THE RELATIONSHIP BETWEEN HOUSEHOLD DEBT AND INTEREST RATES: A SOUTH AFRICAN PERSPECTIVE

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I declare that the above dissertation is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

SIGNATURE DATE

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ABSTRACT

One of the challenges that South Africa has been facing lately is the high level of household debt. Since the dramatic drop from 12 to 5.5 percent in 2008, interest rates have been on a constant hiking cycle (SARB, 2015). The current repurchase rate stands at 6.75% and the prime rate at 10.25%. The volatile interest rate and its impact on the borrowing behaviour of households is something that needs to be investigated. The review of the theoretical and empirical literature on the demand for credit and interest rates revealed different results from authors. The theoretical literature underpinning the study is the loanable fund's theory, the life cycle hypothesis as well as the credit channel of the monetary transmission mechanism.

The aim of this study was to determine the short-run, co-integrating and causal relationship between household debt and interest rates. A quantitative approach was chosen as the best method to measure the variables of interest and to deduce from the applicable theories. The study employed the autoregressive distributed lag (ARDL) approach to co-integration, ordinary least squares model for a deterministic relationship as well as the Wiener Granger-Causality test for bilateral causality between household debt and interest rates. The study used secondary data from the South African Reserve Bank for the period 1990Q1-2016Q4.

The results from the regression analysis showed a negative but insignificant relationship between household debt and interest rates. The results from the ARDL revealed no short-run but only the long-run relationship between household debt and interest rates. The causality tests showed no causality between household debt and interest rates. The results between household debt and inflation, income, GDP, consumption, savings and wealth were also discussed. The implication of this study is that policymakers and credit regulators should be alert to the effects of policy-induced changes.

Keywords: Household debt, Interest rates, ARDL-bounds, Granger-Causality, South Africa.

Tshobokanyo

Nngwe ya dikgwetlho tse di lebaneng Aforikaborwa ke seelo se se kwa godimo sa dikoloto tsa mo malapeng. Fa e sale go tloga ka kwelotlase e e boitshegang ya seelo sa merokotso go tswa go 12% go ya go 5.5% ka 2008, seelo sa merokotso se ntse se lebile kwa godimo ka tsepamo (Monetary Policy Review, 2015). Seelo sa ga jaana sa go reka gape se eme mo go 6.75% mme seelo sa poraeme ke 10.25%. Seelo se se bogale sa merokotso le ditlamorago tsa sona mo mekgweng ya go adima ya malapa se tlhoka go tlhotlhomisiwa. Tshekatsheko ya dikwalo tsa tiori le tsa maitemogelo tse di ka ga topo ya sekoloto le seelo sa merokotso e senola gore bakwadi ba ba farologaneng ba fitlheletse ditshwetso tse di sa tshwaneng. Dikwalo tsa tiori tse di tshegetsang thutopatlisiso di totile tiori ya matlole a a adimisegang, haepotesese ya sediko sa botshelo le kanale ya sekoloto ya sedirisiwa sa tsamaiso ya madi.

Maikaelelo a thutopatlisiso eno ke go lebelela kamano ya paka e khutshwane, paka e telele le sebako sa sekoloto sa magae le seelo sa merokotso. Go tlhophilwe molebo o o lebelelang dipalo gonne o tlaa nna botoka go letla mmatlisisi go lekanyetsa dipharologantsho tsa merokotso go bona dikarabo go tswa mo ditioring tse di dirisiwang. Thutopatlisiso e dirisitse molebo wa *autoregressive distributed lag* (ARDL) malebana le kopanyo ya paka e telele, sekao sa tlwaelo sa sekwere sennye malebana le kamano, le teko ya sebako ya Wiener–Granger malebana le sebako sa sebedi magareng ga sekoloto sa magae le seelo sa merokotso. Thutopatlisiso e dirisitse *data* ya bobedi go tswa kwa Bankeng ya Rasefe ya Aforikaborwa ya sebaka sa 1990Q1 go fitlha 2016Q4.

Dipholo go tswa mo tokololong ya phokotsego di bontsha kamano e e senang bokao magareng ga sekoloto sa mo magaeng le seelo sa merokotso. Dipholo go tswa mo ARDL di bontsha go se nne gona ga botsalano jwa pakakhutshwane (k.g.r. ke jwa pakatelele fela) magareng ga sekoloto sa mo magaeng le seelo sa merokotso. Diteko tsa sebako di bontsha sebako magareng ga sekoloto sa mo magaeng le seelo sa merokotso. Ditlamorago tsa sekoloto sa mo magaeng le infoleišene, lotseno, tlhagiso yotlhe ya naga ya ditirelo le dithoto, tiriso, dipoloko le lehumo le tsona di a tlhagisiwa.

Mafoko a botlhokwa: Sekoloto sa mo magaeng, seelo sa merokotso, molebo wa ARDL, sebako sa Wiener–Granger, Aforikaborwa

Opsomming

’n Hoë vlak van huishoudelike skuld is een van die uitdagings wat Suid-Afrika in die gesig staar. Ná die drastiese daling in rentekoerse van 12% tot 5,5% in 2008 was rentekoerse in ’n voortdurend opwaartse siklus (Monetary Policy Review, 2015). Tans is die terugkoopkoers 6,75% en die prima uitleenkoers 10,25%. Die onbestendige rentekoers en die uitwerking wat dit op huishoudings se leengedrag het, moet ondersoek word. ’n Oorsig van teoretiese en empiriese literatuur oor die vraag na krediet en rentekoerse toon dat verskillende navorsers tot verskillende gevolgtrekkings kom. Die teoretiese literatuur waarop hierdie studie gebaseer is, fokus op die leenbarefondse-teorie, die lewensiklus-hipotese en die kredietkanaalmeganisme vir geldoordrag.

Die studie se doel was om die korttermyn-, koïntegrerende en kousale verbande tussen huishoudelike skuld en rentekoerse te bepaal. ’n Kwantitatiewe benadering is gevolg omdat dit die navorser in staat sou stel om renteveranderlikes te meet en antwoorde met behulp van toepaslike teorieë af te lei. Die studie het koïntegrasie ondersoek deur te kyk na outoregressief verspreide agterstande (ARDL). Die deterministiese verband is ondersoek aan die hand van die gewone kleinstekwadrate-model, en die Wiener–Granger-kousaliteittoets is uitgevoer om bilaterale kousaliteit tussen huishoudelike skuld en rentekoerse te bepaal. Die studie maak gebruik van sekondêre data van die Reserwebank vir die tydperk 1990V1 tot 2016V4.

Die resultate van die regressie-ontleding toon ’n negatiewe maar onbenullige verband tussen huishoudelike skuld en rentekoerse. Die ARDL-resultate dui op geen korttermynverband tussen huishoudelike skuld en rentekoerse nie (dit dui dus slegs op langtermynverbande). Die kousaliteittoets toon dat daar kousaliteit tussen huishoudelike skuld en rentekoerse is. Die uitwerkings van huishoudelike skuld en inflasie, inkomste, bruto binnelandse produk, verbruik, spaar en welvaart word ook bespreek.

Sleutelwoorde: Huishoudelike skuld, rentekoerse, ARDL-grense, Wiener–Granger-kousaliteit, Suid-Afrika

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LIST OF ABBREVIATIONS AND ACRONYMS

ADF:	Augmented Dickey-Fuller
ARDL:	Autoregressive Distributive Lag
BRICS:	Brazil, Russia, India, China and South Africa
CONS:	Household consumption expenditure
CPI:	Consumer Price Index
EU:	European Union
GDP:	Gross Domestic Product
HHD:	Household debt
HDI:	Household disposable income
HNS:	Household net savings
HNW:	Household net wealth
INT:	Interest rates
LM:	Lagrange Multiplier
MPC:	Monetary Policy Committee
MPR:	Monetary Policy Review
NCA:	National Credit Act
NCR:	National Credit Regulator
OECD:	Organisation for Economic Co-operation and Development
OLS:	Ordinary Least Squares
PP:	Phillips-Perron
SARB:	South African Reserve Bank
UK:	United Kingdom
USA:	United States of America
VAR:	Vector autoregressive
VECM:	Vector Error Correlation Model

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1 Introduction

This study presents results from a quantitative study that was investigated using secondary data. The study examined the causal, co-integrating and linear relationship between household debt and interest rates. This study was driven by the high household debt levels in South Africa during periods of increased interest rates, which prompted the study to test the relevant theories.

The main aim of this chapter is, firstly, to introduce the study and to give a background of the problem. Secondly, it discusses the problem statement, research questions and research objectives. Thirdly, it highlights the significance of the study. Fourthly, it summarises the methodology used in the study, and finally, it presents the outline of chapters to follow in the study.

1.2 Definition of key terms

1.2.1 Household Debt

Household debt is defined as the total sum of credit commitments made by a household with the aim of repaying in the future (Prinsloo, 2002). Similarly, debt is a financial contract determined by the borrower's future income in order to smooth over consumption with borrowed resources (Kim, Lee, Son & Son, 2014). Indebted households are recognized as those that have unsettled debt such as mortgage bonds, personal loans, consumer loans and instalment loans with financial institutions (Giordana & Ziegelmeyer, 2017).

1.2.2 Interest rates

Interest rates are the price that the borrower pays for borrowed funds from a lender (SARB, 2015b). Interest rates represent a cost of debt to the borrower and an income to the lender (Dell'Ariccia, Laeven & Marquez, 2014). When the cost of debt increases, borrowers are discouraged from borrowing (Dell'Ariccia et al., 2014). In South Africa, the repurchase rate and the prime overdraft rate are linked to borrowing and lending.

1.3 Background

Household debt has been one of the most persistent problems in South Africa for the past two decades (Mutezo, 2014:73)**.** When households borrow more in order to resolve their current debt problem and over commit themselves, they become over-indebted.

Over-indebtedness occurs when an individual or household cannot meet its financial obligations and is forced to make sacrifices that compromise their ordinary living conditions (d'Alessio & Iezzi, 2013). According to d'Alessio and Iezzi (2013) the most popular indicators of being over-indebted are; the amount in arrears, extent of the debt and the individual perception of debt. The individual perception is when households announce that their debts have become a heavy burden. The extent of the debt is an indication that households have over committed themselves to four or more credit commitments (d'Allessio & Iezzi). The amount in arrears however, is when households have amounts overdue for more than two months on a credit commitment and the cost of servicing the debt is the total income that households spend on repayments (d'Alessio & Iezzi).

The cost of servicing debt is a burden on household income and is indicated in debt ratios. The debt service ratio measures the total amount of disposable income that is dedicated to the repayment of debt (Kim, 2016). In South Africa, this ratio

has fluctuated over the years due to unstable household debt. According to the South African Reserve Bank (SARB), the debt service ratio rose from 6.3 percent in 2004 to 9.2 percent in 2014. An increase in the debt service ratio is a result of strong growth in credit facilities and an increase in lending rates (SARB, 2016a). However, this ratio has not been a true reflection of the intentions of borrowers.

The household debt to income ratio is identified as an effective debt burden indicator, showing the vulnerability of indebted households (Giordana & Ziegelmeyer, 2017). The household debt-to-income ratio was 58.5 percent in 2004 and rose to 78 percent in 2014.This ratio shows the percentage of income households spend on debt payments. The growth of this ratio is an indication that households acquired debt at a faster pace than an increase in income. This is the reason that lenders should ensure that consumers do not borrow more than their income allows them.

General lending to households is fuelled mainly by unsecured loans, which grew rapidly in the recent years (SARB, 2016a). Unsecured debt refers to debt where the borrower does not provide any security to protect the value of the loan (SARB, 2016a). In contrast, secured debt refers to debt where the lender is entitled to take over the collateral provided by the borrower if the borrower does not make payments as promised (Bond, 2013) such as mortgage loans. Recent changes by financial services providers to no longer require a down payment from home loaners in order to purchase a home and an extension of credit to borrowers with impaired records has increased the number of mortgage loans to households. Consequently, making mortgage debt is the largest type of secured debt.

Mortgage advances, instalment sale credit and leasing finance; and other loans and advances are all major components of household debt (SARB, 2015). Other loans and advances are further divided into overdrafts, general loans and credit card advances. Credit card advances are issued to consumers in a form of credit cards, where a percentage of the debt and interest is paid monthly. General loans

refer to loans granted to clients and non-clients in order to finance current consumption expenditure. Overdraft facilities are made available to current account holders, with the option of the amount to be overdrawn and repayment flexible. Instalment sale credit enables a buyer to purchase durable goods with the aim of ownership in the upcoming years, where an arrangement is made for the buyer to pay for the goods in instalments (Hoosain, 2012). Whereas, leasing agreements are transactions where the debtor does not intend to own goods but merely to lease or hire them for a certain period. Mortgage advances are facilities that enable lenders to purchase property on behalf of a borrower; the loan amount depends on the borrower's income and repayment can take as long as thirty years. Mortgage advances have been a major part of credit extension.

The growth of credit extension from banks to the household sector as well as different types of credit that are now offered to consumers contributed to increased levels of household debt over the years (Mutezo, 2014). Easy access to credit made it more convenient for households to increase their current spending instead of waiting for future income (Chipeta & Mbululu, 2012). The increase in the use of credit was also due to aggressive credit provisioning institutions who did not take strict measures. Institutions also made access to credit much easier for previously disadvantaged households, which contributed to the rise of household debt and surpassed the cost of credit to households (Owusu-Sekyere, 2016). According to Prinsloo (2002), the extension of credit is vital as it gives a linkage between monetary policy fluctuations and aggregate demand fluctuations when it comes to the monetary transmission mechanism.

When the Monetary Policy Committee (MPC) makes changes in interest rates and influence credit extension to households, they indirectly affect aggregate demand (Prinsloo, 2002). Usually during economic downturns, economists understand monetary policy as the point of guard (Matemilola, Bany-Ariffin & Muhtar, 2015). The main aim of monetary policy in South Africa is to obtain and sustain price stability in the concern for sustainable economic growth (SARB, 2016b). Monetary

policy's contribution has several dimensions and accommodates temporary shocks.

Monetary tightening entails a period where interest rates are increased in order to regulate the rate of inflation by curbing economic growth (Gomez-Gonzalenz, Kutan, Ojeda-Joya & Ortiz, 2016). The period of increased interest rates affects the ability of households to afford to borrow and it aggravates the existing debt levels for indebted households (Owusu-Sekyere, 2016). Moreover, the central bank selects this stance in order to discourage credit supply by decreasing the pool of loanable funds in the system (Ndikumana, 2014). The monetary policy in South Africa has been tightened gradually over the past two years. The slowdown in growth was due to the beginning of a tightening phase in monetary policy with increases in interest rates and a steady increase in the price of some products (SARB, 2016b).

Monetary expansion is a period of decreased or stabilised interest rates in order to stimulate the economy (Van Zyl, Botha, Skerritt & Goodspeed, 2012). The effects of an expansionary monetary policy include the loosening of the money supply, the unlimited credit supply and cheaper borrowing (Van Zyl *et al*., 2012). The accommodative monetary policy stance was a position taken up by the MPC in 2012 in order to eradicate debt and reduce further consumption expenditure by consumers (Mutezo, 2014). Kandil (2014) defines the accommodative stance to be a policy that regulates the provision of credit for a growing economy; whereas a fall in interest rates motivates an increase in total spending.

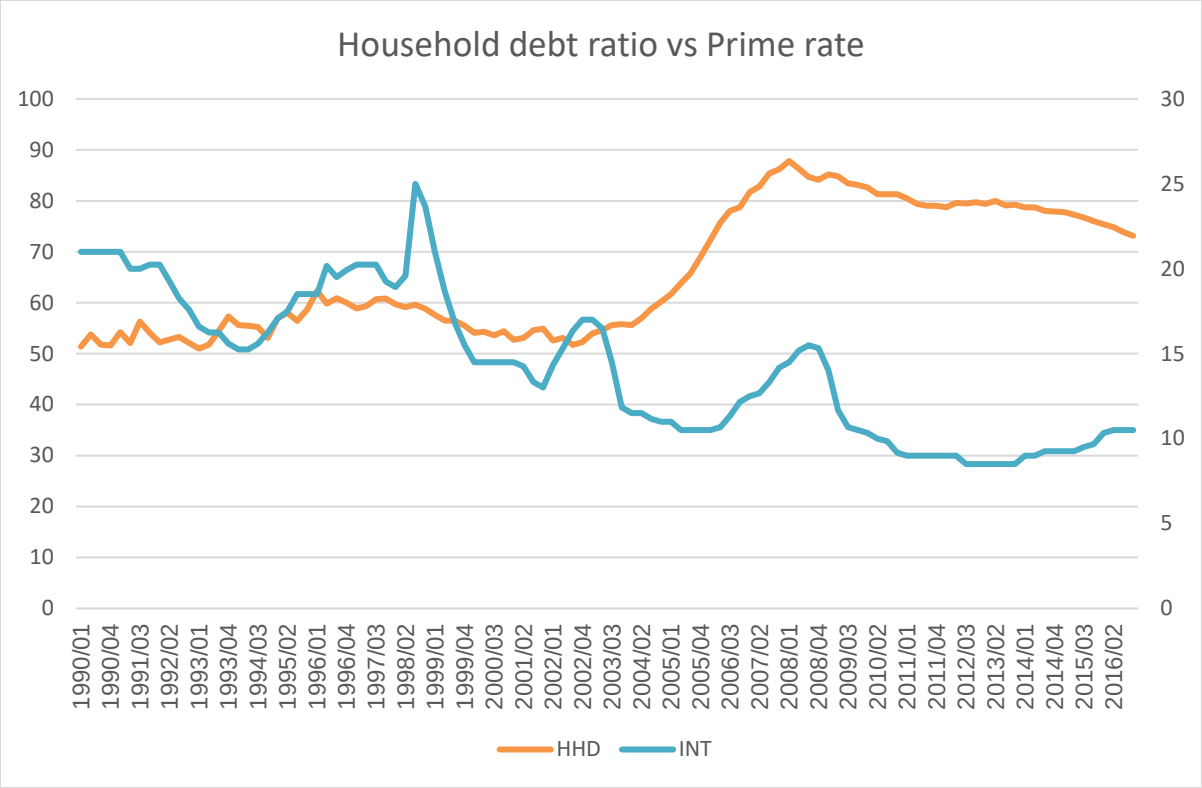

Figure 1.1: Household debt to income ratio vs Prime rate

Source: Author's compilation using data from SARB

As shown in Figure 1.1 it is evident that during the period 1990-2004, the household debt-to-income ratio was stable; during the same period, interest rates were highly volatile. Interest rates peaked at 25% in the year 1999. The graph between the two variables indicates a negative association between them during the majority of times. On the contrary, both graphs experienced a peak during the 2007/8 financial crisis, indicating a positive relationship. Shortly after the crisis, interest rates receded while the ratio of household debt to income remained high.

