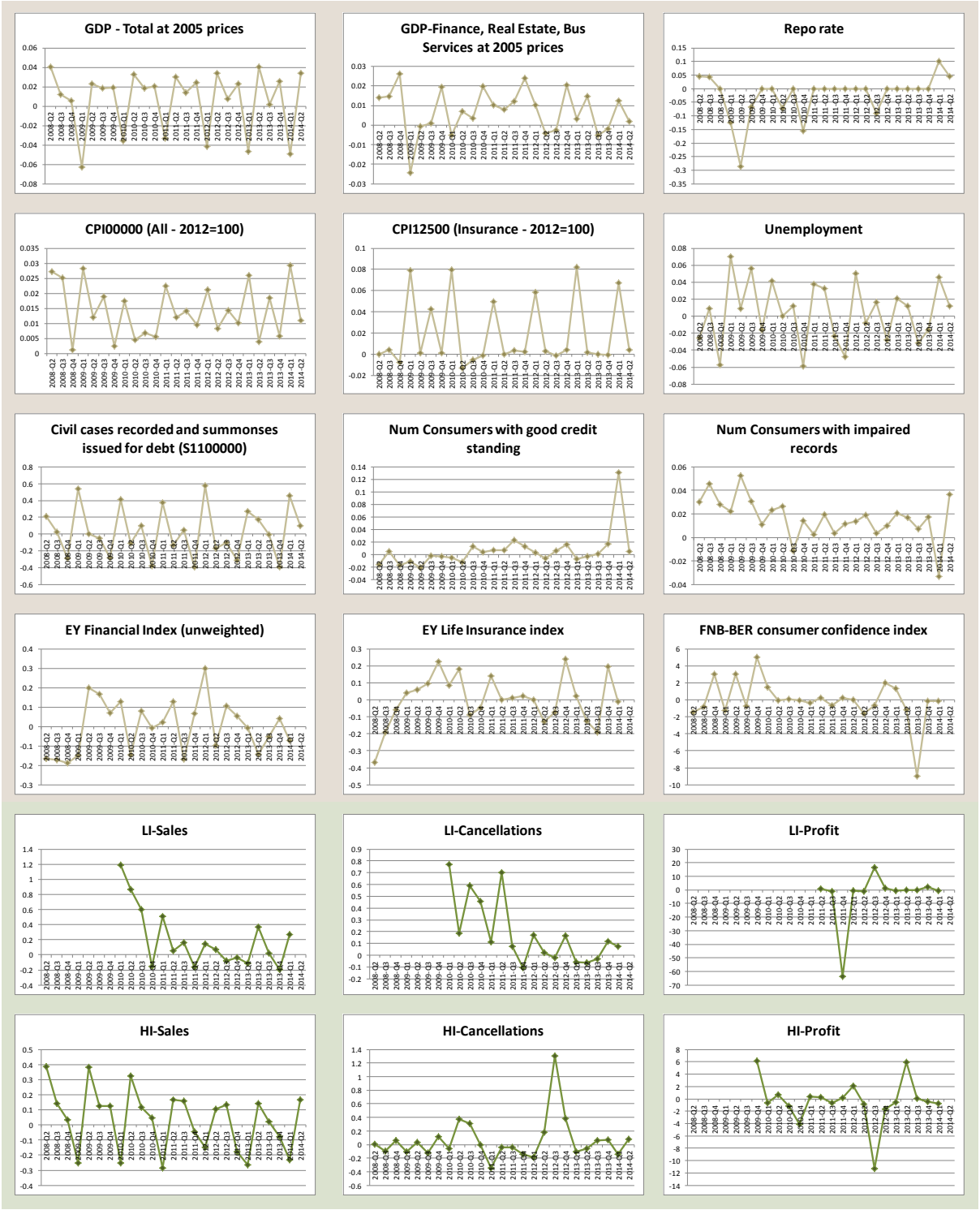


FIGURE 12: GRAPHICAL VIEW OF CORE DATA (CHANGE FORM)

TABLE 6: CORE DATA USED FOR ANALYSIS (CHANGE FORM)

	Independent variables												Dependent variables					
													Low income			High Income		
	GDP - Total at 2005 prices	GDP-Finance, Real Estate, Bus Services at 2005 prices	Repo rate	CPI00000 (All - 2012=100)	CPI12500 (Insurance - 2012=100)	Unemployment	Civil cases recorded and summonses issued for debt (S1100000)	Num Consumers with good credit standing	Num Consumers with impaired records	EY Financial Index (unweighted)	EY Life Insurance index	FNB-BER consumer confidence index	Sales	Cancellations	Profit	Sales	Cancellations	Profit
2008-Q2	0.04062776	0.013958	0.045455	0.027202	0	-0.02586	0.212763	-0.01611	0.030349	-0.16667	-0.37	-1.5				0.386836	0.009399	
2008-Q3	0.01183882	0.014499	0.043478	0.025221	0.004005	0.00885	0.021247	0.004817	0.045655	-0.17143	-0.19048	-0.83333				0.140139	-0.09622	
2008-Q4	0.00552237	0.026194	0	0.00123	-0.00798	-0.05702	-0.2863	-0.0163	0.028169	-0.18966	-0.05882	3				0.03279	0.060103	
2009-Q1	-0.0625488	-0.02434	-0.125	0.028256	0.079088	0.069767	0.537568	-0.01072	0.021918	-0.14894	0.041667	-1.25				-0.2538	-0.10799	
2009-Q2	0.02324473	-0.00084	-0.28571	0.011947	0.001242	0.008696	0.003624	-0.02069	0.052279	0.2	0.06	3				0.383185	0.030872	
2009-Q3	0.0186036	0.00103	-0.06667	0.01889	0.042184	0.056034	-0.04834	-0.00201	0.030573	0.166667	0.09434	-0.75				0.125806	-0.12331	
2009-Q4	0.01879962	0.01936	0	0.002317	0.00119	-0.01633	-0.28176	-0.00302	0.011125	0.071429	0.224138	5				0.125327	0.119223	6.128262
2010-Q1	-0.0359708	-0.00506	0	0.017341	0.079667	0.041494	0.412906	-0.00506	0.023227	0	0.084507	1.5	1.187874	0.769437		-0.25167	-0.05566	-0.66321
2010-Q2	0.03239847	0.006925	-0.07143	0.004545	-0.01322	0	-0.11343	-0.01118	0.026284	0	0.181818	-0.06667	0.863456	0.183712		0.323295	0.370089	0.682204
2010-Q3	0.01817457	0.003425	0	0.006787	-0.00558	0.011952	0.098607	0.013361	-0.01164	0	-0.08791	0.071429	0.600834	0.59008		0.117898	0.309898	-1.15138
2010-Q4	0.02033851	0.019731	-0.15385	0.005618	-0.00112	-0.05906	-0.37594	0.004057	0.014134	0	-0.04819	-0.06667	-0.15237	0.457637		0.044917	-0.00812	-4.0668
2011-Q1	-0.0330084	0.010157	0	0.022346	0.049438	0.037657	0.37661	0.007071	0.002323	0.020243	0.139241	-0.35714	0.512198	0.109347		-0.28544	-0.34781	0.354156
2011-Q2	0.03019316	0.008005	0	0.012022	0	0.032258	-0.13249	0.007021	0.019699	0	0	0.222222	0.052219	0.700933	0.620929	0.168162	-0.04258	0.294041
2011-Q3	0.01412334	0.012046	0	0.014039	0.003212	-0.02344	0.042725	0.022908	0.003409	0	0.011111	-0.63636	0.159654	0.075108	-1.022	0.159012	-0.0382	-0.61874
2011-Q4	0.02403349	0.023965	0	0.009585	0.002134	-0.048	-0.39285	0.013632	0.011325	0.067797	0.021978	0.25	-0.16526	-0.10767	-63.5393	-0.043	-0.14464	0.117737
2012-Q1	-0.0417441	0.010213	0	0.021097	0.058573	0.05042	0.576891	0.002882	0.013438	0	0	0	0.148167	0.170842	-0.52555	-0.14933	-0.18503	2.062553
2012-Q2	0.03385722	-0.00425	0	0.008264	0.003018	-0.008	-0.16838	-0.00575	0.018785	0	0	-1.6	0.069489	0.022864	-0.89386	0.103415	0.180272	-0.87424
2012-Q3	0.00775881	-0.0027	-0.09091	0.014344	-0.001	0.016129	-0.10365	0.006744	0.003254	0	0	-0.66667	-0.08028	-0.02223	16.26215	0.133208	1.303314	-11.2967
2012-Q4	0.02295978	0.020425	0	0.010101	0.004016	-0.02778	-0.31392	0.016268	0.00973	0	0.24	2	-0.0352	0.163709	1.473498	-0.1783	0.38411	-1.61844
2013-Q1	-0.0464836	0.003146	0	0.026	0.082	0.020408	0.272406	-0.00659	0.020343	0	0.021505	1.333333	-0.10877	-0.0591	-0.66731	-0.26437	-0.10938	-0.596
2013-Q2	0.04065541	0.014663	0	0.003899	0.001848	0.012	0.169651	-0.00284	0.016789	-0.1437	-0.12632	-1.14286	0.366188	-0.06308	-0.30788	0.14147	-0.05658	5.92819
2013-Q3	0.00145442	-0.00503	0	0.018447	0	-0.03162	-0.00889	0.000951	0.007224	0	0	-9	0.020603	-0.03095	-0.13284	0.021643	0.058634	0.077053
2013-Q4	0.02534008	-0.00192	0	0.00572	-0.00092	-0.01633	-0.39258	0.017094	0.017418	0.039711	0.19403	-0.125	-0.19841	0.118325	1.993128	-0.07804	0.066311	-0.43659
2014-Q1	-0.049038	0.012331	0.1	0.029384	0.067405	0.045643	0.454516	0.130719	-0.03323	0	-0.0125	-0.14286	0.265342	0.071943	-0.51513	-0.22958	-0.14201	-0.70681
2014-Q2	0.03399878	0.001928	0.045455	0.01105	0.004325	0.011905	0.101976	0.004955	0.036458							0.166709	0.082199	

TABLE 7: SUMMARY STATISTICS OF MACROECONOMIC INDICATORS (CHANGE FORM)