The volatility of interest rates and its impact on the borrowing behaviour of households is something that needs to be investigated since the cost of credit has an impact on the demand for credit (Chisasa & Dlamini, 2013). Due to the unstable Rand and rising inflation, the MPC increased interest rates in the last quarter of 2015 (SARB, 2016b). This should have discouraged consumers from borrowing

but did not succeed as household debt remained high. Two more interest rate hikes followed in 2016. According to Bond (2013), the high-interest rates set by the SARB have led to increased levels of consumer debt. Tighter affordability criteria, as well as limits on interest charges, restrict lenders from supplying credit to households in future (SARB, 2015).

The National Credit Act (NCA) No. 34 of 2005 was introduced in order to control the credit-lending industry and to protect borrowers (National Credit Regulator, 2014). Owusu-Sekyere (2017) highlights the impact that the new affordability assessment regulations of the NCA, as well as the newly tightened credit conditions have on households due to modifications in the Basel III regulatory requirements. This was done in order to monitor and control reckless lending by financial and non-bank institutions; introduce debt counselling as well as prevent over-indebtedness (NCR, 2014). A study by Chipeta and Mbululu (2012) in South Africa shows that after the declaration of the NCA, institutions increased lending in other categories of credit. A similar study was done by De Wet, Botha and Booyens in 2015 to evaluate how the NCA has influenced the level of indebtedness of South African consumers. Findings from this study indicate that there was an increase in unsecured borrowing by South African consumers in order to pay for current loans. According to the NCR (2015), the percentage of credit records in arrears for at least three months was 41.6 for the last quarter of 2015, which was the lowest since 2008. Adewale (2014) is of the view that the growth of unsecured lending has had a strong impact on South Africa's ability to be unaffected by the financial crisis.

Household debt has been on the rise recently, and it has also been a topic of discussion especially since the 2007-2008 financial crises. Many countries were affected by the global financial crisis, as well as the creditworthiness of borrowers and the appetite of financial institutions to advance credit (Chipeta & Mbululu, 2012). The financial crisis started in the United States of America (USA) in the residential mortgage market and then spread worldwide (Brown *et al.,* 2015). This

gave rise to increased levels of household debt in both advanced economies and emerging markets.

Household debt in the USA was on a rise before the crisis and eventually reached its peak during the financial crisis. This debt rose by 170 percent, from $4.7 trillion in 1999 to $12.7 trillion in 2008 (Brown, Haughwout, Lee & van der Klaauw, 2013). These levels managed to drop post-crisis by eleven percent in 2012 which might be due to a strict supply of credit or increase in the cost of credit (Brown *et al*., 2013). Statistics from the SARB show that household debt in South Africa increased from R274 billion in 2008 to R337 billion in 2012. In comparison to the USA, the household debt in South Africa has remained high after the financial crisis.

China has been a major contributor to world growth (SARB, 2016a). It is one of South Africa's major emerging market peers and their economies have always been compared. However, since the global crisis, the Chinese growth has been slowing down and borrowing has already expanded very rapidly, making repayments difficult. The household debt to gross domestic product (GDP) ratio in South Africa went from 44 percent in 2008 to 37 percent in 2015 (Nkabinde, 2016). This is a more encouraging statistic when compared to China's ratio. Household debt to GDP ratio in China rose from 18 percent in 2008 to 36 percent in 2015. However, China's interest rates are different to that of South Africa.

South Africans still bury themselves in more debt and even in the face of the deteriorating economic conditions, household debt levels remain quite elevated nonetheless. A newspaper report indicated that South African consumers were drowning in debt (Strydom, 2013:4). In this report, Nomsa Motshegare who is the chief executive officer of the NCR warned South Africans to monitor their expenses during the holiday season of 2013 and spend their bonuses wisely. A report by the World Bank shows that consumers in Sub-Saharan Africa were the biggest

borrowers in 2014 (World Bank, 2014). According to this report 86 percent of South Africans took out a loan in the period 2013-2014.

1.4 Problem Statement

One of the challenges that South Africa is currently facing is the high level of household debt (SARB, 2016b). During the budget speech of 2014/2015, the former minister of finance Pravin Gordhan mentioned how “the Government is concerned about the level of over-indebtedness of households”. Household over-indebtedness has a negative impact on the health and growth of the economy. Internal issues in the country have played a significant role in the devaluation of the Rand (Bond, 2013). The instability of the currency in South Africa has had an effect on the macro economy, such as inflation and interest rates. The increase in interest rates did not manage to put a halt to household borrowing, which is an opposite reflection of the economic theory, while the NCA of 2005 was amended recently to allow for changes in interest rates and to close any gaps that have become apparent (Moodley, 2016). The amendment to the NCA and affordability assessment regulations set out strict criteria to be followed by lenders (KPMG, 2015). Nonetheless, this has not managed to curb household debt as it continues to soar, and credit records are being impaired.

Previous studies have focused on the deterministic and long-run relationship between household debt and various other variables using techniques such as Johansen test and vector error correction model (VECM). For example, Meniago, Mukuddem-Petersen, Petersen and Mongale (2013), De Wet *et al.,* 2015; Chipeta and Mbululu (2012); Bimha (2014), Mutezo (2014) all tested household debt in South Africa. A study by Meniago *et al.,* (2013) found a negative insignificant relationship between interest rates and household debt. Whereas, De Wet *et al.,* (2015) found a significant relationship between the prime rate and credit demand in South Africa. The present study focused on the deterministic relationship, long-run association and Granger causality between household debt and interest rates

This study used the autoregressive distributive lag (ARDL) bounds approach to determine the co-integration relationship between household debt and interest rates in the long-run as well as the Granger causality method to determine causality. It also determined the relationship between household debt and other variables.

1.5 Research Questions

Based on the problem statement, the following research questions were formulated:

- What is the deterministic relationship between household debt and interest rates?
- What is the co-integrating relationship between household debt and interest rate?
- What is the causal relationship between household debt and interest rate?
- What is the deterministic and co-integrating relationship between household debt and other variables namely: household income, inflation, household consumption expenditure, household savings, gross domestic product and household wealth?

1.6 Research Objectives

- To examine the deterministic relationship between household debt and interest rates.
- To investigate the co-integrating relationship between household debt and interest rate.
- To examine the causal relationship between household debt and interest rate
- To examine the deterministic and co-integrating relationship between household debt and other control variables namely: household income,

inflation, consumption expenditure, household savings, gross domestic product and household wealth.

1.7 Significance and rationale of the study

As indicated in the problem statement, household debt of South African households has increased considerably coupled with unpredictable lending rates. The purpose of the study was to determine households' borrowing reaction to interest rates as well as the impact of credit demand on interest rates. Theoretically, households should reduce borrowing when interest rates increase. However, South African records indicate otherwise. The MPC usually adjusts interest rates when targeting inflation; this study is beneficial to policymakers when making decisions that affect lenders, consumers and ultimately a healthy economy. Therefore, the important role of the bi-directional relationship has prompted the causality study.

This study differs from the previous studies on the subject in several ways. Firstly, unlike previous studies, this study does not only analyse consumption theories in its framework but interest rate theories and channels of monetary transmission mechanism as well. Secondly, while the majority of previous studies used the Johansen test and the VECM the current study employed the newly developed ARDL as well as the Granger causality test.

1.8 Methodology of the study

The philosophical positions of the researcher were a post-positivist worldview and an objective ontological position. This implies that the study tested the loanable fund's theory as well as the channels of the monetary transmission mechanism as this is the motive of post-positivists. The researcher seeks to interpret results without involving personal opinions or feelings regarding the subject. A quantitative method was adopted as it is relevant for examining a relationship among variables,

where a deductive approach is used to test theory. This study made use of econometric techniques to analyse time series data. The quarterly secondary data for the period 1990 to 2016 was sourced from the SARB and the World Bank.

A unit root test was the preliminary step of regression using both the augmented Dickey-Fuller and the Phillips-Perron test. Ordinary Least Squares was a model used in order to test for a deterministic relationship, however, diagnostic tests were carried out in order to check the suitability of this model. Following the presence of a deterministic relationship, the ARDL bounds were estimated to obtain a long-run relationship. A VECM was specified in order to confirm the results of ARDL and estimate short-run causality. Subsequent to the VECM, long-run causality was estimated using the Granger Causality test. A comprehensive discussion of the methodology used in this study is provided in chapter 3.

1.9 Study outline

The rest of the dissertation is as follows:

Chapter 2: Empirical and Theoretical literature
This chapter discusses the theoretical framework underpinned by the study by analysing theories on household debt and interest rates. This chapter also presents an overview of the empirical literature of the study where the previous literature of all the variables is discussed.

Chapter 3: Research Methodology
The chapter presents the quantitative research method used in the study to determine the relationship between household debt and interest rates in South Africa. This chapter also includes the process of data analysis.

Chapter 4: Econometric analysis and discussion of findings

This chapter presents the findings from the econometric analysis as well as the discussion of these findings. The discussion of these findings from the four techniques used includes corroboration

Chapter 5: Summary, Conclusion and Recommendations

Lastly, chapter five presents the summary of results, conclusions, the policy implications of the results, the contribution, limitations of the study as well as recommendations.

1.10 Conclusion

This chapter presents an introductory chapter, where the key terms were defined, the background of the study, research questions and research objectives were discussed. It also discussed the significance and rationale of the study. This chapter introduces the study and the problem which prompted this research and briefly mentions the methodology used in the study as well as the outline of the whole dissertation. As mentioned in the outline, the next chapter discusses the relevant empirical and theoretical literature.

CHAPTER TWO: EMPIRICAL AND THEORETICAL LITERATURE REVIEW

2.1 Introduction

The first chapter provided an introduction and background to the study. It discussed the problem of the study in detail, the objectives and the significance of the study. The aim of the first chapter was to provide an overview and to highlight the problem which has prompted this study to be conducted. This chapter comprises the literature that was reviewed. The intention of the literature review chapter is to discuss the previous work done over recent years as well as seminal work deliberating over theories relevant to the study. A large body of literature has emerged on the borrowing behaviour of households and how those decisions affect the economy (Zinman, 2015).

The main objective of this study is to investigate the bi-directional causal relationship between interest rates and household debt and gives guidance to the structure of the literature review. Therefore, the approach chosen to discuss the literature is thematically, where literature is reviewed according to the variables of interest. The first four sections deal with the impact of household debt on interest rates. The effect on the economy and other factors that affect interest rates are also explored. Further sections deal with the impact of interest rates on household debt and the economy, whereas other factors that affect household debt are explored. Seminal work discusses theories underpinning this study; these theories highlight the elements that help to solve the problem of this study.

2.2 The impact of household debt on the economy

Household debt is defined as the total of household loans as well as other purchases on credit (Kim, 2016). When the household sector cannot afford to fund their purchases with their current income, they borrow money and sacrifice future income.

Low levels of household debt do not necessarily imply weaker performance in countries as compared to moderate levels of debt (Lombardi, Mohanty & Shim, 2017). However, these low levels in household debt are not necessarily followed by growth either (Mian, Sufi & Verner, 2017). According to Mian *et al.,* (2017), moderate levels of household debt results predict a positive net export margin. Moderate household debt has good effects on the economy as it enhances economic development and stability (Cecchetti, Mohanty and Zampolli, 2011). The results of their study suggest that the economies of countries with a household debt-to-gross domestic product ratio of less than twenty percent experience progress faster when debt increases above the threshold of twenty percent.

Generally, high debt is perceived as an hinderance to the advancement and stability of a financial system (Andre, 2016). When households increase their level of borrowing and then spending, this boosts the economy (Lombardi *et al*. 2017). An economic system is stimulated by household debt, but only in the short-run (Kim, 2016). However, high levels of household debt can cause bankruptcy and financial damage to both households and financial institutions when funds are lent out to people who cannot repay their debt (Cecchetti *et al.,* 2011). Moreover, high debt levels can be unfavourable by hindering output growth and increasing volatility (Cecchetti *et al.,* 2011). Mian *et al.,* (2017) emphasise how indebtedness by households has negative consequences on the economy of a country and has proven to be destructive. Furthermore, when many countries have increased levels of household debt at the same time, the demand for other countries' exports is reduced.

There is a consensus in the literature regarding the part that household debt and credit have played in many financial crises and recessions by aggravating these conditions (Lombardi *et al.,* 2017; Jorda, Schularick & Taylor, 2013; Kukk, 2016). According to Chmelar (2013), household debt was an important driver of economic growth in Europe during the pre-crisis period, but the post-crisis over-indebtedness has brought a combination of problems associated with a financial crisis such as

unemployment, retrenchments as well as unexpected drops in real income. Buiter and Rahbari (2012) concur that excessive household debt can negatively affect employment and capacity use in advanced economies. The Greek crisis is an example of how household debt can go from being a major growth driver to a weakening factor (Athanassiou, 2012).

2.3 The impact of household debt on interest rates: theoretical view

The theoretical literature highlights seminal work that underpins the influence of household debt on interest rates. The loanable fund's theory forms part of interest rate theories and analyses the determination of interest rates.

2.3.1 The Loanable Funds Theory

The Swedish economist Knut Wicksell developed the loanable funds theory in 1907. In his study, Wicksell laid out the foundation of this theory based on the Quantity Theory of Money in order to determine changes in prices (Bertocco, 2013). Bertocco (2013) further points out that the Quantity Theory of Money assumes that credit and loans do not exist; and that everybody uses cash during sales and when making purchases. Moreover, in a money economy, the quantity of money in circulation may not be equal to the quantity of money demanded (Bertocco, 2013). However, Wicksell (1907) asserts that in a pure credit economy, those who wish to purchase goods tend to make debt with the bank. The bank uses the rate of interest as the price of credit. The loanable funds theory suggests that the demand and supply for loanable funds (credit) determines the rate of interest (Ohlin, 1937).

Wicksell's study lacked a clear definition of the functions and a model of the loanable fund's theory (Gootzeit, 1988). However, Robertson (1934) formulated the theory of loanable funds with Wicksell as a reference point. The theory is known as the neoclassical theory of credit as it is an extension of the classical theory

(Gootzeit, 1988). This neoclassical theory of credit needs the presence of savers in order for a credit market to exist (Bertocco, 2005).

The pool of loanable funds has two participants as depicted on Figure 2.1, namely savers and borrowers (Brandl, 2017). The discussions between savers and borrowers determine the price of loanable funds, which is the interest rate. Even though in reality there are many interest rates, this framework assumes that there is only one interest rate in order to understand the general trend of interest rates.

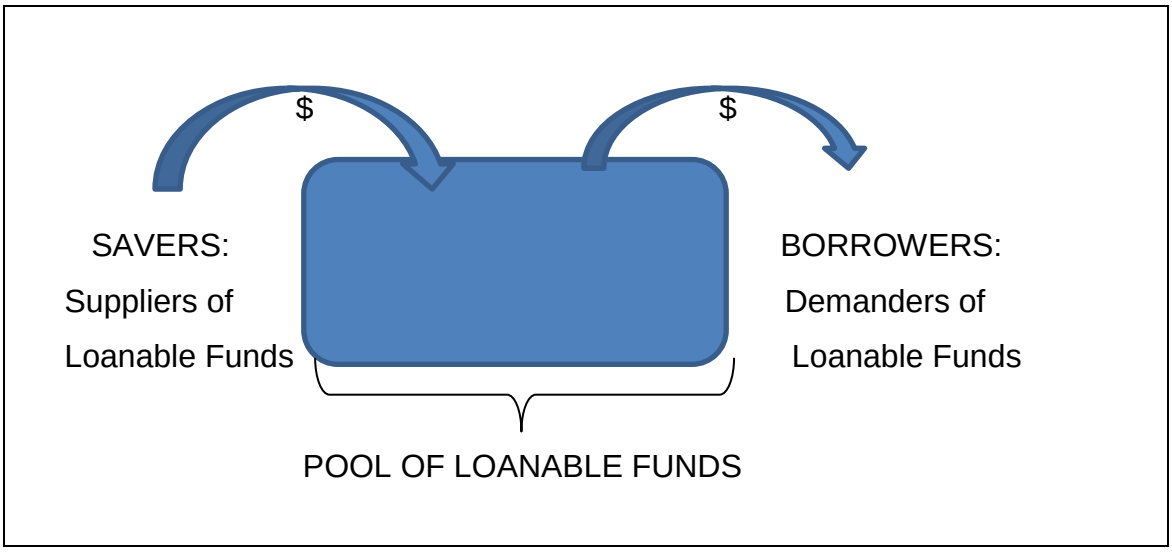

Figure 2.1: Loanable Funds Pool

Source: Brandl (2017: 41)

Ohlin (1937:224) states that in order to explain the determinants of interest rates we need to understand that the demand and supply of credit are governed by the willingness of certain individuals to increase their possession of loanable funds (the net demand for credit); as well as the willingness of certain individuals to decrease their possession of loanable funds (the net supply of credit).

Brandl (2017) defines suppliers (savers) of credit as units with surplus income after expenditure and includes households, firms, and governments. Moreover, when households' disposable income is greater than their consumption level, they add

this excess income to the loanable fund's pool as savings. Firms may also contribute to the pool of loanable funds by providing their surplus income as savings. The government can also contribute to the pool of loanable funds with tax revenue.

According to Kohn (1981), the supply and demand curve describes the market for loanable funds. The supply curve signifies the credit supplied by creditors. The rate of interest where the supply is equal to demand is called the natural rate (Kohn, 1981). The supply curve describes the demand for bonds, which is equivalent to the supply of loanable funds (Mishkin, 2016). The supply curve has a rising slope, where the interest rate is on the vertical axis and quantity of funds is on the horizontal axis (Brandl, 2017). The supply curve depicted in Figure 2.2 shows that as the quantity of loanable funds increases, there is a simultaneous increase in interest rates (Brandl, 2017). The slope is an indication of the higher return that savers make at a higher interest rate.

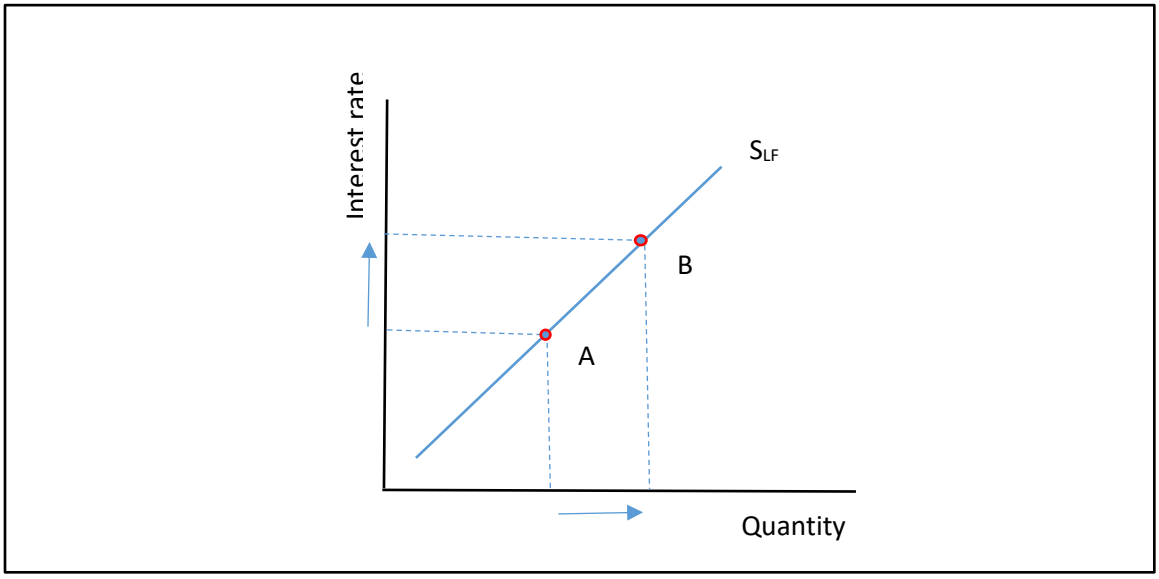

Figure 2.2: Supply curve for Loanable Funds

Source: Brandl (2017:42)

The demanders (borrowers) of credit are units whose expenditure is greater than their income. Households obtain funds from the pool of loanable funds when their consumption exceeds income (Brandl, 2017). Similarly, firms and governments borrow from the financial market when they have a profit-maximizing level of expenditures, which are greater than income (Brandl, 2017). Borrowers withdraw funds from the pool of loanable funds.