	Mean	Median	Minimum	Maximum	Std. Dev.	Skewness	Ex. Kurtosis	Missing obs.	Normality p value (Doornik-Hansen)
GDP - Total at 2005 prices	0.006205	0.018604	-0.06255	0.040655	0.031206	-0.97683	-0.46031	0	0.00037
GDP-Finance, Real Estate, Bus Services at 2005 prices	0.007115	0.008005	-0.02434	0.026194	0.011387	-0.55961	0.51963	0	0.25041
Repo rate	-0.02237	0	-0.28571	0.1	0.076988	-1.7926	3.8446	0	0.00136
CPI00000 (All - 2012=100)	0.014226	0.012022	0.00123	0.029384	0.008718	0.28641	-1.1521	0	0.20837
CPI12500 (Insurance - 2012=100)	0.018141	0.002135	-0.01322	0.082	0.031391	1.1214	-0.42503	0	0.00000
Unemployment	0.004392	0.00885	-0.05906	0.069767	0.035484	-0.07445	-0.83389	0	0.86173
Civil cases & summonses issued for debt (S1100000)	0.026519	0.003624	-0.39285	0.57689	0.29407	0.29346	-0.91624	0	0.46997
Num Consumers with good credit standing	0.006088	0.002882	-0.02069	0.13072	0.028241	3.5595	13.555	0	0.00000
Num Consumers with impaired records	0.016761	0.017418	-0.03323	0.052279	0.017404	-0.5871	1.5203	0	0.03001
EY Financial Index (unweighted)	-0.00075	0.006105	-0.18966	0.29762	0.13593	0.25529	-0.83662	1	0.65227
EY Life Insurance index	0.00101	0.005556	-0.37	0.24	0.14483	-0.42254	0.20319	1	0.40101
FNB-BER consumer confidence index	-0.07336	-0.09583	-9	5	2.4845	-1.4987	5.612	1	0.00015

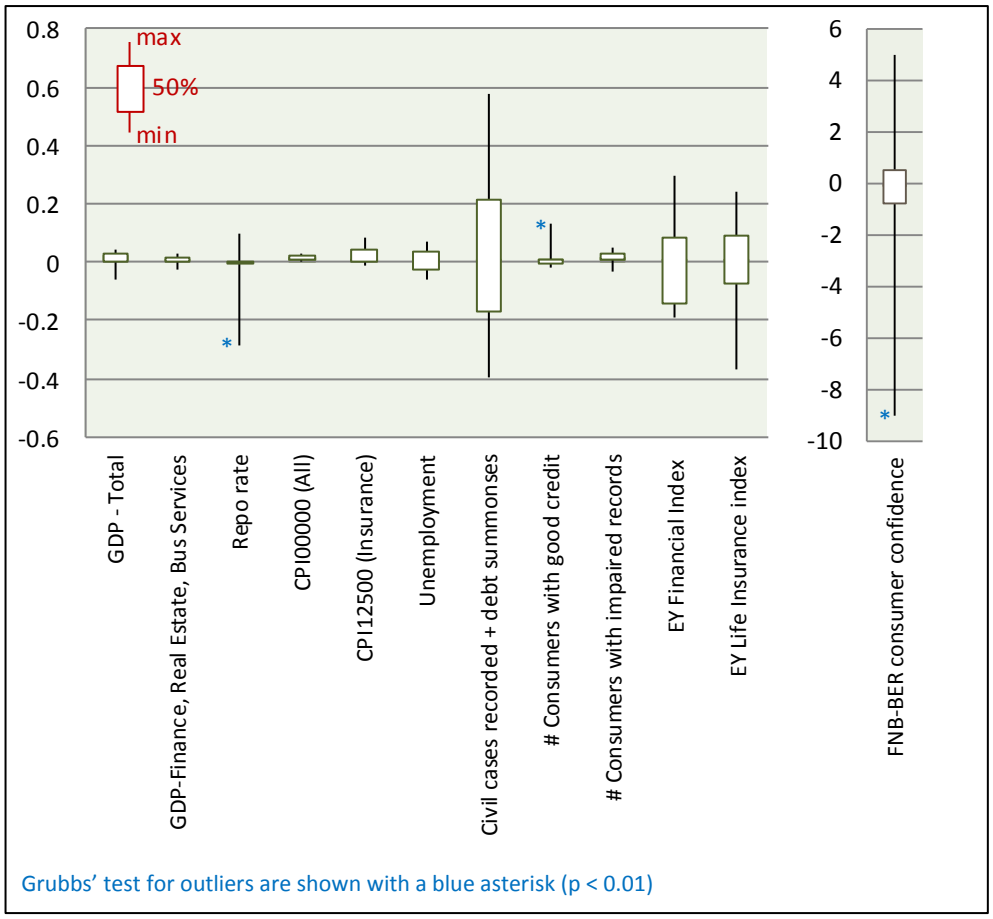


FIGURE 13: BOX PLOTS OF CORE DATA

Table 8 represents a correlation matrix for the independent variables used in this study. All correlations greater than |0.5| were noted. Based on the findings the overall number of independent variables used in the study was reduced from twelve to six. Where possible, normally distributed variables were selected. For example total CPI and CPI for insurance are correlated (0.7), but only total CPI is normally distributed and thus this variable selected for the study. In summary the following independent variables were selected and used for all subsequent regression analyses:

- CPI00000 (Overall - 2012=100)
- EY Life Insurance index
- GDP-Finance, Real Estate, Bus Services (2005)
- Number of consumers with good credit standing
- Repo rate
- Unemployment

Only the repo rate and number of consumers with good credit standing were not normally distributed.

Based on this revised universe of independent variables, the next step in building a predictive regression model was to determine which of the independent variables had the most explanatory power for each of the six dependent variables. For each of the six dependent variables a regression (ordinary least squares) with each independent variable was conducted and the R^2 value captured. All regressions included a constant term as well as separate lags from zero to four. Thus a total of 180 individual regressions were performed and are summarised in Table 9. Significant R^2 values are highlighted in the table and the highest R^2 value per variable is highlighted with a red box.