The demand curve for loanable funds has a descending slope, with interest rate on the vertical axis and on the horizontal axis is the quantity of loanable funds (Brandl, 2017). The demand curve depicted in Figure 2.3 indicates how an increase in the demand for loanable funds leads to a decrease in the price of loanable funds. "As interest rates increase we see a decrease in the quantity of loanable funds demanded" (Brandl, 2017: 44). The slope is an indication that borrowers are encouraged to increase their borrowing at low interest rates as borrowing is cheaper.

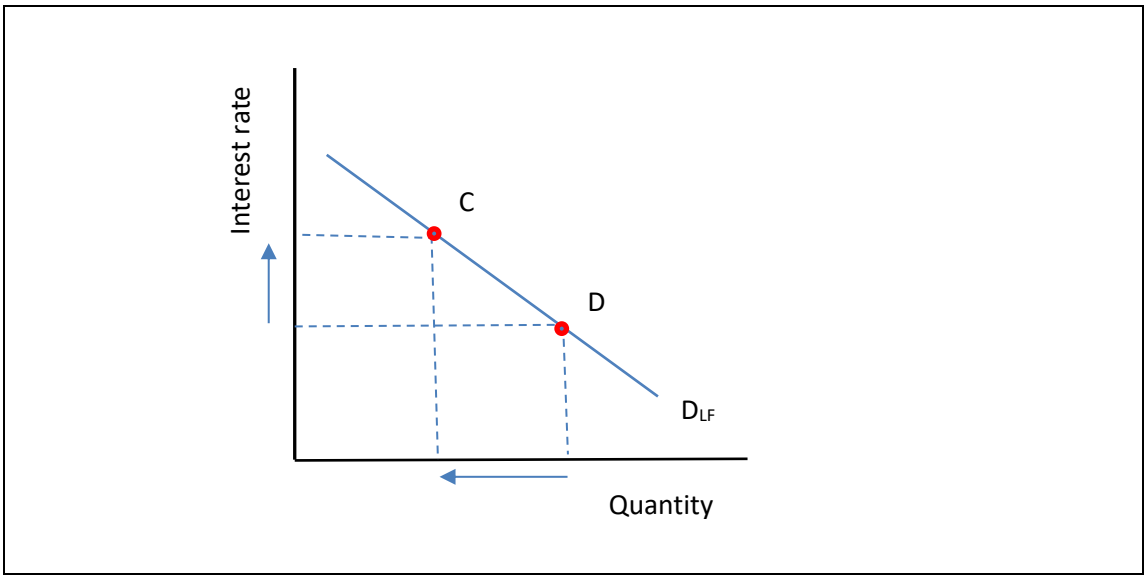

Figure 2.3: Demand curve for Loanable Funds

Source: Brandl (2017:43)

The loanable fund's theory purports that when the demand for loanable funds increases, interest rates tend to decrease. Therefore, this theory is similar to this study as loanable funds represent credit. Furthermore, this theory is relevant to this study as it assumes that interest rates and the demand for loanable funds are inversely related.

Keynes (1937) challenged the loanable fund's theory by introducing the liquidity preference theory (Doig, 2012). Many seminal works (Keynes, 1937; Tsiang, 1956; Rose, 1957 & Nadler, 1989) discussed and compared the loanable fund's theory to the liquidity preference theory. According to Keynes (1937), the difference between the two theories is that; the loanable funds theory is focused on changes in a demand for bank borrowing while the liquidity preference theory is focused on changes in demand for money. Keynes further points out the confusion of authors who use the word ‘loans’, but have different meanings to it. Hansen (1951) criticised the loanable fund's theory by referring to it as being uncertain of the determinants of interest rates. In contrast, Tsiang (1956, 1980) support the formulation of the loanable fund's theory by Robertson (1934). However, Tsiang is of a view that the loanable fund's theory and the liquidity preference theory mean the same thing but use different terms.

2.4 The impact of household debt on interest rates: empirical view

The "demand and supply for loanable funds" determines the market interest rates (SARB, 2015b: 2). Moreover, the increase in interest rates is caused by an increase in the demand coupled with a decrease in the supply of funds (SARB, 2015b), while a decrease in interest rates is caused by the opposite. Household debt growth has been due to an increase in a demand and supply for household credit products; which has had consequences for macro-economic stability such as volatile interest rates (Chmelar, 2013). According to Mian *et al.,* (2017), an increase in the number of borrowers should lead to an increase in the interest rate as long as the credit supply remains the same. Ekwe, Ogbonnaya and Omodero

(2017) concur that keeping other things constant, a demand in loanable funds leads to an increase in interest rates. When demand for borrowed funds is high the bank lending rate can move in the same proportion while if it is low, it sends a signal that business is low, therefore the lending rate should reduce (Ekwe et al., 2017).

A study by Jakab and Kumhof (2015) focused on intermediaries of loanable funds. The results of this study show that following financial shocks, the demand for funds lent by banks has no influence on the price of funds being lent out. According to McLeay, Radia and Thomas (2014), when the demand for loans by households is low, an individual bank lowers its interest rate on loans relative to its competitor. The demand for funds being lent out depends on how efficient those borrowed funds are going to be used (SARB, 2015b). Moreover, when people find it effective and profitable to borrow funds, then the demand for funds increases (SARB, 2015b).

A study by Cheng and Ahmed (2014) examines the demand for credit by poor households in four counties in China. The study used a survey in order to inspect if households acquired loans from more than one source as well as their use of microfinance lenders. This study magnifies the process that poor households go through during the loan application process and the criteria applied by the lenders. The results of the study indicate how the demand for credit by poor households from microlenders leads to high lending rates of interest due to creditworthiness which leads to households being debt constrained (Cheng & Ahmed, 2014). A similar study conducted in the United Kingdom, observed that households that are less credit worthy are more likely to pay higher interest for the loan obtained (Rostamkalaei & Freel, 2016). The results of the study were consistent with the expectations, which notes that clients that are less credit worthy coupled with a lack of a provision for collateral are significantly faced with paying higher than less risky clients (Rostamkalaei & Freel, 2016).

According to Guerriero and Lorenzoni (2017), who study the effects of a credit crunch on constrained households, argues that indebted consumers are forced to repay their debt, while those that are not indebted increase their emergency savings post an unanticipated contraction in their borrowing capability. This affects interest rates in the short-run by reducing them (Guerriero & Lozeroni, 2017). A similar study investigates how the level of household indebtedness affects the monetary transmission mechanism in the USA economy (Alpanda & Zubairy, 2017). The results indicate that during periods of household debt, monetary policy becomes ineffective. This implies that the high debt levels, decisions made by the MPC to change interest rates becomes insignificant (Alpanda & Zubairy, 2017).

2.5 Other factors affecting interest rates

The demand and supply of loanable funds affects interest rates, however, there are other factors that have an impact on interest rates. The two macro-economic factors that are discussed in this section are inflation and money supply.

2.5.1 Inflation

The word ‘inflation’ has been around since the 1850s, describing the decline in the purchasing power of bank notes in circulation (Gidlow, 2011). The availability of paper money caused a decline in the value of cash. Moreover, this led to an inflationary process, as the increase in the supply of money was not accompanied by a rise in the production of goods and services (Gidlow, 2011). However, presently, inflation is synonymous with a process of continuously rising prices (Gidlow, 2011). According to the SARB (2016b), the South African economy abandoned monetary targeting in the year 1998 and, currently conducts inflation targeting. This Inflation targeting is conducted through monetary policy where the effects of adjustments are delayed and should be considered during decision making. Low levels of inflation assist in developing a competitive environment,

thereby protecting the buying power as well as maintaining the standard of living for all citizens (SARB, 2016b).

According to a study conducted by Kose, Emirmahmutoglu and Aksoy (2012), the Turkish economy is also following an inflation targeting regime, in order to understand how interest rates relate with inflation. The results indicate that the Monetary Policy Committee (MPC) of Turkey based their decision to change interest rates on the projected inflation rate. Moreover, these results show a long-term co-integrating relationship between short term interest rates and the inflation rate (Kose *et al.,* 2012). A similar study in Turkey revealed that a change in inflation rate has an eighteen percent impact on interest rates (Kaplan & Gungor, 2017). The purpose of the study was to examine the relationship between money supply, interest rate and inflation rate after the financial crisis of 2008 and policy changes had to be implemented. The study was conducted using the Cholesky Variance Decomposition method as well as the Generalized Variance Decomposition method using monthly macroeconomic data of the year 2008 to the year 2015. Corresponding results were found by Argyropoulos and Tzavalis (2016), which showed how inflation rate changes affect both the nominal and the real interest rate. Comparable results were found by a study in Pakistan, where a positive relationship was found between inflation and the interest rate (Ali, Mahmood & Bashir, 2015). In contrast, empirical results of a study in Kenya found the rate of inflation to be statistically insignificant to interest rates (Were & Wambua, 2014).

2.5.2 Money supply

The SARB defines the supply of money as the sum of bills and coins in the economy at a given time period (SARB, 2015c). According to Ali *et al.,* (2015), the Fisher's effect theory states that when the money supply increases, interest rates should decrease. However, recent literature has different results. The study by Ali et al., (2015) uses the Johansen Cointegration technique and Vector Error Correction Model (VECM) to analyse the relationship among macro-economic

variables. The results of the study indicate that high money supply in Pakistan has a significant impact on the increase in interest rates. This might be due to changes in monetary policy, which affect interest rates. Moreover, South Africa has adopted an inflation targeting framework, so combating inflation means preventing excessive growth in money supply (SARB, 2015c). According to Honda, Kuroki and Tachibana (2013), the money supply might have a liquidity effect on interest rates. The Japanese study uses the vector autoregressive methodology to examine the transmission mechanism. The study examined the effect of the quantitative monetary-easing policy on output and prices. The findings propose that quantitative monetary-easing policy contributes to the economy. Findings from a study by Galindo and Mendez (2014) indicate that when central banks raise liquidity, likewise interest rates escalate. Similarly, a macro-economic analysis on monthly data in Turkey reveals that a year after changes in money supply had occurred, it resulted in changes in interest rates (Kaplan & Gungor, 2017). According to McLeay *et al.,* (2014), the central bank should control money creation as it has a meaningful impact on interest rates. A study done in Nigeria by Raji, Jusoh and Jantan (2014) indicated a causality from money supply to interest rates using Autoregressive Distributed lag (ARDL).

2.6 The impact of interest rates on the economy

Interest rates are the price that the borrower pays for borrowed funds from a lender (SARB, 2015b). The Monetary Policy Committee makes a decision to change the repurchase (repo) rate during their meetings. When the central bank changes its repo rate, it sets the process called the ‘transmission mechanism of monetary policy’ in motion. This process refers to how policy-induced changes gradually affect economic activity (Ireland, 2010). If the repo rate increases, private banks find it expensive to borrow money from the central bank. To maintain their profit margins, private banks increase the prime lending rate (Gidlow, 2011). The prime lending rate is the rate which the banks use to lend money to the private sector (SARB, 2015b).

Changes in interest rates affect households depending on whether they borrowed funds at fixed or variable rates (Debelle, 2004). Moreover, these changes affect the amount of credit that is be extended to households and in the end aggregate demand is affected (Prinsloo, 2002). Low demand ultimately leads to fewer imports and higher unemployment (Jordaan, 2014). Lower prime lending rates mean that the cost of repaying debt is cheaper as debt servicing costs have been minimised (SARB, 2016b). Furthermore, this would reduce the return on asset holdings of a household but ease their liquidity constraints (Debelle, 2004). According to Mohanty (2012:21), a policy-induced increase in interest rates negatively affects output growth, while high levels of interest rates indicates that debt repayment is costly for the borrower and levels of consumption decline (Jordaan, 2014). A higher interest rate also means that the demand for credit as well as inflation is reduced (Ndikumana, 2014). However, an increase in interest rates attracts savings and foreign inflows (Jordaan, 2014).

2.7 The impact of interest rates on household debt: a theoretical view

The theoretical review analyses how the channels of monetary transmission mechanism influence household debt. This theory of monetary policy discusses how policy changes affect credit decisions. The interest rate channel and the credit channel have an impact on households.

2.7.1 Channels of monetary transmission mechanism

The monetary policy transmission mechanism has had much attention in the past as interest rate variations have an extensive influence on the economy (Gumata, Kabundi & Ndou, 2013). The monetary policy transmission mechanism describes how policy decisions affect the economy (SARB, 2016a). These decisions are made to directly affect the economic performance and indirectly influence other factors as such credit and inflation. Boivin, Kiley, and Mishkin (2010) point out the types of monetary transmission as neo-classical and non-neo-classical. The neo

classical channels deduce that financial markets function perfectly, while the non-neo-classical channels arise because of market imperfections (Gumata *et al.,* 2013). These channels operate according to the stage of development of the economy and the stance of the monetary policy (Mohanty, 2012).

Interest rate Channel

The interest rate channel is the main channel in a transmission mechanism (Boivin *et al.,* 2010). Mishkin (1996) discusses the different channels such as the exchange channel and the asset price channel in his study and further points out the dominance of the interest rate channel. Gumata *et al.,* (2013) discovered that the interest rate channel is the most significant channel in South Africa due to inflation targeting. Changes in short-term nominal interest rates lead to changes in long-term nominal interest rates (Ireland, 2010). Moreover, when these nominal prices are slow to adjust, changes in nominal interest rates turn into changes in real interest rates as well (Ireland, 2010). Furthermore, this mechanism can still be effective even when nominal interest rates are at zero, as an expansion in the money supply can stimulate spending by lowering real interest rates (Mishkin, 1996).

Gumata *et al.,* (2013) indicate how this channel focuses on the real interest rate as it affects consumer spending and investment decisions. It describes how changes in the real interest rate have an effect on the prime overdraft rate and ultimately household debt (Gumata *et al.,* 2013). Similarly, Igan, Kabundi, Nadal-De Simone and Tamirisa (2013) found that the interest rate channel indirectly affects households. Furthermore, higher interest rates affect households' creditworthiness and reduce their demand for loans (Igan *et al.,* 2013). Household demands for loans decline during monetary tightening due to an interest rate channel (Ciccarelli, Maddaloni & Peydro, 2015).

When the central bank makes a decision to decrease the interest rate, banks find it cheaper to borrow from the central bank and this increases money supply. Households react to interest rates adjustments by altering their spending patterns. A schematic representation of the effects of the interest rate channel on household debt is given in equation 2.1:

$$M \uparrow \rightarrow \downarrow interest\ rates \downarrow \rightarrow consumption \uparrow \rightarrow borrowing \uparrow \rightarrow HD \uparrow \qquad 2.1$$

This equation shows that during an expansionary monetary policy, interest rates fall, which in turn may lead to an increase in consumer spending as well as an increase in borrowing. As a result, household debt as well as aggregate demand increases. The opposite applies for a tightened monetary policy.

Credit Channel

The non-neoclassical type of transmission is called the credit channel. The credit channel of monetary policy transmission mechanism discusses the effects that monetary policy has on the capacity of credit made available to companies and households (Farajnezhad, Ziaei, Choo & Karimiyan, 2016). This channel is divided into two categories namely the bank lending channel and the balance sheet channel. The credit channel focuses on how changes in interest rates affect the demand and supply of credit, which has an effect on the balance sheets of borrowers as well as lenders. (Ciccarelli *et al.,* 2015).

The bank-lending channel involves the role that banks play in the supply side of loans and credit (Farajnezhad *et al.,* 2016). This directly affects the borrowers' access to credit especially those depending on bank loans (Bernanke & Gertler, 1995). According to Igan *et al.,* (2013), the supply of loans should decrease subsequent to a monetary tightening policy. Therefore, the decline in loan supply is likely to lessen real activity (Bernanke & Gertler, 1995). The monetary tightening results in a higher cost of credit, which limits bank lending activities (Matemilola,

Bany-Ariffin & Muhtar 2015), and household debt decreases as a result. While an expansionary monetary policy should increase the supply of loans by increasing bank reserves and deposits (Mishkin, 1996), the increase in loans results in an increase in consumer spending (Igan *et al., .*2013). Even though this channel is still found to be empirically relevant (Bernanke & Gertler, 1995), its importance has diminished due to banks playing a less important role in credit markets (Mishkin, 1996). However, lending standards and a demand in loans respond to the instabilities of the economy. A schematic presentation of the effects of the bank lending channel of household debt is depicted in the equation below. Equation 2.2 indicates that during monetary expansion, interest rates fall leading to a decline in the supply of credit and household debt consequently falls.

$$M \downarrow \rightarrow interest\ rate \uparrow \rightarrow supply\ of\ new\ credit \downarrow \rightarrow HD \downarrow \quad 2.2$$

The balance sheet channel is based on the balance sheets of households, firms and banks. This channel is focused on how monetary policy changes affect the demand for credit by households. When monetary tightening takes place, increased interest rates affect the consumption and debt of many households (Floden, Kilstrom, Sigurdsson & Vestman, 2017). Mishkin (1996) highlights the cash flow view, where monetary contraction reduces consumers' cash flow by raising interest rates. The reduction in cash flow results in a decline in spending as consumers are not willing to spend. A schematic presentation of the effects of the balance sheet channel on household is shown in the following equation:

$$M \downarrow \rightarrow interest\ rate \uparrow \rightarrow debt\ servicing\ expenses \uparrow \rightarrow credit\ demand \downarrow \rightarrow HD \downarrow \quad 2.3$$

This equation shows that during monetary contraction, current debt servicing expenses increase and the demand for new credit decreases leading to a fall in household debt. The channels of monetary transmission mechanisms are relevant

to this study. The interest rate and credit channels show the indirect effect that monetary policy changes in interest rates have on lending and borrowing.

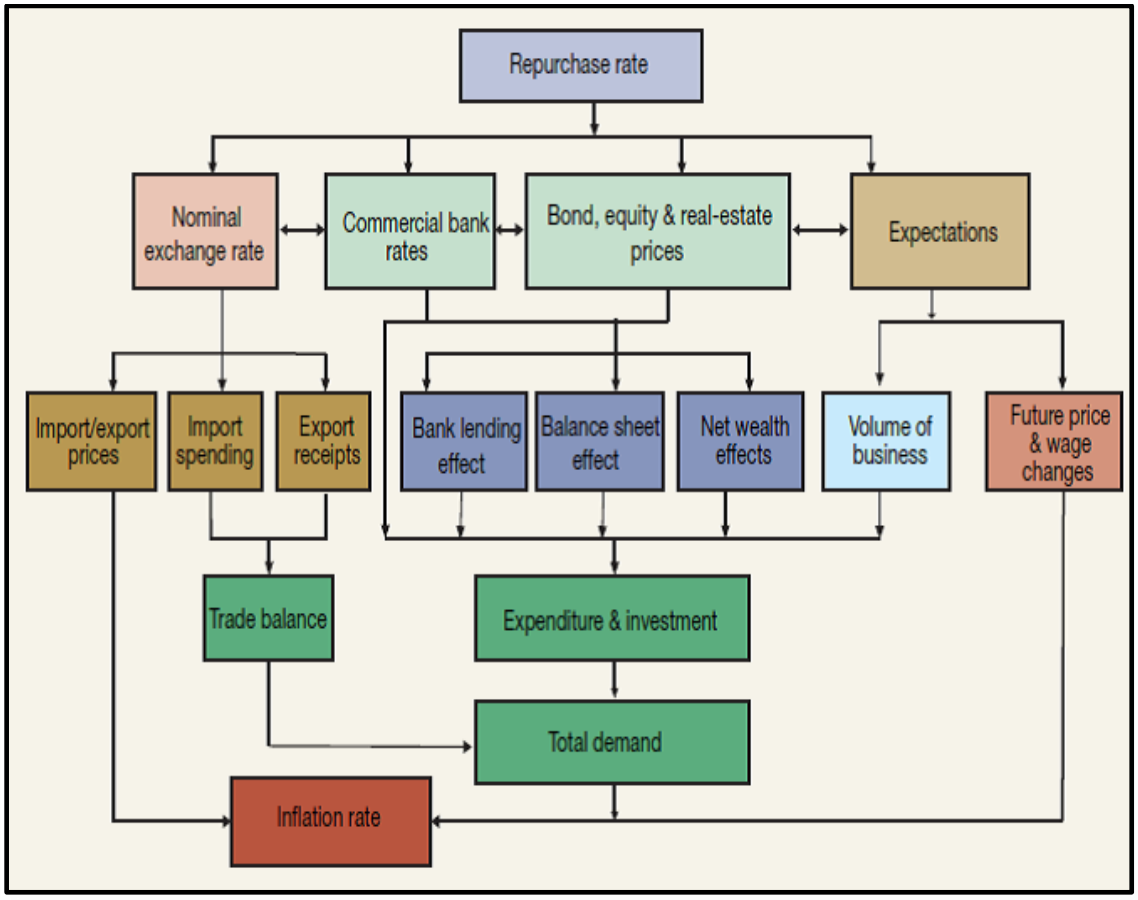

Figure 2.4: The monetary policy transmission mechanism

Source: SARB, Monetary Policy Review (2004)

2.8 The impact of interest rates on household debt: Empirical literature

The growth of household debt in developed economies has been associated with variable interest rates in the past, as debt is adjusted with movements in interest rates (Chmelar, 2013). This study recognises both the repurchase and the prime rate as interest rates that have an impact on consumers.

A study by Waldron and Zampolli (2010) expounds how consumers took advantage of falling interest rates both internationally and in the United Kingdom (UK). Consistent with theory, the results of the study imply that consumers in the UK take on more debt when interest rates are low. Similar results from a study in Australia by Meng, Hoang, and Siriwardana (2013) indicate that increasing household debt in Australia is a consequence of low interest rates. Moreover, Svenson (2014) explains the increase in household debt as a result of Swedish banks offering households low interest rates. Chmelar (2013) points out how a drop-in interest rates since the late 1990s has been the cause for the rise in household debt for European economies. Although Chmelar (2013) acknowledges that interest rate volatility has had an effect on household debt, he establishes that interest rates cannot clarify this major increase in household debt on its own. Therefore, the former studies agree that the results coincide with theory while Chmelar (2013) finds his results to be unconvincing.

According to Scott and Pressman (2015), U.S households suffered high debt obligations during periods of high interest rates. Countries like Korea are also faced with the increase in debt (Lee, 2011). A study by Lee (2011) which focuses on household debt and home mortgage loans concludes that a solution to the household debt during interest rate hikes is extending maturities of household loans. Lee (2011) also mentions macro-economic variables that can affect household debt and the primary factor being interest rates. An increase in interest rates erodes households' liquidity leading to an increase in household debt (Lee, 2011). A similar study in Korea was done, where findings showed that changes in lending rates have no significant impact on the increase in household debt (Chung, 2009).

In agreement with theory, the study by Koivu (2012) purports the existence of a negative association between interest rates and credit demand. The results of this study in China show that when lending rates increase, borrowing becomes more expensive, hence a decline in the demand for credit. Jordaan's (2014) work used

a combination of the macro-economic model and social accounting matrix to study households in South Africa. The author's findings show that higher income households are more affected by a surge in the interest rate and results in higher debt due to available credit access. While, Mian *et al.,* (2017) find low interest rates to result in higher household debt in countries that are part of the Organisation for Economic Co-operation and Development (OECD) due to credit supplied to risky borrowers. Hurwitz and Luiz (2007) studied the level of indebtedness of the urban working class in South Africa as they have more access to credit and found that they overly commit themselves at high rates.

A study by Mutezo (2014) in South Africa did not find a significant short-run relationship but found a long-run relationship between household debt and interest rates using the ARDL bounds testing procedure. The author concludes that those periods of low interest rates and a combination of other factors are the reason for the increase in household debt. Gumata *et al.,* (2013) argue that during periods of low interest rates, the supply of loans is reduced by banks leading to lower debt levels. Results by Chisasa and Dlamini (2013) found interest rates to be insignificant when it came to consumers' decisions to purchase durable goods; the study used an Ordinary Least Squares (OLS) regression, model. This study concluded that consumers purchase goods regardless of the level of interest rates. In contrast, De Wet, Botha, and Booyens (2015) found a negative significant relationship between the prime rate and credit demand in South Africa using the OLS regression model. Owusu-Sekyere (2017) stresses that interest rate hikes in South Africa restrict households from acquiring new debt and managing their existing debt.

Panel data from eleven OECD countries is used to explore household borrowing determinants (Stockhammer & Wildauer, 2017). This study empirically tests four hypotheses: the expenditure cascades hypothesis, the housing boom hypothesis, the low interest hypothesis and the financial regulation hypothesis. The results of this study indicate that low interest rates are a predictor of household borrowing,

these results are consistent with that of the low interest hypothesis. Where, the low interest hypothesis posits that low interest rates inspire households to acquire more debt. A study by Auclert (2017) evaluates the part that the transmission mechanism of monetary policy plays in the indebtedness of households. The study uses statistics from Italian and US to assess how a weaker monetary policy made of low interest rates influences the consumption and borrowing behaviour of households.

Best, Cloyne, lzetzki and Kleven (2015) investigate the response of household debt to interest rate changes. The study uses data from mortgage contracts of households in the UK to develop a dynamic model that shows these responses. The findings of this study indicate that households demand mortgage debt when low interest rates are offered. The limitation of these findings is that the response is only for housing demand and no other debts Best *et al*., 2015). A similar study by Floden *et al.,* (2017) reports interest rate changes to be statistically significant to indebtedness especially homeowners.

2.9 Other factors affecting household debt: Theoretical view

Several theories have been developed to clarify the borrowing behaviour of households. The absolute income hypothesis by Keynes (1936) assumes that current consumption behaviour by households is determined by current household income. This theory states that as income increases, consumption expenditure also increases but with a lesser amount. The Keynesian theory is actually more focused on saving behaviour. Keynes (1936) was concerned that over saving would encourage recession. The author suggested that as income levels increased, consumers would rather save more and spend less. However, there was insufficient evidence to support this. Two other theories were developed, the life-cycle, and permanent income hypotheses.

The life-cycle hypothesis (LCH) by Modigliani (1975) assumes that in order to smooth current consumption, consumers incur large amounts of debt (Meniago, Mukuddem-Petersen, Petersen, and Mogale; 2013). According to Mercier and Botes (2015) households' saving rate should be a function of expected income growth in order for households to reach a preferred level of wealth. Households tend to maximise utility over their life-cycle in order to overcome income shocks. Therefore, households make decisions on current consumption based on future income (Saad, 2011). The income of an individual increases throughout their life and decreases towards retirement. During periods of low income, households borrow to fund current consumption with the aim of repayment in future when income is higher (D'Allessio & Iezzi, 2013). This theory also emphasises that households' savings are negative during their early working life and during retirement and incur debt to fund consumption.

The permanent income hypothesis (PIH) by Friedman (1957) suggests that the consumption behaviour of households is determined by their future income. This theory complements the LCH as it gives emphasis to the saving and borrowing behaviour in order to smooth consumption. When current income is less than future income then households use their savings to finance consumption expenditure (Chung, 2009). However, the life cycle-permanent income hypothesis was criticised by Hall (1978) for not considering liquidity constraints. According to Hall (1978), households are not capable of smoothing consumption with temporary instabilities of income causing liquidity constraints. Even though Hall (1978) concludes that there is little reason to doubt the framework, the author recommends further research in order for a more satisfactory framework to be developed.

2.10 Other factors affecting household debt: empirical view

The consumption theories inspired the inclusion of household consumption, household income, household savings and household wealth as factors that have

an influence on household debt. Inflation and gross domestic products (GDP) are macro-economic variables and are included as control variables.

2.10.1 Inflation

Inflation measures the prices of goods and services. The SARB (2015c) agrees that if the rate of inflation increases, the purchasing power of funds loaned out drops. According to De Wet *et al.,* (2015) a consumer's buying power is determined by the level of inflation as it also affects income. However, the authors also mention that South Africa has a history of high levels of inflation with insignificant impact on income.

Findings from the study by De Wet *et al.,* (2015) showed that consumer price index (CPI) is insignificant, which suggested that it does not have a huge effect on consumer's indebtedness. However, Meniago *et al.,* (2013) found a positive significant relationship between household debt and consumer price index. Similar results were found by Mason and Jayadev (2014) using data from the USA over the period 1929- 2011. They study the effects of the Fischer dynamics on the household debt to income ratio. The results imply that the demand for household credit is an effect of an increase in inflation (Mason & Jayadev, 2014).

Meng *et al.,* (2013) suggest that while inflation has an insignificant effect on the Australian household debt, it does however encourage borrowing but discourages lending. Meng *et al.,* (2013) further explains that, in the midst of high levels of inflation, lenders refrain from lending causing household debt to decrease.

2.10.2 Household Income

It is important to note that income growth means an increase in the level of employment (SARB, 2015). Households also became eligible for more credit and can therefore incur more debt.

Households use their disposable income to finance their consumption expenditure. Therefore, an increase in household income means that households do not require the assistance of debt to back up consumption. Low income means that there is less money to fund consumption, and high debt levels can have a burden on income. According to the SARB, the household debt-to-income ratio was 78 percent in 2015. This ratio simply shows how much of the monthly income is be spent on the payment and repayment of household debt. This ratio also shows that only R22 from every R100 will be for other necessities. This means that households spend almost all their income on the repayment of debts and cannot afford to save or purchase their monthly necessities.

A study by Scott and Pressman (2015) uses a survey to analyse household debt in the USA shows that stagnant incomes have denied consumers an opportunity to pay off their debt balances. This has led to households seeking longer working hours in order to get a salary hike and; reduced savings to afford their monthly necessities. Kim, Lee, Son and Son (2014) argue that an upsurge in household debt is a result of newly indebted households who obtained a growth in permanent income causing the household debt-to-income ratio to escalate. However, Meniago *et al.,* (2013) used a vector error correction model (VECM) to report that South Africans tend to borrow more due to income reduction. Their study shows that income has a negative but significant relationship with household borrowing. In contrast, Mutezo (2014) argues that an increase in income for South African households is the reason for the rising debt. Thus, an increase in income would mean an increase in consumption and expenditure. Moreover, an increase in income would also mean that a consumer qualifies for more debt leading to rising household debt. Chisasa and Dlamini (2013) found household income to have a positive but insignificant relationship to the purchasing decisions of consumers. Although the study focused on durable goods, it highlights consumers' buying behavior.

2.10.3 Household consumption

Household consumption expenditure has significantly increased over the years (SARB, 2016). Households have been able to afford their spending due to an increase in income. This shows consumer confidence because the pattern of consumption expenditure matches that of income. The increased consumption by households results in output demand and employment. According to the income and expenditure reports 2013/2014 from Statistics South Africa, spending by households has more than doubled in the previous decade with R 975 274 million in the year 2005 to R2 639 952 million in the year 2016. The increase in consumption expenditure also means that in periods of falling income, households acquired debt to finance consumption. The increase in consumption is associated with a growth in household debt (Lombardi *et al.,* 2017).

Consumption expenditure by households plays a major role in economic growth (Prinsloo, 2002; Adewale, 2014). The largest portion of GDP in South Africa comprises household consumption at around 60%, which has been an important source of economic growth since the financial crisis (SARB, 2016b). According to consumption models, current and future income determine consumption expenditure. However, household spending now exceeds disposable incomes by around two percent (SARB, 2016b). Contradictory to theory, de Wet *et al.,* (2015) found a negative significant relationship between consumption expenditure and over-indebtedness, while a study by Mutezo (2014) concluded that an increase in household spending is due to high debt levels and consequently over-indebtedness. Meniago *et al.,'s* (2013), results coincide with theory, which stipulates that the higher the consumption by households, the higher their debt levels. Mercier and Botes (2015) find that South Africans do not reduce their debt at the expense of their consumption expenditure.

Households in the US use household debt to smooth their consumption and to pay for goods and services (Dynan, 2012). Bunn and Rostom (2014) found similar

evidence; which confirms that high levels of debt have provided some support to UK consumption expenditure. On the other hand, Aniola and Golas (2012) purport that households' consumption in the European Union (EU) countries is excessive during times of high household debt due to lack of knowledge. However, Eggertson and Krugman (2012) find that highly indebted households receive limited debt to hold, which forces them to reduce their spending levels. Moreover, according to regression results from a study by Dynan (2012), changes in USA household wealth have a significant influence on household consumption. Setterfield and Kim (2016) study the consumption behaviour of USA

2.10.4 Household wealth

Statistics from the SARB show that the ratio of household wealth to income has been unstable for years. This stagnating ratio has an effect on the balance sheet of households' hence household debt. South African household wealth is not up to standard and tends to influence households' ability to retire comfortably (Momentum & UNISA, 2015). During the financial crisis, household wealth was negatively affected by declining property values but managed to recover again after the crisis (Mokoena, 2008).

Household wealth comprises housing wealth, pension wealth and financial wealth (Isaksen, Kramp, Sorensen & Sorensen, 2011). Cloyne, Ferreira and Surico (2016) define financial wealth as the amount remaining after paying your mortgage debt while housing wealth is the difference between the property value and the value of any outstanding mortgage. Household wealth is an indication of investment income because it is the expectation of future income from assets. Pension wealth is defined as funded pensions and excludes pension provided by the government after the age of 60 (Aron & Muellbauer, 2013). Findings from a study in the U.K show that half of the population have low net wealth but high housing wealth (Cloyne *et al.,* 2016).

A study by Kuhn (2010) used time series to analyse changes in the wealth of the household sector as it has an impact on demand in the economy. The decline in property values during the financial crisis in 2007 had an influence on the net wealth of South African households (Kuhn, 2010). Prinsloo (2002) is of the view that rising household debt was due to the rising house prices and their impact on household wealth. Therefore, the increasing levels of household debt should have a corresponding increase in household assets (Kuhn, 2010). According to a report by Momentum and UNISA (2015), household net wealth in South Africa declined by R64.5 billion Rands in the second quarter of 2015. This was due to a decrease in the value of household assets, which was affected by financial assets, contributions to savings products and a slowdown in house price growth. The majority of household debt contains mortgage loans (Bimha, 2014).

According to Hoosain (2012), household wealth plays a major role in household debt, this is indicated by an increase in household debt coupled with an increase in household wealth. An econometric analysis based on the data for nine OECD countries showed that an increase in Danish household debt was compensated by the increase in household wealth (Isaksen *et al.,* 2011). Mutezo (2014) finds a significant relationship between household debt and household wealth indicating low savings and minimal investment in assets.

2.10.5 Household savings

Data by SARB has shown how household savings have deteriorated since the financial crisis. South African households have not been able to save in the recent years due to high levels of debt (reference). Savings by households have reached negative values and households are still struggling to recover.

Household savings is the amount put aside from income after consumption expenditure. Households use their income to save for emergencies, future consumption and for retirement. When household income is insufficient,

households dig into their savings to fund their consumption. Households also contribute to pension schemes as a savings product to ensure tax advantages rather than reducing their debt (Isaksen *et al.,* 2011). On the other hand, South Africans do not have savings pools, so they end up cashing in their retirement savings instead (South African Savings Institute, 2015). The low saving rate by households means that households will struggle to maintain their standard of living during retirement. According to Setterfield and Kim (2016), households regard savings as a luxury as they struggle to cope with financial demands.

Chakrabarti, Lee, van der Klaauw and Zafar (2015) use macroeconomic data to analyse the response of households to economic conditions after the 2007 financial crisis. The results indicate that household saving is negatively related to household debt. The results further indicate the change in spending and saving behaviour as well as expectations of income after the recession. This implies that either households had a change in attitude and paid their debt while increasing their savings or households increased their debt levels and could not afford to save (Chakrabarti *et al*, 2015). Results from an Italian survey indicated that a fall in the savings of households goes along with an increase in household debt (Japelli, Marino & Padula, 2014). The USA economy has been going through a similar experience over the past three decades, with falling savings rates coupled with rising household debt (Setterfield & Kim, 2016). Similarly, a study by Scott and Pressman (2015) finds that high levels of debt are accompanied by low levels of savings in US households.

Savings by the South African household sector has recently weakened due to an increase in consumption coupled with stagnant income (SARB, 2016). However, results in South Africa have shown that as household savings rates increase, household debt also increases (Meniago *et al.,* 2013). Although these results were found to be insignificant, they are an indication that the more households save, the more they believe they are capable of managing debt.

2.10.6 Gross Domestic Product (GDP)

Gross Domestic Product (GDP) is a monetary measure of the market value of all goods and services produced in a period. It is a variable widely known to represent economic growth. "The growth rate of GDP is a popular indicator of economic development" (Meng *et al.,* 2013: 88).

According to results by Chipeta and Mbululu (2012), GDP has a significant and negative relationship to credit, indicating that growth in the economy did not support further growth of the credit extended to households and other sectors of the economy. In contrast, Meniago *et al.,* (2013) found GDP to be significant but positively related to household debt. According to Meniago *et al.,* (2013), this positive sign coincides with theory and was expected. Similarly, Meng *et al.,* (2013) found GDP to be significant and positively related to household debt. Authors further discuss this positive relationship, the growth of GDP results in income growth of households leading to increased consumer confidence and demand for credit as well as increased capacity to borrow (Meng *et al.,* 2013).