TABLE 8: CORRELATION MATRIX OF MACROECONOMIC INDICATORS

	GDP - Total at 2005 prices	GDP-Finance, Real Estate, Bus Services at 2005 prices	Repo rate	CPI00000 (Overall - 2012=100)	CPI12500 (Insurance - 2012=100)	Unemployment	Civil cases & summonses issued for debt (S1100000)	Num Consumers with good credit standing	Num Consumers with impaired records	EY Financial Index - unweighted	EY Life Insurance index	FNB-BER consumer confidence index
GDP - Total at 2005 prices	1	0.3425	-0.0648	-0.6551	-0.8954	-0.5735	-0.7198	-0.2963	0.3271	-0.1195	-0.1623	0.0061
GDP-Finance, Real Estate, Bus Services at 2005 prices		1	0.3085	-0.344	-0.3945	-0.5818	-0.4131	0.1615	-0.1141	-0.1089	-0.008	0.3784
Repo rate			1	0.1881	0.0933	-0.0084	0.158	0.4432	-0.404	-0.2904	-0.2067	-0.1671
CPI00000 (Overall - 2012=100)				1	0.6981	0.5676	0.7314	0.2835	-0.0816	-0.0411	-0.2922	-0.3237
CPI12500 (Insurance - 2012=100)					1	0.7107	0.7623	0.2362	-0.18	0.2052	0.1868	0.0479
Unemployment						1	0.7568	0.172	-0.0602	0.3288	0.1648	-0.0065
Civil cases & summonses issued for debt (S1100000)							1	0.1831	-0.1545	0.0328	-0.1854	-0.1677
Num Consumers with good credit standing								1	-0.7412	-0.0371	0.0715	-0.0583
Num Consumers with impaired records									1	-0.0152	-0.0774	0.1614
EY Financial Index (unweighted)										1	0.3923	0.2592
EY Life Insurance index											1	0.5315
FNB-BER consumer confidence index												1

Key:

Normal distribution

Selected independent variables

correlation > |0.6|

correlation > |0.5|

TABLE 9: R^2 VALUES FOR SINGLE VARIABLE REGRESSION ANALYSES

	Low income														
	Sales					Cancellations					Profit				
	C + L0	C + L1	C + L2	C + L3	C + L4	C + L0	C + L1	C + L2	C + L3	C + L4	C + L0	C + L1	C + L2	C + L3	C + L4
GDP-Finance, Real Estate, Bus Services (2005)	5.95E-02	2.31E-02	6.45E-03	2.22E-02	**7.27E-01**	1.59E-02	1.34E-02	1.30E-02	5.89E-02	1.15E-01	3.35E-01	6.81E-02	1.73E-03	1.03E-02	8.89E-02
Repo rate	1.50E-02	3.76E-02	1.96E-03	**5.32E-01**	2.57E-01	2.20E-02	6.20E-03	3.37E-01	1.27E-01	4.19E-02	2.96E-02	7.74E-03	8.97E-03	5.46E-03	**6.10E-01**
CPI00000 (Overall - 2012=100)	4.00E-04	5.72E-02	3.45E-03	8.04E-02	2.70E-01	2.41E-02	4.43E-02	2.19E-02	4.19E-02	1.48E-02	2.56E-02	3.50E-03	1.68E-02	1.65E-01	9.48E-02
Unemployment	2.42E-01	9.67E-04	2.66E-02	6.40E-03	3.77E-01	5.97E-02	1.60E-02	6.18E-04	2.87E-02	1.28E-01	2.33E-01	4.19E-02	3.13E-02	1.59E-01	1.85E-01
Num Consumers with good credit standing	6.90E-03	2.52E-01	3.95E-04	2.64E-01	4.44E-01	1.08E-02	5.66E-02	1.40E-01	1.59E-01	2.19E-01	9.00E-06	3.89E-01	1.02E-02	8.15E-04	3.78E-02
EY Life Insurance index	2.90E-02	2.77E-01	1.52E-01	5.03E-02	8.92E-03	1.68E-02	1.64E-01	2.53E-02	1.37E-02	3.12E-01	5.00E-03	1.19E-02	1.92E-03	1.37E-01	4.44E-02

	High income														
	Sales					Cancellations					Profit				
	C + L0	C + L1	C + L2	C + L3	C + L4	C + L0	C + L1	C + L2	C + L3	C + L4	C + L0	C + L1	C + L2	C + L3	C + L4
GDP-Finance, Real Estate, Bus Services (2005)	1.96E-02	3.47E-01	1.14E-01	1.99E-03	3.60E-02	1.77E-02	1.71E-01	9.43E-03	4.92E-02	2.93E-02	1.10E-01	4.57E-02	7.33E-03	3.33E-01	6.30E-03
Repo rate	7.46E-02	1.85E-04	1.59E-02	1.03E-02	1.41E-02	3.76E-02	1.31E-02	8.81E-03	1.23E-02	8.63E-03	2.11E-01	1.81E-02	1.22E-01	8.03E-02	5.61E-03
CPI00000 (Overall - 2012=100)	1.39E-01	3.92E-01	6.47E-02	1.18E-02	9.11E-02	1.00E-01	9.00E-06	1.29E-03	3.35E-03	2.03E-02	3.63E-02	1.97E-01	5.06E-02	7.22E-02	2.07E-02
Unemployment	1.05E-01	**6.13E-01**	5.73E-02	5.21E-03	1.07E-01	2.76E-02	6.72E-02	2.96E-02	1.73E-02	6.85E-02	5.33E-03	3.71E-02	1.37E-01	2.24E-01	2.33E-04
Num Consumers with good credit standing	1.23E-01	7.00E-06	7.46E-02	1.67E-01	7.01E-02	7.66E-03	4.66E-03	2.95E-02	1.22E-01	1.29E-01	9.97E-03	2.04E-04	4.47E-03	3.96E-02	3.16E-01
EY Life Insurance index	1.26E-01	1.80E-02	2.22E-01	5.49E-04	1.85E-01	1.63E-04	2.24E-02	1.08E-02	2.12E-02	7.03E-04	4.30E-02	9.01E-02	3.94E-02	5.92E-03	7.10E-02

R squared > 0.7
0.5 < R squared < 0.7
Highest R squared

Note: R^2 values refer to separate correlations between each independent variable (rows), lagged zero to three times, and the dependent variables of sales, cancellations and profit in both low and high income consumers.