A positive association between household credit and economic growth was found in Europe by Chmelar (2013). Results from a study done in Korea show that household debt responds positively and significantly to GDP growth during an expansionary phase but negatively and significantly during the contractionary phase of the economic system (Kim *et al.,* 2014). Co-integration analysis results using VECM show that household debt and GDP growth rate are positively related in the short-run but negatively related in the long-run (Kim, 2016). On the other hand, a study by Rahman and Masih (2014) found that movements in GDP do not affect household debt and found the relationship to be insignificant.

2.11 Conclusion

The focus of this chapter has been on the previous literature in order to better understand the problem as well as on the theoretical perspective underpinning the variables. The loanable funds theory posits that the demand and supply for loanable funds determine interest rates. While the interest rate channel of monetary transmission suggests that changes in interest rates determine the demand for credit and; the credit channel posits that changes in interest rates determine the demand and supply of loans. There is still no consensus in literature about the effect of interest rates on household debt and the effect of household debt on interest rates. This study thrives to provide answers regarding the relationship between the two variables and more. Chapter three discusses the research methodology and approach used in order to achieve the objectives of this study.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

Chapter 2 delved into the previous related literature. It discussed both the theoretical and empirical perspectives of household debt and interest rates. It also discussed the impact of household debt and interest rates on the economy, their impact on each other as well as other factors that influence them.

This chapter addresses the research methodology which the approach and strategy adopted to achieve the aim of this study, which is to investigate the relationship between household debt and interest rates. Research methodology is the method a researcher uses when undertaking a research task, however, this method commands the aid of certain tools (Leedy & Ormrod, 2015). The first two sections describe the philosophical orientation of the researcher as well as the research approach and design chosen for this study. These two sections show the steps taken in order to select a method to collect and analyse data. Further sections discuss the data, the variables and the econometric models in detail. The following section discusses the research philosophy underpinning this study.

3.2 Research philosophy

Research philosophy is defined as the practical concerns that influence a researcher's view about how knowledge should be processed (Saunders, Lewis & Thornhill, 2012). Creswell (2014) defines research philosophy as the assumptions or outlook that a researcher brings to a study. Put simply, a research philosophy is the assumption which the researcher has, or the way in which the researcher views the world. The formulation of the research questions, methods and interpretation of findings is shaped on the basis of the researcher’s assumptions about knowledge. Hence, the research strategy and method that the researcher

follows should fit within the chosen philosophical framework. One of the two major views in research philosophy is epistemology.

3.2.1 Epistemological orientation

Epistemology is a position regarding the principles and procedures acceptable in the social world (Bryman, Bell, Hirschsohn, Dos Santos, Du Tuit, Masenge, Van Aardt & Wagner, 2014:12). Constructivism, transformative, pragmatism and post-positivism are world-views of epistemology.

Constructivism is an approach that asserts the process of engaging with people in order to seek better understanding of the world (Creswell, 2014). One of the major elements of this world-view is that the researcher relies on the perspective of participants to make interpretations. Transformative world-view seeks to extend constructivism by being the voice of the marginalised people and bringing change (Creswell, 2014). Therefore, this approach advocates for the discussion of specific issues where participants work together with the researcher. Pragmatism does not believe in the adoption of one system but choosing one that best meets the needs of the researcher (Creswell, 2014). The pragmatist does not believe in arguing about truth and reality but rather about focussing on the research question (Saunders *et al*., 2012).

Post-positivists emphasise the need to do experiments by identifying and assessing the causes that determine effects (Creswell, 2014). Post-positivists advocate for theory verification which starts with a theory, followed by the researcher collecting data and finally either supporting or refuting that theory (Creswell, 2014). This world-view is the one that best suits this particular study and the intentions of the researcher. This study began with the relevant theory addressing the relationship between household debt and interest rates, followed by the collection, analysis and interpretation of data to verify the loanable fund's theory as well as the channels of the monetary transmission mechanism. This

study adopts the post-positivist world view where the researcher regards objectivism as a relevant ontological view (Saunders *et al.,* 2012).

3.2.2 Ontological orientation

Ontology is the researcher's view of the nature of reality. Subjectivism and Objectivism are the two ontological orientations widely discussed in literature. Subjectivism also known as constructionism, is an ontological orientation that affirms that social actors produce social phenomena through social interaction (Bryman *et al*., 2014). On the other hand, objectivism is the ontological orientation that states that social phenomena are independent of social actors (Saunders *et al.,* 2012). The ontological orientation of the researcher in this study is objective and independent of the social actors. This means that the researcher does not involve any emotions or personal views regarding the relationship between household debt and interest rates or any other variables when interpreting the results in this research.

3.3 Research approach and design

A research approach is a plan with the comprehensive methods of how data was collected, analysed and interpreted (Creswell, 2014). Bryman *et al.,* 2014) differentiate between the two commonly used approaches namely, quantitative and qualitative research approaches. These approaches involve similar steps of finding a research problem, collecting the data and analysing this data (Leedy & Ormrod, 2015). However, these approaches are used to solve different questions and using different data. These methods are briefly discussed in the section below.

3.3.1 Qualitative research approach

The purpose of a qualitative research approach is to describe the phenomenon in more detail (Leedy & Ormrod, 2015). Qualitative researchers are engaged in their

research process where they interact with participants in their environment, in order for participants to maintain their setting (Creswell, 2014:4).

The nature of qualitative data is more word-based and less numerical (Leedy & Ormrod, 2015). The collection of qualitative data is loosely structured while its analysis is subjective and has the potential of being biased (Leedy & Ormrod, 2015). Qualitative research is associated but not limited to the inductive approach (Saunders *et al.,* 2012), where the researcher generates theory from the findings of the study (Leedy & Ormrod, 2015:100)

3.3.2 Quantitative research approach

The purpose of a quantitative research approach is to explain, predict, confirm and validate phenomenon. Furthermore, quantitative researchers tend to focus on results that other people and places can relate to (Leedy & Ormrod, 2015: 98).

The nature of the quantitative research process is more focused as variables are known and methods are planned beforehand. Quantitative research has established guidelines, as it was the original approach to research, therefore allowing the researcher to objectively measure these known variables.

The collection of quantitative data is usually done through standardised instruments where a large sample of numerical data is preferred and viewed as more representative of the population (Leedy & Ormrod, 2015: 99). Leedy and Ormrod (2015) further explain how the analysis of quantitative data is usually done by using statistical means where the results are interpreted in numbers. Furthermore, authors mention that deduction is the most dominant view of how theory relates to research. The deductive approach begins with a premise, where the logic behind it is that when the premises are true then the conclusion must also be true (Saunders *et al.,* 2012).

This study focuses on the quantitative research approach, which is relevant for testing objective theories in order to determine or examine the relationship between variables (Creswell, 2014:4). The objectives of this study include testing for causality between household debt and interest rates based on the "The Loanable Funds Theory" as well as the "Channels of monetary transmission mechanism". Moreover, causality happens to be one of the key strengths of quantitative research approach (Bryman *et al.,* 2014).

3.3.3 Research design

Research design provides a structure that guides the researcher on how to go about collecting and analysing data (Bryman *et al.,* 2014). Furthermore, authors highlight how the choice of the design should explain the importance of certain dimensions of the research process. Saunders *et al*., (2012) categorize these research designs as exploratory, descriptive and explanatory.

Exploratory research involves seeking and assessing new phenomena. Descriptive research seeks to indicate a clear picture of the phenomena. Explanatory research involves studies that seek to explain the relationship between variables specifically causal relationships (Saunders *et al*., 2012). A theoretical framework that underpins the relationship between variables is used when conducting an explanatory study (Veal, 2017). The present study tested the loanable fund's theory and the channels of the monetary transmission mechanism to establish a causal relationship between household debt and interest rates. The explanatory design was adopted in order to identify the cause and effect relationship between household debt and interest rates.

3.4 Nature of data and data source

This study is based on quarterly time-series data from the first quarter of 1990 to the last quarter of 2016. The data contained secondary data obtained from the

South African Reserve Bank (SARB) database as well as the World Bank. Secondary data on online public platforms such as the SARB and the World Bank are credible and available to everyone. Data is in constant terms, which is seasonally adjusted and reflective of real prices. The following data was obtained from SARB for the period January 1990 to December 2016: household debt to disposable income ratio, prime overdraft rate, percentage change in household disposable income, ratio of final consumption expenditure by households to GDP, and ratio of household savings to disposable income and household wealth to disposable income ratio. The inflation dataset from the SARB excludes food, non-alcoholic beverages and fuel and focuses only on urban areas. The amount fails to capture the change in prices of essential expenditure of households. The GDP growth rate was unobtainable from the SARB. For these reasons, the inflation and the GDP datasets were obtained from the World Bank database. However, monthly data such as the prime overdraft rate and GDP deflator were converted to quarterly data using arithmetic mean. Prior to the econometric analysis of this data, descriptive statistical analysis was carried out for each variable in order to examine the statistical properties of these variables. The statistical properties are represented by the mean, median, mode and standard deviation, since skewness and kurtosis are discussed in the diagnostic test.

3.5 Measurement of variables

In order to investigate the causal relationship between household debt and interest rates we used household debt-to-disposable income ratio as proxy for national debt of households in South Africa. This ratio of household debt was derived by using the published household debt to income ratio. According to theory, the demand for debt leads to a decrease in interest rates. Therefore, a negative coefficient is expected. This ratio captures the burden of debt as well as the extent of the debt itself. Household debt to income ratio has been used by many authors (Meniago, Mukuddem-Petersen, Petersen & Mongale, 2013; Jordaan, 2014; Flodén, Kilström, Sigurdsson, & Vestman, 2017).

The prime overdraft rate was used as a proxy for the interest rate variable. The monthly data attained from the SARB was first converted to quarterly data. The prime overdraft rate is the rate that lenders/financial institutions use to lend to borrowers. Financial institutions use the prime rate when lending, so changes in this rate affect households. According to theory, changes in interest rates affect the cost of credit, which influences the demand and supply of credit. An increase in the prime rate would restrain households from obtaining debt, therefore, a negative coefficient is expected. The prime overdraft rate has been used by many authors (Meniago *et al.,* 2013; De Wet, Botha & Booyens*,* 2015; Meng, Hoang & Siriwardana, 2013; Chmelar, 2013; Gumata, Kabundi & Ndou, 2013; Mutezo, 2014).

Regression and cointegration were tested using household debt as the dependent variable and interest rates, inflation, household income, wealth, savings, consumption and GDP as independent variables.

The inflation variable was represented by the GDP deflator obtained from the World Bank database. The annual data from the World Bank was adjusted to quarterly data. GDP deflator measures the price level of all goods and services in an economy. This macro-economic variable is used as a control variable and could influence the demand and supply of credit. According to monetary policy, when inflation is expected to increase, it affects credit demand and supply. Therefore, household debt is expected to increase with an increase in the price of goods and services resulting in a positive coefficient. GDP deflator has been used by many authors (Meng *et al.,* 2013; Meniago *et al.,* 2013., De Wet *et al.,* 2015).

The percentage change in household disposable income is used as proxy for household income. According to Modigliani's (1975) life cycle hypothesis, households incur debt during periods of high income as they are more capable of obtaining credit. Therefore, the expected coefficient is positive. Change in household debt has been used by authors (Scott and Pressman, 2015; Chisasa & Dlamini, 2013).

The ratio of household consumption expenditure to GDP is used as proxy for the consumption variable. This variable measure household spending of durable goods, semi-durable goods, non-durable goods and services in an economy. The permanent income hypothesis by Friedman (1957) purports households struggle to adjust their spending more during periods of low income. The expected coefficient is positive. The following authors have used this proxy (Dynan, 2012; Eggertson & Krugman, 2012; Mercier & Botes, 2015).

Household net wealth was represented by the ratio of household net wealth to disposable income. This is an adequate measurement as it indicates how income impacts on wealth. Households acquire more wealth when they do not have to spend their income on debt (when household debt decreases). The expected outcome is a negative coefficient. The ratio of wealth to income has been used by these authors (Aron & Muelbauer, 2013; Bimha, 2014; Scott & Pressman, 2015).
The ratio of household savings to disposable income was used as proxy for household net savings. Therefore, if households have additional income after funding for consumption, it is used for savings rather than debt. The expected coefficient is negative. The ratio of savings to income has been used by the following authors (Setterfield and Kim, 2016; Isaksen *et al.,* 2011).

Gross domestic product growth rate was used as proxy for economic growth. GDP is a macro-economic variable and also used a control variable, as the stability of the economy affects household decisions. When there is higher economic growth, households tend to borrow more. The expected sign of coefficient is positive. GDP growth rate has been used as proxy by many authors (Chmelar, 2013; Kim, 2016; Meniago *et al.,* 2013; Meng *et al.,* 2013).

Table 3.1: Summarizes other researchers who have used similar variables.

Variables	**Proxy**	**Authors**	**Expected sign of coefficient**
Household debt	Household debt-to-income ratio	(Meniago et al, 2013; Jordaan, 2014; Flodén, Kilström, Sigurdsson, & Vestman, 2017).	Negative
Interest rate	Prime overdraft rate	Koivu (2008); Chung (2009); Lee (2011); Meng et al (2013); Chmelar (2013) Gumata, Kabundi and Ndou (2013); Mutezo (2014)	Negative
Inflation	GDP deflator	Meng *et al.,* (2013); Meniago *et al.,* (2013)., De Wet *et al.,* (2015)	Positive
Household income	Percentage change in household disposable income	Scott and Pressman (2015); Chisasa and Dlamini (2013); Mutezo (2014)	Positive
Economic growth	Rate of GDP growth	Meniago *et al.,* (2013); Meng *et al.,* (2013)	Positive
Household consumption expenditure	Ratio of household consumption expenditure to GDP	Dynan (2012); Eggertson and Krugman (2012); Bunn and Rostom (2014); Mutezo (2014); Mercier and Botes (2015)	Positive
Household savings	Ratio of household savings to income	Setterfield and Kim (2016); Isaksen *et al.,* (2011)	Negative
Household wealth	Ratio of wealth to household income	Aron and Muelbauer (2013); Bimha (2014); Scott and Pressman (2015)	Negative

3.6 Data analysis

This study employs four econometric techniques in order to examine the relationship between variables. Correlation analysis was only performed informally to evaluate the relationship Firstly, the researcher tested for a deterministic relationship using the Ordinary Least Squares (OLS) regression model. Secondly, co-integration is tested by using the Autoregressive distributive lag (ARDL) bound test. Thirdly, Vector Error Correction Model is used to determine long and short-run dynamics and lastly, the Granger Causality model is used to test for a causal relationship.

3.6.1 Correlation analysis

Correlation analysis is used as a simple measure of relationship for variables. It measures the linear dependence between two variables. Correlation between two variables simply means that the two variables are treated equally. This means that changes in one variable does not cause changes in another variable. The relationship of the two variables is measured by the correlation coefficient where a correlation coefficient of 1/-1 shows a perfect positive/ negative relationship between variables (Brooks, 2014). However, before conducting the estimation, it has been suggested that all variables must be stationary and co-integrated.

3.6.2 Stationarity tests

Unit root testing is a compulsory primary test in time-series analysis done in order to ensure that we do not encounter a unit root problem also known as non-stationarity (Gujarati & Porter, 2009). A non-stationary series is one who's mean, variance and covariance change over time. The stationarity of a series is important in order to ensure that the series maintains its behaviour and properties, that the regressions are not spurious and that the analysis is valid (Brooks, 2014). Prior to formal techniques, it is important to examine the graphical representation of the

series in order to check for the possibility of non-stationarity. The formal tests of stationarity are done by testing the order of integration. The augmented Dickey-Fuller (ADF) (1979) and Phillips-Perron (PP) (1988) tests were used to test for unit root in the series to ensure that the relevant techniques are used. The ADF test is the improved version of the Dickey-Fuller test where lagged values of the dependent variable are added in order to 'augment' the series. The ADF test uses critical values and a regression equation with a random walk to test for unit root. The regression is as follows:

$$\Delta\delta_t = \beta_1 + \beta_2 t + \emptyset\delta_{t-1} + \sum_{i=1}^{p} \varphi_i \Delta\, \delta_{t-1} + u_t \qquad 3.1$$

Where the objective of the above equation is to find out if ∅ = one, meaning that unit root is absent. The null hypothesis is that H_0: Y_t is non-stationary, while the alternative hypothesis is that H_0: Y_t is stationary and there is no unit root. When the presence of a unit root is found in a variable, the particular variable should be differenced. The lag length of the ADF is automatically selected as Schwarz Info Criterion and respectively.

$$\Delta\delta_t = \beta_{2t-1} + \emptyset\left(n - \frac{N}{2}\right) + \sum_{i-1}^{p} \varphi_i \Delta\delta_{t-1} + u_{2t} \qquad 3.2$$

For both equations, Δ is the difference operator and u_t as well as u_{2t} are the error terms. The PP test is similar to the ADF test but uses automatic statistical methods in order to correct for residuals that are serially correlated. The lag length of the PP test is automatically selected as the Bartlett kernel criterion.

3.6.3 Pre-diagnostic tests for regression analysis

Various tests are performed in order to ensure that the regression model is a good fit for the particular set of data and to ensure that estimates are valid. These tests are performed to prove that certain assumptions are true (Wooldridge, 2015).

3.6.3.1 Multi-collinearity

The assumption is that the independent variables in a series are not highly correlated. The correlation between variables is unlikely to be zero since it would mean that there is no relationship between independent variables. A correlation coefficient of above 0.80 is considered multi-collinearity, meaning that the independent variables are highly correlated (Studenmund, 2015). Perfect collinearity is impossible between two variables as it only occurs when there is an exact relationship between variables. However, a high correlation between the dependent variable and an independent variable does not qualify as multi-collinearity. This study employed Correlation analysis in order to visually detect and measure a high correlation.

3.6.3.2 Serial correlation

The assumption is that the residuals are uncorrelated. Serial correlation occurs when residuals show a positive autocorrelation. The joint test between Breusch (1978) and Godfrey (1978) is a popular test for serial correlation. The Breusch-Godfrey test also known as the Lagrange Multiplier (LM) test examines how several lagged residuals in a model describe the residual. The null hypothesis states that there is no serial correlation of any order (Brooks, 2014).

3.6.3.3 Normality

The assumption is that the disturbances are normally distributed. The Jarque-Bera (1987) test uses the characteristics of the data to test for normality. Jarque and Bera joined ideas in order to test for normality by computing the skewness and kurtosis in the data. Kurtosis refers to how the probability of a variable is either peak or flat, and skewness refers to the balance of the distribution. Under normal distribution, skewness and kurtosis have a joint coefficient of zero. The null

hypothesis is that the error terms are normally distributed. The model for the Jarque-Bera statistic is:

$$JB = T\left[\frac{s^2}{6} + \frac{(k_2-3)^2}{24}\right] \quad 3.3$$

Where T is the sample size, s^2 denotes the coefficient of skewness, and $(k_2 - 3)$ denotes the excess kurtosis.

3.6.3.4 Heteroscedasticity

The assumption is that there is homoscedasticity. The Breusch-Pagan (1979) test is used for heteroscedasticity by using the chi-square distribution in order to examine whether a z- pattern can be detected in the error terms. The Breusch-Pagan is simple to use and can easily detect heteroscedasticity in a series. The presence of heteroscedasticity in a series deems a regression model inefficient (Breusch-Pagan, 1979).

3.6.4 Regression analysis

Regression analysis is a statistical method that clarifies the movements in the dependent variable by movements in the independent variables by means of an equation (Studenmund, 2017). A multivariate linear regression model accommodates more than one explanatory variable, where the impact of one-unit increase in the first explanatory variable on the dependent variables is isolated, holding other explanatory variables constant (Studenmund, 2017:30). This study tested the relationship between the dependent variable, household debt and independent variables, interest rate, inflation, household income, consumption expenditure, household wealth, household savings; and gross domestic product.

3.6.4.1 Ordinary Least Squares (OLS)

Regression analysis in this study is estimated by the Ordinary Least Squares model. Ordinary Least Squares is the most widely used method of regression estimation technique (Studenmund, 2017). This regression model was run first in order to find a deterministic relationship between the dependent variable and independent variables. Studenmund (2017:54) further mentions the three advantages of using the Ordinary Least Squares model, namely: it is simple to use, properties of estimates are valuable and it can rationally reduce the squared residuals.

The following equation was estimated:

$$HHD_t = \beta_0 + \beta_1 INT + \beta_2 CPI + \beta_3 HDI + \beta_4 CONS + \beta_5 HNS + \beta_6 HNW + \beta_7 GDP + \varepsilon_t \quad 3.4$$

Where:

HHD_t = household debt

β_0 = the intercept

$\beta_1 - \beta_7$ = coefficients explaining the elasticities of variables

INT = interest rates

CPI = inflation.

HDI =household disposable income

CONS = consumption expenditure

HNS = household net savings

HNW= household net wealth

GDP= gross domestic product

ε_t = error term

3.6.5 Lag Length Selection

The optimal lag length must be determined prior to co-integration. This study employed the VAR model in order to select the lag length using five information criteria, which are sequential modified likelihood ratio test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion Hannan-Quinn criterion (HQ). Unlike the conventional granger causality method, the vector error correction based causality test allows for the inclusion of the lagged error correction term derived from the co-integration equation. Due to the inclusion of this term, the long-run information lost through differencing is reintroduced in a statistically accepted way (Narayan & Smyth, 2008).

3.6.6 Co-integration test

After establishing that variables are stationary, it is necessary to determine whether or not there is any long term relationship between them, this means testing the co-integration. Co-integration is defined as determining the existence of a long term relationship of variables by getting rid of results that are spurious in nature by corresponding the degree of non-stationarity of the variables in an equation in order to make residuals of the equation stationary (Studenmund, 2017:401). If a long-run equilibrium relationship exists between a set of variables, those variables are said to be co-integrated. Co-integration is also important in avoiding false regression by the regression models as it also tests for short-run relationships (Meniago, Mukuddem- Petersen, Petersen & Mongale, 2013). This study adopted co-integration analysis and error correction modelling using the Auto Regressive Distributed Lag bounds testing approach and the Vector Error Correction Model.

3.6.6.1 Auto Regressive Distributed Lag (ARDL) Bounds-Testing Approach

This study tests for a long-run co-integration relationship between variables by using the ARDL bounds testing approach to co-integration by Pesaran and Shin

(1998). It is a preferred method for co-integration as it offers numerous advantages. Firstly, this approach can be employed regardless of the order of integration of the variables, as long as the order is not more than one (Mutezo, 2014). Therefore, this approach can be used in cases where the underlying variables are of order zero [*I*(0)], order one *[I*(1)] or mutually co-integrated, avoiding a degree of pretesting and uncertainty (Pesaran, Shin & Smith, 2001). This approach has advantages such as superior sample properties and impartial estimates of the long-run model (Pesaran & Shin, 1998).

ARDL framework for the equations:

$$\Delta HHD_t = \mu_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta HHD_{t-1} + \sum_{i=1}^{n} \gamma_{2i} \Delta INT_{t-1} + \gamma_3 HHD_{t-1} + \gamma_4 INT_{t-1} + \varepsilon_t \quad 3.5$$

$$\Delta INT_t = k_0 + \sum_{i=1}^{n} \varphi_{1i} \Delta INT_{t-1} + \sum_{i=1}^{n} \varphi_{2i} \Delta HHD_{t-1} + \varphi_3 INT_{t-1} + \varphi_4 HHD_{t-1} + \varepsilon_t$$

$$\Delta HHD_t = R_0 + \sum_{i=1}^{n} \omega_{1i} \Delta HHD_{t-1} + \sum_{i=1}^{n} \omega_{2i} \Delta CPI_{t-1} + \omega_3 HHD_{t-1} + \omega_4 CPI_{t-1} + \varepsilon_t \quad 3.6$$

$$\Delta CPI_t = \theta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta CPI_{t-1} + \sum_{i=1}^{n} \beta_{2i} \Delta HHD_{t-1} + \beta_3 CPI_{t-1} + \beta_4 HHD_{t-1} + \varepsilon_t$$

$$\Delta HHD_t = \vartheta_0 + \sum_{i=1}^{n} \sigma_{1i} \Delta HHD_{t-1} + \sum_{i=1}^{n} \sigma_{2i} \Delta HDI_{t-1} + \sigma_3 HHD_{t-1} + \sigma_4 HDI_{t-1} + \varepsilon_t \quad 3.7$$

$$\Delta HDI_t = \pi_0 + \sum_{i=1}^{n} \tau_{1i} \Delta HDI_{t-1} + \sum_{i=1}^{n} \tau_{2i} \Delta HHD_{t-1} + \tau_3 HDI_{t-1} + \tau_4 HHD_{t-1} + \varepsilon_t$$

$$\Delta HHD_t = \emptyset_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta HHD_{t-1} + \sum_{i=1}^{n} \alpha_{2i} \Delta CONS_{t-1} + \alpha_3 HHD_{t-1} + \alpha_4 CONS_{t-1} + \varepsilon_t \quad 3.8$$

$$\Delta CONS_t = \rho_0 + \sum_{i=1}^{n} \delta_{1i} \Delta CONS_{t-1} + \sum_{i=1}^{n} \delta_{2i} \Delta HHD_{t-1} + \delta_3 CONS_{t-1} + \delta_4 HHD_{t-1} + \varepsilon_t$$

$$\Delta HHD_t = \infty_0 + \sum_{i=1}^{n} \aleph_{1i} \Delta HHD_{t-1} + \sum_{i=1}^{n} \aleph_{2i} \Delta HNS_{t-1} + \aleph_3 HHD_{t-1} + \aleph_4 HNS_{t-1} + \varepsilon_t \quad 3.9$$

$$\Delta HNS_t = \propto_0 + \sum_{i=1}^{n} v_{1i} \Delta HNS_{t-1} + \sum_{i=1}^{n} v_{2i} \Delta HHD_{t-1} + v_3 HNS_{t-1} + v_4 HHD_{t-1} + \varepsilon_t$$

$$\Delta HHD_t = a_0 + \sum_{i=1}^{n} q_{1i} \Delta HHD_{t-1} + \sum_{i=1}^{n} q_{2i} \Delta HNW_{t-1} + q_3 HHD_{t-1} + q_4 HNW_{t-1} + \varepsilon_t \quad 3.10$$

$$\Delta HNW_t = m_0 + \sum_{i=1}^{n} c_{1i} \Delta HNW_{t-1} + \sum_{i=1}^{n} c_{2i} \Delta HHD_{t-1} + c_3 HNW_{t-1} + c_4 HHD_{t-1} + \varepsilon_t$$

$$\Delta HHD_t = a_0 + \sum_{i=1}^{n} q_{1i} \Delta HHD_{t-1} + \sum_{i=1}^{n} q_{2i} \Delta GDP_{t-1} + q_3 HHD_{t-1} + q_4 GDP_{t-1} + \varepsilon_t \quad 3.11$$

$$\Delta GDP_t = m_0 + \sum_{i=1}^{n} c_{1i} \Delta GDP_{t-1} + \sum_{i=1}^{n} c_{2i} \Delta HHD_{t-1} + c_3 GDP_{t-1} + c_4 HHD_{t-1} + \varepsilon_t$$

In the ARDL equations, the first terms with the summation signs are the error correction dynamics, while the second terms correspond to the long-run

relationship, Δ the difference operator. The study made use of the ARDL approach since until recently, studies have shown that this approach has been preferred to other conventional co-integration approaches such as those by Engle and Granger (1988) and Gregory and Hansen (1996). The study employs Pesaran and Shin (2001) bounds testing analysis; if the f-statistic is above the upper bound then there is a long-run relationship, if the f-statistic is lower than the lower bound then there is no co-integrating relationship. However, if the f-statistic value falls between the upper and lower bound, then the results are inconclusive.

3.6.6.2 Vector Error Correction Model (VECM)

This study used the Vector Error correction Model also for co-integration. This approach was mainly used for robustness purposes, as it complements the ARDL approach very well. The VECM is secondarily used to confirm the long-run relationship and primarily employed to test the short-run causality amongst the variables under investigation.

VECM framework:

$$\Delta HHD = a_o + \sum_{j=1}^{n} a_1 \Delta HHD_{t-j} + \sum_{j=1}^{n} a_2 \Delta INT_{t-j} + \sum_{j=1}^{n} a_3 \Delta HDI_{t-j} \varphi_1 ECT_{t-1} + \varepsilon_{1t} \quad 3.12$$

$$\Delta INT = a_0 + \sum_{j=1}^{n} a_1 \Delta INT_{t-j} + \sum_{j=1}^{n} a_2 \Delta HHD_{t-j} + \sum_{j=1}^{n} a_3 \Delta HDI_{t-j} + \varphi_1 ECT_{t-1} + \varepsilon_{1t} \quad 3.13$$

$$\Delta HDI = a_0 + \sum_{j=1}^{n} a_1 \Delta HDI_{t-j} + \sum_{j=1}^{n} a_2 \Delta HHD_{t-j} + \sum_{j=1}^{n} a_3 \Delta INT_{t-j} + \varphi_1 ECT_{t-1} + \varepsilon_{1t} \quad 3.14$$

Where: Δ is the difference operator, *n* is chosen lag length

3.7 Granger Causality

The direction of causality in economic relationships is useful when we know that two variables are related but are unaware of which variable causes the other to move (Studenmund, 2017:392). "Granger causality is a circumstance in which one time-series variable consistently and predictably changes before another variable"

(Studenmund 2017:393). When dealing with two variables, interest rate and household debt, then we are dealing with bilateral causality.

Causality framework:

$$HHD_t = \sum_{i=1}^{n} \propto_i INT_{t-1} + \sum_{j=1}^{n} \beta_j HHD_{t-j} + u_{1t} \quad 3.15$$

$$INT_t = \sum_{i=1}^{n} \mu_i INT_{t-1} + \sum_{j=1}^{n} \delta_j HHD_{t-j} + u_{2t} \quad 3.16$$

3.8 Conclusion

This chapter expounded the methodology adopted in the study. Various econometric techniques and related proxies used in the estimation of the direction of causality and robustness of the nexus between household debt and interest rate in South Africa. The chapter went further proving justification for the choice of the particular methods employed in this study. The four models were discussed and estimated, and diagnostic tests were taken into account. The next chapter presents empirical results from each of the estimation techniques ranging from unit root tests, co-integration tests to Granger causality tests and the interpretation of the results.

CHAPTER FOUR: ECONOMETRIC ANALYSIS AND DISCUSSION OF FINDINGS

4.1 Introduction

The previous chapter described the methods used in this study. It discussed the approach and tools adopted in order to answer the research questions of this study. The models used to determine the relationship between variables were discussed.

This chapter discusses the results of the relevant tests performed as mentioned earlier. The first section reminds the reader of the research objectives of the study. The second and third sections deal with the descriptive statistics, which describe the sample, and the correlation analysis which explains the linear relationship between variables before further relationships are investigated. The fourth and fifth sections discuss the results of pre-tests such as the unit root tests and other diagnostic tests performed to ensure that the data and the model are fitted. Further sections discuss the results of the regression, co-integration and causality analysis. Moreover, these results are compared to theory and findings of other empirical studies.

4.2 Research objectives

- To examine the deterministic relationship between household debt and interest rates.
- To investigate the co-integrating relationship between household debt and interest rate.
- To examine the causal relationship between household debt and interest rate
- To examine the deterministic and co-integrating relationship between household debt and other variables namely household income, inflation,

consumption expenditure, household savings, gross domestic product and household wealth.

4.3 Descriptive statistics

A breakdown of statistical analysis is presented in this section in order to validate and justify the normality of data used in econometric modelling. Therefore, statistical analysis was used to reasonably describe the main features of the dataset by making reference to measures of central tendency such as mean, median, range and standard deviation. Table 4.1 presents the summary of the statistics of each variable for the period 1990: Q1 to 2016: Q4, which resulted in 108 observations, in this instance most of them are in ratio format.

Table 4.1: Descriptive statistics results

	HHD	**CONS**	**INT**	**HNW**	**HNS**	**HDI**	**GDP**	**CPI**
MEAN	65.899	61.413	14.306	325.785	0.962	3.025	0.594	2.119
MEDIAN	59.900	61.500	14.500	320.150	0.700	2.750	0.684	1.901
MAXIMUM	87.800	64.700	25.000	400.300	9.700	24.100	1.401	3.913
MINIMUM	51.000	58.200	8.500	260.900	-2.400	-11.900	-0.534	1.249
STD.DEV.	12.278	1.492	4.295	38.268	2.605	5.558	0.507	0.768

Source: Author's compilation from Eviews 10

During this period, household debt to income ratio (HHD) for South Africa averaged at 65.89% with a low of 51%, a high of 87.8% and a standard deviation of 12.27%. The standard deviation indicates that, on average, household debt ratio lies 12.27% away from the mean rate of 65 in our 108-observation sample. The maximum of 87.8% shows that the increase in income of households allowed for increased access to credit, while spending grew faster than income growth. The minimum of 51% shows that as incomes became more stagnant, households could no longer afford to borrow more. The prime overdraft rate (INT) has a maximum of

25% because of the tightening of monetary conditions, and the minimum as a result of a decline in the cost of funding (repurchase rate).

With regards to gross domestic product growth rate (GDP), the maximum of 1.4% is an indication of the improved performance in economic activity while the minimum of -0.53% is a reflection of ongoing sinking economic conditions. The ratio of final consumption expenditure by households to gross domestic product (CONS) had the lowest range (maximum – minimum). The low range of 6.5% means that the slow growth in consumption is consistent with slow growth in gross domestic product, where stagnant economic growth leads to an increase in the prices of products leading to a decline in consumer confidence. A 3.9% maximum in inflation (CPI) shows higher food prices and the minimum shows a decrease in the price of goods and services.

The maximum (24%) and minimum (-12%) percentage change in disposable income of households (HDI) is an indication of periods when income matches inflation. The high ratio (400%) of household wealth to disposable income of households (HNW) shows how an increase in income could have such positive wealth effects. This increase in income also motivates household savings. However, a weak ratio (9.7%) of saving by households to disposable income (HNS) by households is a result of a strong propensity to consume.

4.4 Correlation matrix

Correlation analysis measures the strength and direction of the linear association between two variables using the correlation coefficient (Gujarati & Porter, 2009). Using covariance analysis, we computed the correlation coefficient as well as the probability of independent variables in relation to the dependent variable. The correlation coefficient of 1 describes the perfect positive relationship, while the probability of 0 shows a significant relationship between variables. The results in table 4.2 show a negative significant linear relationship between household debt

and interest rates of 68%. The coefficient of 68% indicates the extent to which household debt increases with a corresponding decrease in interest rates. The results coincide with theory, which shows that the demand for debt increases when interest rates are low.

Further results show a strong significant relationship between household debt and consumption expenditure, household wealth, household savings and inflation of 64%, 83%, 76% and 56% respectively. These results indicate a strong parallel relationship between the dependent variable and independent variables. These correlation results indicate a negative relationship between household debt and consumption expenditure, household savings, household income and inflation. Moreover, a positive relationship between household debt and household wealth as well as GDP is identified. A negative significant relationship between household debt and consumption expenditure indicates that when households increase their debt, they decrease their consumption expenditure. This result is an unexpected but implies that when households incur debt, it is not for consumption purposes. The results further indicate a positive significant relationship between household debt and household wealth. This shows that household wealth increases with household debt. A negative significant relationship is shown between household debt and household savings indicating that when households increase their savings, they reduce their debt. Furthermore, the negative significant relationship between household debt and inflation indicates that as inflation rises household debt decreases. However, a weak insignificant relationship between household debt and household income and GDP of 2.8% and 13% is presented. This implies that households incur debt irrespective of whether the economy is growing or stagnating. This could be due to mortgage borrowers becoming homeowners.

Table 4.2: Correlation analysis results

Corr. Coefficient Probability	**HHD**
CONS	-0.6425*** 0.0000
INT	-0.6814*** 0.0000
HNW	0.8326*** 0.0000
HNS	-0.7612*** 0.0000
HDI	-0.0280 0.7738
GDP	0.1300 0.1960
CPI	-0.5600*** 0.0000

Source: Author's compilation from Eviews 10

4.5 Unit Root Tests

This study performed unit root tests as discussed in the previous chapter. Both the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests were performed in order to investigate the stationarity of variables. If the study could not reject the null hypothesis of a unit root at level, then tests were done to check whether variables were stationary at first difference. The results of the ADF and PP tests are reported in Table 4.3. The tests were carried out at level with intercept, trend and intercept and neither trend nor intercept. The lag length was automatically selected by Schwarz Information Criterion and Bartlett Kernel for ADF and for PP respectively. The results from table 4.3 shows that variables (CONS, HDI, HNW & HNS) were stationary at level while variables (HHD, INT, CPI & GDP) were stationary at first difference.