4.2. Estimation of models

Based on the R^2 values computed in Table 9 for the individual regressions, the top three explanatory variables for each of the dependent variables were selected for further analysis. These are summarised in Table 10. A step wise approach was then followed to determine which combination of these three variables had the greatest explanatory power for each of the dependent variables. Table 11 lists the adjusted R^2 values of various combinations of the best three independent variables. The combination with the highest adjusted R^2 value is highlighted with a red box. Of the six dependent variables, only three show significant R^2 values (low income sales and profit, and high income sales)

TABLE 10: SUMMARY OF TOP THREE (HIGHEST R^2) REGRESSORS

		Best variable	Lag	Second best variable	Lag	Third best variable	Lag
Low income	Sales	GDP-Finance, Real Estate, Bus Services at 2005 prices	4	Repo rate	3	Num Consumers with good credit standing	4
	Cancellations	Repo rate	2	EY Life Insurance index	4	Num Consumers with good credit standing	4
	Profit	Repo rate	4	Num Consumers with good credit standing	1	GDP-Finance, Real Estate, Bus Services at 2005 prices	0
High income	Sales	Unemployment	1	CPI00000 (Overall - 2012=100)	1	GDP-Finance, Real Estate, Bus Services at 2005 prices	1
	Cancellations	GDP-Finance, Real Estate, Bus Services at 2005 prices	1	Num Consumers with good credit standing	4	CPI00000 (Overall - 2012=100)	0
	Profit	GDP-Finance, Real Estate, Bus Services at 2005 prices	3	Num Consumers with good credit standing	4	Unemployment	3

TABLE 11: DETERMINATION OF OPTIMAL REGRESSION MODELS

		Adjusted R^2			
		Best individual variable	Top two variables	Best and third best variables	Top three variables
Low income	Sales	**7.09E-01**	**7.08E-01**	**7.51E-01**	**7.71E-01**
	Cancellations	2.93E-01	3.95E-01	3.27E-01	4.47E-01
	Profit	**5.71E-01**	**7.16E-01**	**7.11E-01**	**7.49E-01**
High income	Sales	**5.96E-01**	**6.28E-01**	**6.06E-01**	**6.38E-01**
	Cancellations	1.33E-01	2.52E-01	1.22E-01	**2.62E-01**
	Profit	2.91E-01	**3.24E-01**	2.54E-01	2.78E-01

Adjusted R^2 > 0.7
0.5 < R^2 < 0.7
Highest adjusted R^2

For all of the regression barring high income profit a combination of the top three variables generated the highest adjusted R^2 value. More detailed analyses for each of these predictive models were then conducted. Table 12 lists the values of all coefficients and also provides the standard error and p values for each of the coefficients (Variables 1, 2 and 3 are different for each dependent variable and are described in Table 10). Significant p values ($p < 0.05$) are highlighted in red and indicate a statistical significance for the coefficients being non-zero. Small sample size might account for some of the p values not being significant despite the demonstrated improvement in the overall adjusted R^2 value by including the additional independent variables as shown above in Table 11.

TABLE 12: SUMMARY STATISTICS FOR OPTIMAL REGRESSION MODELS

			Constant	Variable 1	Variable 2	Variable 3
Low income	Sales	Coefficient	0.261	-15.154	-1.392	-11.074
		Std error	8.28E-02	6.89E+00	9.28E-01	5.02E+00
		p value	7.70E-03	4.65E-02	1.58E-01	4.59E-02
	Cancellations	Coefficient	0.107	-1.898	1.050	-7.403
		Std error	5.99E-02	1.30E+00	5.21E-01	4.84E+00
		p value	9.76E-02	1.69E-01	6.53E-02	1.50E-01
	Profit	Coefficient	10.129	236.225	-579.413	-529.315
		Std error	3.82E+00	6.08E+01	3.77E+02	3.58E+02
		p value	2.90E-02	4.60E-03	1.63E-01	1.78E-01
High income	Sales	Coefficient	-0.048	2.747	5.539	-3.204
		Std error	5.56E-02	9.26E-01	3.29E+00	2.54E+00
		p value	3.95E-01	7.60E-03	1.08E-01	2.21E-01
	Cancellations	Coefficient	0.277	-10.681	12.837	-10.382
		Std error	1.29E-01	6.14E+00	5.66E+00	9.28E+00
		p value	4.70E-02	1.00E-01	3.67E-02	2.79E-01
	Profit	Coefficient	0.462	-115.550	-103.615	N/A
		Std error	8.49E-01	7.79E+01	7.77E+01	N/A
		p value	5.94E-01	1.59E-01	2.03E-01	N/A

p value < 0.05

Note: Refer to Table 10 for the independent variable names for each dependent variable and see Figure 15 for a full description of the regression models

In order to test the overall robustness of the predictive models described above, an OLS regression for each of the three dependent variables in high and low income groups was conducted using all twelve of the original macroeconomic variables. The results of this analysis are presented in Table 13. For each of the dependent variables, the top three (lowest p values) independent variables are highlighted with a red box and the implied best three variables from this study (Table 10) are highlighted using green text. Table 14 provides a summary of these findings and suggests that the regressions predicted by this study are indeed similar to those of a single regression, which includes all twelve macroeconomic variables. Table 8 was used to infer the correlation between variables.