Table 4.3: Unit root results

Variables	Model	ADF	Philips-Peron
Household debt (HHD)	Intercept	3.535946*** I(1)	9.745918*** I(1)
	Trend & Intercept	3.569492*** I(1)	9.581489*** I(1)
	None	3.481090*** I(1)	9.711656*** I(1)
Interest Rate (INT)	Intercept	6.766405*** I(1)	6.410605*** I(1)
	Trend & Intercept	3.416945* I(0)	6.381607*** I(1)
	None	6.743990*** I(1)	6.457689*** I(1)
Consumption (CONS)	Intercept	10.26289*** I(1)	12.34109*** I(1)
	Trend & Intercept	4.304374*** I(0)	4.171366*** I(0)
	None	10.29835*** I(1)	12.38550*** I(1)
Inflation (CPI)	Intercept	7.675364*** I(1)	11.88904*** I(1)
	Trend & Intercept	7.836759*** I(1)	16.17734*** I(1)
	None	7.521718*** I(1)	10.68944*** I(1)
Household income (HDI)	Intercept	3.739212*** I(0)	12.17353*** I(0)
	Trend & Intercept	3.723506** I(0)	12.11802*** I(0)
	None	2.336251** I(0)	10.52985*** I(0)
Household wealth(HNW)	Intercept	8.919511*** I(1)	8.828205*** I(1)
	Trend & Intercept	3.253886* I(0)	3.253886* I(0)
	None	8.951521*** I(1)	8.862536*** I(1)
Household saving (HNS)	Intercept	3.094561** I(0)	3.387819** I(0)
	Trend & Intercept	6.458566*** I(0)	6.490394*** I(0)
	None	3.663555*** I(0)	3.579122*** I(0)
Gross Domestic Product (GDP)	Intercept	10.19842*** I(1)	10.20207*** I(1)
	Trend & Intercept	10.22626*** I(1)	10.24573*** I(1)
	None	10.24695*** I(1)	10.25242*** I(1)

Source: Author's calculations from Eviews 10

Note: *, **, *** shows that the Augmented Dickey-Fuller test and Phillips-Perron test statistic is significant at 10%, 5%, and 1% respectively. I(0) denotes stationary at level, while I(1) denotes stationary at first difference.

4.6 Lag Length Selection

In order to perform co-integration tests using the ARDL and VECM models, the optimal lag length was determined beforehand using VAR. Several information criteria were used to obtain the maximum optimal lag length as shown in table 4.4.

Table 4.4: VAR results

Variables	Lag	LogL	LR	FPE	AIC	SC	HQ
DHHD DINT	1	-295.145	27.929	1.504*	6.084*	6.241*	6.147*
DHHD DCPI	4	-156.399	17.867*	0.116*	3.523*	3.995	3.714
DHHD CONS	3	-262.001	24.091*	0.905*	5.576*	5.943	5.724*
DHHD HDI	6	-412.663	31.125*	24.268*	8.862*	9.543	9.138
DHHD HNW	1	-539.619	263.175	209.953*	11.023*	11.180*	11.086*
DHHD HNS	5	-296.530	10.773*	2.140*	6.435*	7.012	6.668
DHHD DGDP	3	-147.299	11.286*	0.089*	3.259*	3.626	3.407

Source: Author's compilation from Eviews 10

Note: * indicates lag order selected by the criterion
LogL: log likelihood
LR: Sequential modified LR test statistic
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

4.7 Diagnostic tests for the regression model

Diagnostic tests were performed to check the validity of the VAR and Ordinary Least Squares (OLS). These tests were carried out in order to ensure that the models are reliable and fit. The models had to be tested for multi-collinearity, serial correlation, normality and heteroscedasticity. The tests used were Correlation analysis for multi-collinearity, the Breusch-Godfrey Lagrange Multiplier (LM) test

for serial correlation, the Jarque-Bera test for normality, and the Breusch-Pagan test for heteroscedasticity.

4.7.1 Measuring the degree of multi-collinearity

We do not test for multi-collinearity, as some degree of multi-collinearity exists in every series, but only measure the strength (Brooks, 2014). There are various acceptable methods that can be used to measure multi-collinearity but none of them are official (Studenmund, 2017). In this study, correlation analysis is used to detect severe multi-collinearity between independent variables. In this section correlation coefficients are not used to test the significance or the direction of the relationship between variables but to detect a strong or near perfect relationship between independent variables. A high correlation coefficient between variables is the cause of multi-collinearity, therefore a correlation coefficient of more than 0.80 is too high (Studenmund, 2017:251). According to Studenmund (2017) when the correlation coefficient is more than 0.80, one of the two variables should be dropped, or the sample size should be increased. The results of the correlation analysis in table 4.5 shows that the correlation coefficients between independent variables shows no sign of multi-collinearity.

Table 4.5: Multi-collinearity results

Correlation coefficient	**CONS**	**INT**	**HNW**	**HNS**	**HDI**	**GDP**
INT	0.6209					
HNW	-0.6754	-0.7457				
HNS	0.5082	0.6851	-0.7524			
HDI	0.0390	-0.1106	0.0572	0.0244		
GDP	0.1263	-0.2912	0.1754	-0.3372	0.3141	
CPI	0.2520	0.6688	-0.4751	0.5940	-0.1482	-0.4722

Source: Author's compilation from Eviews 10

4.7.2 Test for serial correlation

The Breusch-Godfrey Serial Correlation LM test is used to detect the presence of auto correlation. The null hypothesis of this test is that there is no serial correlation and the alternative is that there is serial correlation. In order for the model to be without serial correlation, the probability value should be more than 0.05. The summary of results from the test provided in table 4.6 indicate that the probability value of 0.1170 is more than 0.05. Therefore, we failed to reject the null hypothesis, which means that the model does not have any serial correlation. The full results are presented in the appendices (see appendix A1).

4.7.3 Test for Normality

The Jacque-Bera test is used for normality in the model. The null hypothesis is that the model is normally distributed while the alternative is that the model is not normally distributed. In order for the residuals to follow normal distribution, the probability value should be more than 0.05. The summary of results provided in table 4.6 shows a probability value of 0.0007 is less than 0.05. Therefore, we reject the null hypothesis that the residuals are normally distributed. This means that the model is not normally distributed and does not pass one of the assumptions of a good regression model. However, Harris (1995) disputes the view that non-normality invalidates or creates bias for the model. Moreover, Gujarati and Porter (2009:544) as well as Studenmund (2017:117) are in agreement that normal distribution is not a prerequisite for OLS estimation. The full results are presented in the appendices (see Appendix A2).

4.7.4 Test for heteroscedasticity

The Breusch-Pagan model is used to test for heteroscedasticity in the model. The null hypothesis is homoscedasticity, the alternative being heteroscedasticity. In order for variance to be homoscedastic, the value of the probability should be more

than 0.05. The summary of results presented in table 4.6 indicate that probability value of 0.7613 is more than 0.05. Therefore, we fail to reject the null hypothesis meaning that there is homoscedasticity. The residual is linear, and the variance is constant in the model. The full results are presented in the appendices (see Appendix A3).

Table 4.6: Diagnostic tests results

Test	Model	Null hypothesis	F-statistic	Probability
Serial correlation	Breusch-Godfrey	No serial correlation	5.4503	0.1170
Heteroscedasticity	Breusch-Pagan	Homoscedasticity	0.5124	0.7613
Normality	Jarque-Bera	Normal distribution	14.4655	0.0007

4.8 Regression analysis

The Ordinary Least Squares method was used in order to find the existence of a deterministic relationship between variables. The null hypothesis is that there is no relationship between household debt and the independent variables, the alternative being that there is a relationship between household debt and independent variables. In order for a significant relationship to exist, the probability value should be less than 0.05. This means that when the probability value is more than 0.05 then the relationship is insignificant. The results in table 4.7 indicate that only DGDP, CONS and HDI are significant to DHHD, while DINT, DCPI, HNW and HNS are insignificant to DHHD.

The F-statistic, which is used to determine the joint significance of the variables is highly significant. The corresponding probability value of F-statistics is 0.001 which is less than 0.05 as desired. The value of the r-squared is high (52%), meaning that the model and the data are better fitted. This high percentage means that 52

percent of variation in our dependent variable (DHHD) can be explained by the influence of the independent variables jointly. This means that 48 percent of the variation can be explained by other external influences. The Durbin-Watson statistic confirms the results of the diagnostic tests by showing the absence of any serial correlation with a value of 1.8, which is close to 2. The sign of the coefficient of the variables should coincide with either theory or empirical studies. There is a positive relationship between household debt and its lagged value at time t-1, this shows that household debt is persistent and keeps increasing year on year.

The negative insignificant relationship between household debt and interest rates confirms the loanable funds theory. The results show that when interest rates go up by one unit then household debt goes down 0.0149 units. Theoretically, as interest rates increase, debt becomes expensive and the demand for credit and ultimately household debt decrease. De Wet, Botha and Booyens (2015) found the same negative relationship between credit demand and interest rates. Similarly, Koivu (2008) and Mutezo (2014) found that interest rates have a negative relationship with household debt. Other scholars such as, Meng, Hoang and Siriwardana, (2013) and Mian, Sufi and Verner (2017) confirm a negative relationship between these variables. This confirms that during periods of low interest rates, households tend to borrow more. These results however, found the relationship to be insignificant. Other authors such as Chung (2009) also found an insignificant relationship between household debt and interest rates.

The negative insignificant relationship between inflation and household debt means that when inflation goes up by one unit then household debt goes down 0.5571 units; this is not an expected result. Meng *et al.,* (2013) and De Wet *et al.,* (2015) found similar results implying that an increase in the level of inflation discourages households from borrowing According to monetary policy, the increase in the price of goods and services influences household debt to increase as consumption becomes expensive.

The positive significant relationship between consumption expenditure and household debt is in line with the life cycle theory (Modigliani, 1975) and was expected. According to theory, households opt to smooth current consumption by borrowing. Therefore, debt by households is due to additional consumption which households prefer not to postpone. Our results show that when consumption expenditure goes up by one unit, then household debt goes up by 0.255. Similar results were found by Meniago, Mukuddem-Petersen, Petersen and Mogale (2013) as well as by Bunn and Rostom (2014). Household consumption has been the main source of growth in the economy recently (MPR, 2016). This implies that in order for household debt to stabilise, the policymakers should focus on other major sources of economic growth excluding household consumption and household debt as spending now exceeds income.

The negative significant relationship between household income and household debt means that when household income goes up by one unit then household debt goes down by 0.0625 units. According to the permanent income hypothesis (Friedman, 1957), during periods of low or stagnant income, households incur debt in order to afford the current with the aim of paying when income increases. Therefore, when income increases, households are able to pay off their debts. Meniago *et al.,* (2013) found similar evidence, which shows that when household income increases, households are able to build up a desired level of wealth.

The positive insignificant relationship between household wealth and household debt means that, when household wealth goes up by one unit then household debt also goes up by 0.0021 units. This result is not in line with theory and was not expected. A negative relationship between household debt and household wealth was expected. According to the life cycle theory, households acquire assets (wealth) later on in life when their debt levels are lower.

The negative relationship between household savings and household debt means that when household savings goes up by one unit then household debt goes down by 0.1508 units. The permanent income hypothesis asserts that when households can afford to save, then they can afford not to take up more but pay their current debts instead (Friedman, 1957). Similar results were found by Setterfield and Kim (2016) as well as by Scott and Pressman (2015). Such studies are an indication that households fund their consumption with savings during tough times, then acquire more debt when savings are not sufficient.

The positive significant relationship between gross domestic product and household debt is in line with theory. According to the credit channel of monetary transmission mechanism, during an expansionary monetary policy, household debt as well as aggregate output increase. Our results show that households acquire more debt during developmental economic conditions means that when gross domestic product goes up by one unit then household debt goes up by 0.7648 units. Numerous authors (Meng *et al.,* 2013; Meniago *et al.,* 2013; Kim, Lee, Son and Son (2014); Chmelar, 2013) confirm these results. The implication on the monetary policy is that monetary stances chosen by policy makers in order to grow the economy or target inflation, also affect levels of household debt.

Table 4.7: OLS results

Dependent variable: DHHD		
Variable	**Coefficient**	**Probability**
C	-16.3696	0.0849
DHHD (-1)	0.0357	07126
DINT	-0.0149	0.9195
DCPI	-0.5572	0.3153
CONS	0.2559	0.0502
HDI	-0.0626	0.0311
HNW	0.0021	0.7487
HNS	-0.1508	0.0908
DGDP	0.7648	0.0269
R-squared: F-statistics: Probability (F-stats): Durbin-Watson stat:	0.5252 3.5242 0.0013 1.8143	

Source: Author's compilation from Eviews 10

4.9 Auto Regressive Distributive Lag (ARDL) bounds test

Following the regression, where we determined the existence of a relationship between variables, the ARDL bounds test was used to test for long-run relationship/ co-integration. Even though unit root testing of variables is not a requirement for ARDL, the test still provided direction on whether ARDL is applicable. This is because the ARDL test can only be used for variables that are integrated in the order of one or zero. The results were obtained from the ARDL estimation approach, where most variables were integrated at first difference except household saving (HNS) and household income (HDI), which were integrated at level. Furthermore, the lag lengths were already determined in section 4.6 and were be used again in this model.

The value of the f-statistics is compared to the critical values at 0.05 level provided by Pesaran, Shin and Smith (2001:303) and since our model is unrestricted, has indicated an intercept and no trend; the lower bound is 2.86 and the upper bound is 3.22. The null hypothesis is that the dependent variable and the independent variable are equal to zero, meaning that there is no long-run association. When the f-statistics value is more than the upper bound value, we can reject the null hypothesis.

The summary of the bounds test results provided in table 4.8 indicates the existence of a long-run relationship between interest rates and household debt. The f-statistics value is greater than both the lower and the upper critical bounds, therefore, we reject the null hypothesis. These results show that the relationship is significant at one percent level. These results imply that households have a tendency to increase borrowing during periods of cyclical upturns when the cost of debt is lower. These low borrowing costs also make existing debt cheaper to repay. Moreover, access to credit during these times also contributes to an increase in household debt. The opposite can also be said that during economic downturns when borrowing is expensive, households are discouraged from borrowing. From these results, we can conclude that an upsurge in household debt can be linked with reduced interest rates in the long-run. These results are consistent with other studies, for example Mutezo (2014) infers that the rising levels in household debt is due to a combination of factors which includes low interest rates, while Meng *et al.,* (2013) deduces that interest rates have a negative impact of household debt.
The results also indicate a long-run association between household debt and inflation. The f-statistics value shows significance at 1%. The results imply that in the long-run households tend to decrease borrowing due to increased levels of inflation. These results coincide with previous studies. Meng *et al.,* (2013) point out the impact that inflation has on both the demand for debt by devaluing the debt and the supply of household debt by discouraging lending through erosion of principal.

A long-run association between household debt and consumption expenditure indicates that households increase their borrowing in order to fund for consumption. Moreover, the level of significance shows that households' consumption expenditure positively contributes to household debt. These results are consistent with previous research, for example, Mutezo (2014) suggests that an increase in the consumption of households sustains high levels of household debt. Similarly, Lombardi, Mohanty and Shim (2017) report that higher household consumption is associated with household indebtedness in the long-run.

The results further indicate a long-run relationship between household debt and household income. This implies that when household members get an increase in their income, they reduce their current debt and new debt uptake even though they have access to more credit. This finding is consistent to previous studies, Chipeta and Mbululu (2012) debate that households who earn more, do not borrow more since they can afford their consumption levels.

ARDL results indicate a long-run association between household debt and GDP. This implies that households borrow during periods of monetary expansion and less during periods of contraction. Meng *et al.,* (2013) agree that consumers feel confident enough to borrow during periods of economic development.

The f-statistics value of household savings indicate a long-run relationship. From these results we can conclude that households incur debt during periods of low savings. These results are similar to those of Setterfield and Kim (2016) who contend that household debt can be attached to low savings.

The results of the ARDL test indicate an f-statistics value of 2.666 for household wealth; this shows no evidence of a long-run relationship between household debt and household wealth. The f-statistics value is lower than all the critical values and is insignificant. This implies that households acquire debt irrespective of the increase or decrease in their wealth.

Table 4.8: ARDL results

Dependent variable: DHHD						
Independent variables	**F-statistics value**		**Co-integration status**			
Interest rates (DINT)	16.333***		Co-integrated			
Inflation (DCPI)	7.485***		Co-integrated			
Consumption exp. (CONS)	8.578***		Co-integrated			
Household income (HDI)	18.881***		Co-integrated			
Household wealth (HNW)	2.666		Not co-integrated			
Household savings (HNS)	12.078***		Co-integrated			
Gross Dom. Product (DGDP)	8.798***		Co-integrated			
Asymptotic Critical Values						
Pesaran *et al.,* (2001: 303), Table CII (iii) Case III	1%		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	3.43	3.82	2.86	3.22	2.57	2.91

Source: Author's calculations from Eviews 10
Note: *** denotes significant at 1% level

4.10 Vector Error Correction Model (VECM)

The VECM was specified after detecting co-integration among variables. It specified long-run and short-run dynamics between variables. This model was used for robustness purposes as well as to confirm results of the ARDL model and granger causality tests. Now that we have detected the existence of a long-run relationship for most of the variables, we can continue with VECM. However, since there was no long-run association between household debt and household wealth from the ARDL model, we cannot run restricted VAR (VECM) on these variables. Moreover, all variables were run at the same order of first difference. The speed

of adjustment towards the long-run equilibrium must be negative in sign and the probability must be significant for a long-run relationship to exist.

4.10.1 VECM long-run results

A summary of the long-run results is presented in table 4.9. The results revealed a long-run causality that runs from interest rates to household debt. The coefficient of -0.2419 indicated a significant relationship and that the model restores to its equilibrium 24.20% every quarter. This confirms the results found by the ARDL model. The implication of these results is that changes in interest rates have an influence on the borrowing of households in the long-run. The positive changes in interest rates discourage consumers from borrowing while negative changes encourage borrowing in the long-run. The error correction term of -0.01 means that there is a long-run relationship from inflation to household debt. This implies that the increase in the price of goods and services influences a decrease in household debt in the long-run. The coefficient of the co-integrating model shows that consumption has an influence of household debt in the long-run. This implies that as households consume more with the same income, they acquire debt to fund this consumption. The coefficient of -0.4303 indicates the speed of adjustment towards the long-run equilibrium of 43%. The long-run causality running from income implies that households are confident to acquire more debt when income levels have increased. The results further indicate that household saving has an influence on household debt in the long-run, implying that households do not acquire debt when they can afford to save. Moreover, there is a long-run causality running from GDP to household debt, indicating that households are motivated to borrow during periods of economic growth. Furthermore, a long-run relationship from household debt to interest rates was found. This result confirms the results found from the ARDL model.

Table 4.9: VECM long-run results

Dependent variable: DHHD					
Independent variables	**Lags**	**Probability**	**Std. Error**	**t-Stats**	**Coefficient**
Interest rates (DINT)	1	0.0022	0.077092	-3.13883	-0.241978
Inflation (DCPI)	4	0.7463	0.03118	-0.32454	-0.010099
Consumption exp. (CONS)	3	0.0054	0.148330	-2.84561	-0.422090
Household income (HDI)	6	0.0025	0.137985	-3.11896	-0.430370
Household savings (HNS)	5	0.0790	0.150562	-1.77682	-0.267521
Gross Domestic Product (DGDP)	3	0.0012	0.162706	-3.35033	-0.545120
Dependent variable: DINT					
Household debt (DHHD)	1	0.0000	0.100306	-5.65986	-0.567719

Source: Author's compilation from Eviews 10

4.10.2 VECM short-run results

A summary of the short-run causality results between dependent and independent variables is provided in table 4.10. The results show that there is short-run causality running household income to household debt. The coefficient is positive, which means that an increase in household income has an influence on household debt in the short-run. These results imply that in the short-run when households get an income increase, they acquire more debt. Logically, they qualify for more debt and can increase their standard of living because of access to credit.

The rest of the independent variables show no short-run causal relationship with household debt. Furthermore, a short-run causal relationship running from

household debt to interest rates was found. The results imply that in the short-run and when households take up more debt, this boosts the economy but then shortly after that the MPC lowers or stabilises interest rates.