TABLE 13: ROBUSTNESS TEST: OLS REGRESSION USING ALL INDEPENDENT VARIABLES

			Constant	GDP - Total at 2005 prices	GDP-Finance, Real Estate, Bus Services at 2005 prices	Repo rate	CPI00000 (Overall - 2012=100)	CPI12500 (Insurance - 2012=100)	Unemployment	Civil cases & summonses issued for debt (S1100000)	Num Consumers with good credit standing	Num Consumers with impaired records	EY Financial Index - unweighted	EY Life Insurance index	FNB-BER consumer confidence index
Low income	**Sales**	Coefficient	0.256	21.350	-13.285	-3.214	-23.509	16.829	-1.642	1.647	-1.268	-16.760	0.030	2.270	-0.060
		Std error	1.43E+00	4.55E+01	2.34E+01	5.66E+00	7.23E+01	2.79E+01	1.36E+01	1.99E+00	9.65E+00	2.71E+01	1.90E+00	2.17E+00	1.22E-01
		p value	8.66E-01	6.63E-01	**6.01E-01**	**6.01E-01**	7.61E-01	5.79E-01	9.10E-01	4.55E-01	**9.02E-01**	5.70E-01	9.88E-01	3.54E-01	6.49E-01
	Cancellations	Coefficient	-0.505	32.992	-16.943	-4.725	18.544	19.261	-5.652	1.263	3.819	-11.315	1.998	1.400	-0.021
		Std error	1.37E+00	4.36E+01	2.24E+01	5.42E+00	6.92E+01	2.67E+01	1.30E+01	1.91E+00	9.25E+00	2.60E+01	1.82E+00	2.07E+00	1.17E-01
		p value	7.30E-01	4.91E-01	4.92E-01	**4.33E-01**	8.02E-01	5.11E-01	6.86E-01	5.44E-01	**7.01E-01**	6.85E-01	3.35E-01	**5.37E-01**	8.66E-01
	Profit	Coefficient	-	-	-	-	-	-	-	-	-	-	-	-	-
		Std error	-	-	-	-	-	-	-	-	-	-	-	-	-
		p value	-	-	-	-	-	-	-	-	-	-	-	-	-
High income	**Sales**	Coefficient	-0.016	4.101	-1.064	-0.602	4.063	-4.086	0.634	0.254	0.580	1.487	-0.050	-0.231	0.016
		Std error	7.49E-02	1.88E+00	3.44E+00	4.06E-01	5.24E+00	2.02E+00	1.48E+00	1.91E-01	1.46E+00	2.60E+00	2.04E-01	2.44E-01	1.37E-02
		p value	8.32E-01	5.19E-02	**7.63E-01**	1.66E-01	**4.54E-01**	6.83E-02	**6.77E-01**	2.10E-01	7.00E-01	5.78E-01	8.12E-01	3.65E-01	2.66E-01
	Cancellations	Coefficient	0.396	-3.249	-13.145	-0.255	12.731	-9.399	2.707	-0.588	-4.272	-12.744	0.074	-0.531	0.060
		Std error	2.27E-01	5.70E+00	1.04E+01	1.23E+00	1.59E+01	6.13E+00	4.49E+00	5.78E-01	4.44E+00	7.86E+00	6.18E-01	7.41E-01	4.16E-02
		p value	1.09E-01	5.80E-01	**2.33E-01**	8.40E-01	**4.39E-01**	1.53E-01	5.58E-01	3.31E-01	**3.56E-01**	1.33E-01	9.06E-01	4.88E-01	1.78E-01
	Profit	Coefficient	10.811	-317.382	319.837	79.461	-844.420	-108.751	76.873	-5.582	-16.440	204.939	-14.410	-9.037	-0.558
		Std error	2.74E+00	9.36E+01	7.02E+01	1.21E+01	1.75E+02	7.02E+01	4.07E+01	5.50E+00	3.14E+01	8.60E+01	4.99E+00	5.72E+00	3.78E-01
		p value	1.08E-02	1.94E-02	**6.08E-03**	1.22E-03	4.81E-03	1.82E-01	**1.17E-01**	3.56E-01	**6.23E-01**	6.29E-02	3.43E-02	1.75E-01	2.00E-01

p value < 0.05

Lowest three p values

OLS optimal variables

LI Profit: Insufficient data to model

TABLE 14: SUMMARY OF ROBUSTNESS TEST FOR REGRESSION MODELS

		Variables predicted in study	Variables suggested by single regression	Discussion
Low income	**Sales**	GDP-Finance, Real Estate, Bus Services at 2005 prices Repo rate Num Consumers with good credit standing	Civil cases & summonses issued for debt (S1100000) EY Life Insurance index Num Consumers with impaired records	Two of the three independent variables suggested by the study overlap with variables estimated by the single regression. Only the Repo rate and EY Life insurance index are uncorrelated
	Cancellations	Repo rate EY Life Insurance index Num Consumers with good credit standing	Repo rate EY Financial Index – unweighted GDP - Total at 2005 prices	The Repo rate is suggested in both regression analyses as are the slightly correlated EY indices. The two models differ in the selection of the third best variable
	Profit	Repo rate Num Consumers with good credit standing GDP-Finance, Real Estate, Bus Services at 2005 prices	-	Data set too small to conduct analysis
High income	**Sales**	Unemployment CPI00000 (Overall - 2012=100) GDP-Finance, Real Estate, Bus Services at 2005 prices	Repo rate CPI12500 (Insurance - 2012=100) GDP - Total at 2005 prices	Inflation (CPI) and GDP are suggested as explanatory variables in both regression analyses with unemployment being excluded from the single regression test case
	Cancellations	GDP-Finance, Real Estate, Bus Services at 2005 prices Num Consumers with good credit standing CPI00000 (Overall - 2012=100)	Constant Num Consumers with impaired records CPI12500 (Insurance - 2012=100)	Credit worthiness and inflation (CPI) are suggested in both regressions as explanatory variables. In the single regression no other variables showed higher p values than the constant, but GDP was significant in the study
	Profit	GDP-Finance, Real Estate, Bus Services at 2005 prices Num Consumers with good credit standing Unemployment	GDP-Finance, Real Estate, Bus Services at 2005 prices Repo CPI00000 (Overall - 2012=100)	All three variable suggested in this study were identified directly or through correlated variables in the single regression

Highly correlated or matching variables are highlighted in green
Weakly correlated variables are highlighted in orange

This above robustness test provides strong support for the predictive models put forward in this study. Finally, for each of the six proposed regression models (Table 12), a series of statistical analyses were performed in order to test the assumptions of residual errors being i) normally distributed, ii) homoscedastic and iii) not autocorrelated. These findings are summarised in Table 15. Only the regressions for high income cancellations violated any assumptions (both normality and homoscedasticity). Since this adjusted R^2 value for this particular dependent variable was low (0.262), this violation was not deemed important as the model itself is not highly predictive. Figure 14 shows graphical plots, where the actual values of the dependent variables are compared to the predictive regression models.

TABLE 15: DIAGNOSTIC TESTS FOR REGRESSION MODELS

		Residuals normality test (p value)	Heteroscedasticity (White test p Value)	Autocorrelation (Bresch-Godfrey p value)
Low income	Sales	**5.16E-01**	**5.21E-01**	**5.08E-01**
	Cancellations	**2.06E-01**	**1.93E-01**	**8.06E-01**
	Profit	**9.23E-01**	**2.27E-01**	**1.30E-01**
High income	Sales	**5.23E-01**	**5.46E-01**	**3.48E-01**
	Cancellations	1.67E-02	4.28E-02	**5.11E-01**
	Profit	**2.49E-01**	**2.74E-01**	**3.11E-01**

p value > 0.05

FIGURE 14: GRAPHICAL VIEW OF ACTUAL DATA (RED) VS FITTED REGRESSION (BLUE)

Figure 15 summarises the proposed regression models for each of the dependent variables. Based on the adjusted R^2 values (Table 11) only the models highlighted in red appear to have significant explanatory power. The regressions for low income sales and profits had the highest adjusted R^2 values (0.77 and 0.75 respectively), while high income sales had an adjusted R^2 value of 0.64. These three regression models thus serve as potentially strong predictors of sales and profitability in the insurance industry. The models suggest that movements in GDP, consumer credit standing and the repo rate will inform future sales and profitability for low income consumer groups; while future sales in high income consumer groups are better explained by changes in unemployment, CPI and GDP.

General equation:

$$Insurance\ demand = \beta_0 + \beta_1 V_1 + \beta_2 V_2 + \beta_3 V_3$$

Where β_i are coefficients and V_i are independent variables

Key to variable names:

CPI00000 (All - 2012=100)	C
EY Life insurance index	E
GDP-Finance, Real Estate, Business Services at 2005 prices	G
Number of consumers with good credit standing	N
Repo rate	R
Unemployment	U

Low income:

$$Sales = 0.261 - 15.154\, G_{(L4)} - 1.392 R_{(L3)} - 11.074\, N_{(L4)}$$

$$Cancellations = 0.107 - 1.898 R_{(L2)} + 1.050\, E_{(L4)} - 7.403\, N_{(L4)}$$

$$Profit = 10.129 + 236.225 R_{(L4)} - 579.413\, N_{(L1)} - 529.315\, G_{(L0)}$$

High income:

$$Sales = -0.048 + 2.747 U_{(L1)} + 5.539\, C_{(L1)} - 3.204\, G_{(L1)}$$

$$Cancellations = 0.277 - 10.681\, G_{(L1)} + 12.837\, N_{(L4)} - 10.382\, C_{(L0)}$$

$$Profit = 0.462 - 115.550\, G_{(L3)} - 103.615\, N_{(L4)}$$

Note:
Equations in red have adjusted R^2 values > 0.64
Subscripts explain the variable lags

FIGURE 15: PROPOSED REGRESSION MODELS

4.3. Interpretation of results and discussion

The objective of this research was to determine whether insurance demand can be explained by any macroeconomic factors. Two sample cohorts were selected for this study; a low income group and a high income group. The underlying hypothesis being that a low income consumer may be more sensitive and responsive to shifts in the macroeconomic environment than a high income consumer. This builds on early studies which modelled insurance demand (risk aversion) as a function of wealth and net worth (Mossin, 1968; Pratt, 1964). Since net worth and risk aversion have an inverse relationship, it is reasonable to propose that high income consumers' demand for insurance is not tightly coupled to the macro economy and rather based on individual demographic factors such as age, education, family size, marital status, race, gender and religion (Liebenberg et al., 2012; Zietz, 2003). In order to explore this, insurance demand and profitability were investigated in this study using three different variables: sales, cancellations and underwriting profit.

Sales

Models with significant adjusted R^2 values were identified for sales in both the low and high income data sets. Interestingly, only GDP (Finance, Real Estate, and Business Services) was a common independent variable for both models, but was most informative with four lags in the low income group and only one lag in the high income group. The coefficient in both models was negative, which suggests that as the macro economy contracts insurance demand increases. This supports a view that consumer risk aversion is dynamic and seems to have an inverse relationship to economic performance.

Sales to low income consumers also had an inverse relationship to the repo rate (three lags) and their credit standing (four lags). As the repo rate increases prime interest rates tend to increase and thus the cost of borrowing increases, which is likely to impact low income consumers and reduce consumption. The negative coefficient for credit standing might imply that individuals with a sustainable ability to support current consumption levels may change their risk aversion and start to self-insure. All of the independent variables used to explain sales to low income consumers had 3 or 4 lags, which suggests a slow response time to macroeconomic factors.

Conversely all explanatory variables used for high income sales only had one lag. In addition to GDP, sales to high income consumers showed proportional relationships to inflation (total CPI) and unemployment. The positive coefficients for CPI and unemployment are of interest. In the case of demand push inflation an inverse relationship is expected; however if cost push inflation occurs, then inflation and unemployment can move together causing stagflation.

Generally, inflationary increases and higher unemployment lead to reduced consumption. In this case high income consumers may actually be adjusting their consumption based on sentiment and not financial constraint. The policies sold in this study are individual Life policies and the short lags (quick response time) suggests that buying behaviours are proactive rather than reactive as is

the case for the low income consumers where macroeconomic changes take up to a year to start affecting buying behaviours.

Cancellations

Neither low nor high income groups demonstrated any significant correlation between the selected macroeconomic factors and policy cancellations. Policy sales were influenced by inflation, interest rates, unemployment and credit standing; which ultimately relate to an individual's net worth. Although some of these variables produced the "best" model for cancellations, the overall adjusted R^2 values were relatively low to deem significant (0.45 and 0.26 respectively for low and high income consumers). Thus the decision to cancel an insurance policy is likely to be informed by other social or demographic factors over and above macroeconomic factors (Schwarcz, 2010).

Underwriting profit

Profitability was well described for the low income consumer group with an adjusted R^2 value of 0.75. Interestingly the explanatory variables were the same as those that influenced sales, the only difference being a positive coefficient for the repo rate in the regression for profit. This is easily explained by the investment income returns that Life insurers earn by investing premiums. In high interest environments the returns will improve and thus the overall profitability of the business should also improve (Frey & Steinmann, 2012; Karl et al., 2010).

Interestingly there is a lag of a year before a change to interest rates influences underwriting profitability; however the other explanatory variables of consumer credit standing and GDP (Finance, Real Estate, and Business Services) have more immediate impacts (one and zero lags, respectively). Although GDP and consumer credit standing were common variables that also produced the "best" model for high income consumer underwriting profits, the adjusted R^2 was quite low (0.32).

5. Conclusion

Understanding the drivers of insurance demand is complicated by the variety of products sold, consumer segments, distribution channels and business environments. This study aimed to remove some of this complexity by focusing on one type of product (Life insurance policies sold to individuals), separating low from high income consumers and exploring insurance demand in a single business environment. Three potential measures of insurance demand were investigated: new business sales, policy cancellations and underwriting profit. For each of these dependent variables an initial universe of twelve macroeconomic variables was identified and each candidate explanatory variable was evaluated using an ordinary least squares regression analysis. Using a step wise approach optimal regressions for each of the three dependent variables (sales, cancellations and profitability split into high and low income groups) were defined. Three of the six regressions generated adjusted R^2 values which implied the models were informative.

Sales for both low and high income consumers were defined with GDP (Finance, Real Estate, and Business Services) being a common independent variable. Other explanatory variables included repo rate and consumer credit standing (low income) and unemployment and total CPI (high income). As described in Chapter 4, the variable lags for low income consumers suggested buying behaviours shifted slowly (up to 1 year) in response to macroeconomic changes, while high income consumer responses were more rapid (3 months). This might suggest that the drivers of a shift in buying behaviour may differ between low and high income consumers. The rapid response of high income consumers might imply consumption is based on sentiment and personal preferences rather than financial constraint. However, the insignificance of the EY Life insurance index in these models is surprising and could discount this view.

Since both low income and high income consumer groups buying behaviours could be successfully modelled, the hypothesis that high income consumers are insensitive to macroeconomic changes cannot be supported. However, based on the above findings the underlying basis for the shift in consumption has not been adequately explained. It is still an open question whether reduced disposable income in low income consumers and sentiment / demographic factors in high income consumers are the true drivers of the shifts in consumption in these two groups. A more detailed study with a larger sample and additional demographic data may resolve this question.

Underwriting profits in the low income consumer group could also be explained well by the proposed regression model, which included GDP (Finance, Real Estate, and Business Services), repo rate and consumer credit standing. The overlap of independent variables between sales and profits for the low income consumer models is not surprising and it rather suggests a natural relationship between the two. The only difference is the positive correlation between repo rate and profits, while for sales it has an inverse relationship. It is likely that the correlation between investment returns and interest rates accounts for the positive correlation with profits (Frey & Steinmann, 2012; Karl et al., 2010).

Unfortunately the sample sizes used in this study were too small to permit inclusion of forecast tests. In order to progress and advance this study, it is essential to test the current models using hold

out samples and ideally with data sets from multiple insurers. This would help to substantiate the current findings and allow for the creation of more robust models. Additional demographic factors such as age, education, family size, marital status, race, gender and religion (Liebenberg et al., 2012; Zietz, 2003), should also be included in order to separate whether insurance demand differs between low and high income consumers based on demographic characteristics as well as macroeconomic factors. A further extension would be to explore insurance demand across multiple products. This would help businesses in making strategic decisions on which products to sell, and which consumer segments to target based on prevailing macroeconomic conditions.

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