Table 4.10: VECM short-run results

Dependent variable: DHHD	**Probability**	**Coefficient**
Interest rates (**DINT)**	0.2618	1.2593
Inflation	0.5347	3.1396
Consumption expenditure	0.0667	7.1678
Household Income	0.0001	27.0243
Household wealth	0.4889	0.4790
Household saving	0.1151	8.8522
Gross Dom. Product	0.8349	0.8608
Dependent variable: DINT	**Probability**	**Coefficient**
Household debt	0.0091	6.7980

Source: Author's compilation from Eviews 10

4.11 Granger Causality

Following co-integration, we test for long-run causality using the Granger causality test. We only test causality between household debt and interest rates, as this is one of the objectives of the study. The null hypothesis says that interest rates do not Granger cause household debt and household debt does not Granger cause interest rates. The probability should be less than 0.05 in order for us to reject the null hypothesis. However, for both the first and the fourth lag, the probability values are more than 0.05. Therefore, we fail to reject the null hypothesis and conclude that there is no long-run causality between household debt and interest rates.

These results were not expected as indicated by the monetary transmission mechanism.

Table 4.11: Granger Causality results

Null hypothesis	**Lags**	**F-statistic**	**Probability**
DINT does not Granger Cause DHHD	1	1.2590	0.2645
DHHD does not Granger Cause DINT	1	0.2734	0.6022
DHHD does not Granger Cause DINT	4	0.3242	0.8611
DINT does not Granger Cause DHHD	4	1.5720	0.1882

4.12 Conclusion

Analysis was completed in five phases consisting of 10 sections successfully using Eviews 10. This chapter started with descriptive statistics, which explain the sample followed by the correlation matrix, which explained the linear relationships between variables. Prior to analysis, unit root results of the augmented Dickey-Fuller and Phillips-Perron test revealed that some variables were at stationary level and some variables at first difference.

The VAR model was estimated in order to determine the lag lengths followed by pre-diagnostic tests. The diagnostic tests were performed and revealed that residuals were not normally distributed, however, that did not invalidate our model. The results of the regression model found a negative and insignificant relationship between household debt and interest rates. Furthermore, a negative relationship was found between household debt and inflation, household income and household savings; while a positive relationship was found between household debt and consumption and household wealth and gross domestic product. The ARDL model for co-integration indicates a long-run relationship between household debt and interest rates, while the VECM indicates both long-run

relationship and short-run causality. The Granger causality model showed no long-run causal relationship between the two variables.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The preceding chapter discussed the results of the various econometric tests performed using the EViews software. The various tests were performed in order to explain the relationship between household debt and interest rates as well as household debt and other variables. The analysis commenced by unit root tests; this was done in preparation of regression analysis and co-integration models. Once all pre-diagnostic tests were done, regression analysis was performed using the Ordinary Least Squares (OLS) method in order for a deterministic relationship between household and interest rates as well as household debt and other independent variables. The co-integration analysis was done using the Autoregressive distributive lag (ARDL) bounds test for household debt and all independent variables. Then, the Vector Error Correction Model was also used for long-run and short-run dynamics. Finally, the causal relationship between household debt and interest rates was tested using the Granger Causality test. Furthermore, results were discussed within the context of relevant theories and other empirical studies.

The main aim of this chapter is, firstly, to highlight the theoretical framework that explains the nexus between household debt and interest rates and also between household debt and other variables. Secondly it provides the summary of results and the policy implications of the results in this study. Thirdly, it discusses the main theoretical, methodological, and findings contribution of the study. Fourthly, it highlights the major shortcomings of the study, and finally, it provides some recommendations and possible direction for future studies.

This chapter proceeds as follows: Section 5.2 highlights the theoretical contribution of this study, while section 5.3 provides a summary of the results and policy

implications of the results. Section 5.4 discusses the limitations of the study and finally Section 5.5 discusses the recommendations and direction for future studies.

5.2 Theoretical framework

This study was based on three main theories that explained the link between household debt and interest rate as well as household debt and other variables. These theories included the loanable funds theory, channels of monetary transmission mechanisms, and the consumption theory and these are discussed in the following sections in that order.

5.2.1 Loanable Fund's Theory

The loanable funds theory explains the linkage between interest rate and household debt. The theory is based on the relationship between demand and supply for loanable funds (credit) and the rate of interest (Ohlin, 1937). This theory needs the presence of lenders and borrowers in order to exist (Bertocco, 2005). The interaction between savers and borrowers determine the equilibrium price of loanable funds, which is the interest rate. Even though in reality there are many interest rates, this framework assumes that there is only one interest rate in order to understand the general trend of interest rates. The supply curve of loanable funds shows that as the quantity of loanable funds supplied increases, there is a simultaneous increase in interest rates (Brandl, 2017). While the demand curve shows that as the demand for loanable funds increases, there is a simultaneous decrease in interest rates. The downward slope of the demand curve is an indication that borrowers are encouraged to increase their borrowing at low interest rates as borrowing is cheaper (Brandl, 2017). Therefore, this theory implies that there is a negative relationship between the demand for credit and interest rates.

5.2.2 Channels of monetary transmission mechanism

This theory explains how changes in monetary policy affect the borrowing patterns of individuals. The channels of monetary policy transmission mechanism describe how policy decisions affect the economy (SARB, 2016a). These decisions are made to directly affect the economic performance and indirectly influence other factors such as credit. The channels describe how the different policy stances affect households, such as the expansionary policy which reduces interest rates and encourages borrowing in order to boost the economy. The interest rate channel and the credit channel highlight the indirect influence of policy adjustments on household debt. The interest rate channel focuses on how changes in interest rates affect the prime lending rate (Gumata, Kabundi & Ndou, 2013) and ultimately the consumption and demand for credit by households (Igan, Kabundi, Nadal-De Simone & Tamirisa, 2013). The credit channel focuses on how changes in interest rates affect the demand and supply of loans and credit.

5.2.3 Consumption theories

The life-cycle hypothesis (LCH) by Modigliani (1975) assumes that in order to smooth current consumption, consumers incur large amounts of debt early in life. Households tend to maximise utility over their life-cycle in order to overcome income shocks. Therefore, households make decisions on current consumption based on future income (Saad, 2011). The income of an individual increases throughout their life and decreases towards retirement. During periods of low income, households borrow to fund current consumption with the aim of repayment in future when income is higher (D'Allessio & Lezzi, 2013). This theory also emphasises that households' savings are negative during their early working life and during retirement and they incur debt to fund consumption. According to Wildauer (2016) the life-cycle model depends on households that can differentiate fluctuations of income and wealth that are permanent and those that are

temporary. Therefore, this theory assumes that interest rate levels are irrelevant when it comes to household marginal propensity to borrow.

5.3 Summary of results and policy implications

The first broad objective of this study was to investigate the nature of relationship between household debt and interest rates in South Africa. The results from the regression model indicated a negative and insignificant relation concerning household debt and interest rates. The negative relationship confirms the loanable funds theory as well as the interest rate channel of monetary transmission, which asserts that a low interest rate environment inspires borrowing. These results correspond with what Meng, Hoang and Siriwardana (2013) found. The ARDL and VECM results showed that there is a long-run association between interest rates and household debt. VECM shows that there is no short-run causality from household debt to interest rates, but the existence of a short-run causal relationship from household debt to interest rates. The results implies that policy makers should take into account the consequences of inflation targeting through monetary policy. The effects of policy-induced changes are slow to reflect on inflation as well as household debt and this can only be witnessed in the long-run. The results also indicated that there is no Granger causality that runs from interest rates to household debt. This means that a long-run change in interest rates does not lead to a change in household debt. Therefore, this means that although there is a co-integrating relationship between household debt and interest rates the nature of relationship in the form of Granger causality is insignificant.

The results showed a negative insignificant relationship between inflation and household debt. These results are contradictory to the channels of monetary transmission mechanism, which contends that during periods of high inflation, the cost of living increases and households react by borrowing. However, the monetary authorities tend to respond through increasing interest rates to counter it. The increase in interest rates ultimately discourages borrowing. These results

are consistent with that of De Wet, Botha and Booyens (2015). Co-integration analysis by ARDL indicated the existence of a long-run association between the inflation and household debt, however, this was not confirmed by the VECM.

According to the life-cycle theory, a positive significant relation exists between consumption expenditure and household debt as households are not prepared to sacrifice their increased levels of consumption but would rather borrow. The results of this study confirm this theory, similarly Bunn and Rostom (2014) concur with these results. Furthermore, ARDL and VECM indicate the existence of co-integration but not short-run dynamics between household debt and household consumption. This implies that households consider the duration of their life when consuming meaning higher consumption during the early years. The implication on policy, is that consumption expenditure should not be promoted in order to boost the economy, but other contributors of growth should be focused on.

In examining the nexus between household income and household debt the results showed a negative significant relation between household income and household debt. These results correspond with the life-cycle theory, which postulates that households incur debt during periods when their income in not sufficient for consumption. The negative relationship implies that during periods of high disposable income, households opt to pay off their debts, Meniago, Mukuddem-Petersen, Petersen and Mogale (2013) found similar results. The implications of these results show that one of the consequences of economic growth should be household income growth in order for households to be able to manage their debt levels. The existence of a long-run association as well as short-run dynamic indicates that current as well as future income have an impact on household debt. Household wealth has a negative but insignificant relationship with household debt. According to the life cycle theory, households do not invest in assets when income levels are low but borrow in order to fund consumption. However, households accumulate wealth by obtaining assets later on in life and reduce their borrowing. These results are in line with the life cycle theory. The expansionary

policy creates an increase in the demand for wealth, however, households cannot afford to pay cash for assets such as houses. Therefore, households borrow in order to obtain those assets. The results from the long-run association as well as short-run dynamics indicate no relation between household debt and household wealth.

The results of this study confirm the life cycle theory, which asserts a negative relation between saving and household debt. Setterfield and Kim (2016) found similar results. The results imply that during periods when households cannot afford consumption, savings are reduced in order to compensate for consumption. Moreover, not only is there dissaving but households decide to increase debt uptake. The implication of these results indicates that during low interest environment, further dissaving will occur which may not necessarily be an objective of emerging markets monetary policies. Further results indicate a long-run association between household debt and household saving, implying the effects of low saving rates on household debt in the long-run.

According to the channels of monetary transmission mechanism, there is a positive relation between household debt and gross domestic product (GDP). The results of this study are in agreement with theory, which implies that households are encouraged to borrow during an expansionary policy, which affects aggregate demand by lowering interest rates. Kim, Lee, Son and Son's (2014) results also show that household debt increases as economic growth increases. This means policy makers should be aware of the adverse effect that the different policy stance has on the increase in household debt when implementing policies that improve economic growth. However, the effects may not be so catastrophic during economic growth, as unemployment is lower and households may service their debt.

5.4 Contribution of the study

There are four major contributions of this study. Firstly, there is a significant methodological contribution as we comprehensively investigate the linkages between household debt and interest rates and also the nexus between household debt and other macro-economic variables. Different from other studies we investigated the deterministic relationship, long-rung association and Granger causality amongst the variables. While most studies focused only on the long-run association between variables this study further looked at short-run dynamics and the Granger causality on selected variables. Moreover, even the well analysed long-run relationship of the present study is unique in that it uses the ARDL method, while other studies use popular methods such as the Johansen and the VECM only.

Secondly, some of the results in this study are quite different from other studies, especially, the revelation that debt increases with economic growth. However, the results of this study are consistent with the results of other studies. The theoretical contribution of this study entails the loanable fund's theory as well as the channels of monetary transmission mechanism.

Thirdly, the period analysed (1990 - 2016) was long enough as it captured most of the important periods in the field of finance in South Africa. These important periods or events include the implementation of the National Credit Act, the end of the Apartheid Era and year 2007/8 financial crisis.

Finally, the study contributes immensely to policy implementation as our research provided possible policy action depending with what the country wants to achieve.

5.5 Recommendations

The co-integration results indicate a significant relationship between interest rates and household debt. Therefore, we recommend that policy makers should monitor the policies that enhance economic growth especially during different economic cycles. This means that while they strive for economic growth, its negative implication on household debt in the long-run should be considered. This could be done by implementing different policy stances during the different economic cycles. Moreover, moderate household debt is what the country should strive for in order for the economic growth target to be achieved. Households should be advised about over committing themselves during periods of low interest rate, as they can rather take advantage by speeding up their debt repayments and improving their bank balances.

The regression and co-integration results indicate a positive significant long-run association between household debt and household consumption. Meanwhile, although household consumption expenditure is a contributor of economic growth, policy makers should be concerned with how high household consumption results in high levels of household debt. Households should be counselled on the dangers of debt uptake during economic downturns but rather be encouraged to curb consumption.

Household income is indicated to have a significant impact on the increase of household debt. Therefore, credit regulators should be concerned with how lending institutions go through proper affordability checks when lending to households. Credit regulators should also ensure that there are programs that are available to households in terms of dealing with debt. Households should be advised not to rely on future income when obtaining debt but rather on current income.

5.6 Limitations of the study and areas for further research

The study was conducted using data collected in South African households. Therefore, the study is focused on South Africa, an emerging market. Moreover, the results of the study may not be generalised to developed markets. The study also used only one unit of measure, therefore future studies should explore the incorporation of other emerging countries such as Brazil, Russia, India, China and South Africa (BRICS) and do a comparison study. Secondly, the period analysed did not separate pre-crisis, during crisis and post crisis. The current study was unable to separate the periods due to data limitation during the crises periods. Further studies should explore the different periods. Finally, future studies are encouraged to specify the different classes and income levels of households.

5.7 Conclusion

The conclusion is that even though there is no long-run causality between household debt and interest rates, the decrease in interest rates has a significant impact on the increase in household debt in the long-run. The study also found other factors to have supported the increase in household debt in South Africa. Moreover, the short-run causal relationship from household to interest rates is unique. The implication of this study is that policy makers and credit regulators should be alert of the effects of policy-induced changes.

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APPENDIX A: Econometric analysis

A1 Serial Correlation results

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

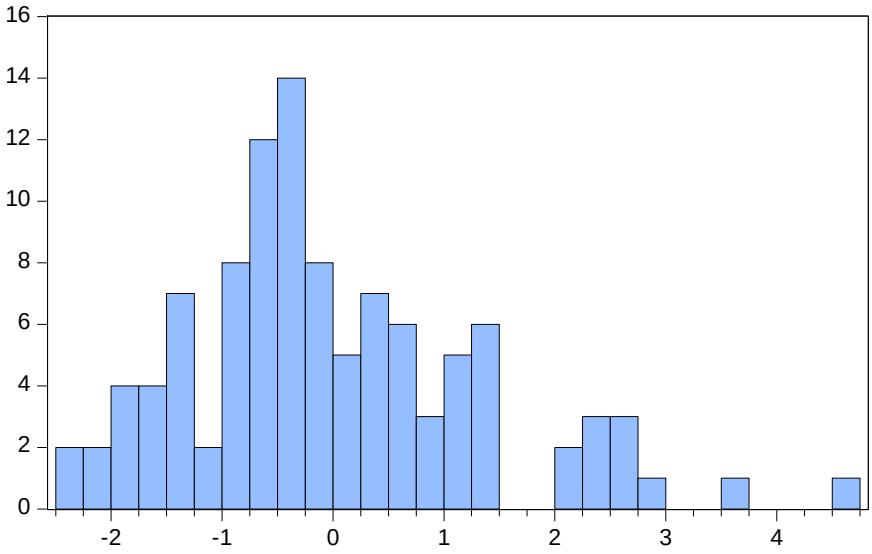
F-statistic	5.450324	Prob. F(1,96)	0.1216
Obs*R-squared	5.694751	Prob. Chi-Square(1)	0.1170

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/12/17 Time: 12:48
Sample: 1990Q3 2016Q4
Included observations: 106
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.795597	9.421313	-0.509016	0.6119
DHHD(-1)	-0.509172	0.237727	-2.141835	0.0347
DINT	-0.003492	0.144545	-0.024160	0.9808
DCPI	0.011046	0.539807	0.020462	0.9837
CONS	0.082016	0.134655	0.609080	0.5439
HDI	0.025539	0.030042	0.850121	0.3974
HNW	-0.000601	0.006397	-0.093915	0.9254
HNS	-0.079763	0.092840	-0.859141	0.3924
GDP	0.098194	0.335443	0.292728	0.7704
RESID(-1)	0.593534	0.254235	2.334593	0.0216

R-squared	0.053724	Mean dependent var	-7.95E-15
Adjusted R-squared	-0.034989	S.D. dependent var	1.316721
S.E. of regression	1.339559	Akaike info criterion	3.512146
Sum squared resid	172.2640	Schwarz criterion	3.763413
Log likelihood	-176.1437	Hannan-Quinn criter.	3.613986
F-statistic	0.605592	Durbin-Watson stat	2.027551
Prob(F-statistic)	0.789502		

A2 Normality results



Series: Residuals	
Sample 1990Q3 2016Q4	
Observations 106	
Mean	-7.95e-15
Median	-0.277790
Maximum	4.526722
Minimum	-2.393350
Std. Dev.	1.316721
Skewness	0.821473
Kurtosis	3.758901
Jarque-Bera	14.46548
Probability	0.000723

A3 Heteroskedasticity results

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.512395	Prob. F(8,97)	0.8445
Obs*R-squared	4.297871	Prob. Chi-Square(8)	0.8293
Scaled explained SS	4.964680	Prob. Chi-Square(8)	0.7613

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/12/17 Time: 12:28
Sample: 1990Q3 2016Q4
Included observations: 106

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.937500	20.04896	-0.296150	0.7677
DHHD(-1)	0.125828	0.206251	0.610072	0.5432
DINT	0.208483	0.315164	0.661508	0.5099
DCPI	0.305842	1.177006	0.259847	0.7955
CONS	0.208353	0.283447	0.735070	0.4641
HDI	0.009341	0.061009	0.153114	0.8786
HNW	-0.014330	0.013937	-1.028219	0.3064
HNS	-0.200849	0.188231	-1.067030	0.2886
GDP	-0.511029	0.725662	-0.704225	0.4830

R-squared	0.040546	Mean dependent var	1.717398
Adjusted R-squared	-0.038584	S.D. dependent var	2.866139
S.E. of regression	2.920910	Akaike info criterion	5.062751
Sum squared resid	827.5763	Schwarz criterion	5.288892
Log likelihood	-259.3258	Hannan-Quinn criter.	5.154407
F-statistic	0.512395	Durbin-Watson stat	1.650615
Prob(F-statistic)	0.844498		

A4 OLS results

Dependent Variable: DHHD
Method: Least Squares
Date: 12/12/17 Time: 12:22
Sample (adjusted): 1990Q3 2016Q4
Included observations: 106 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-16.36964	9.403210	-1.740857	0.0849
DHHD(-1)	0.035742	0.096734	0.369485	0.7126
DINT	-0.014980	0.147816	-0.101344	0.9195
DCPI	-0.557159	0.552030	-1.009291	0.3153
CONS	0.255886	0.132940	1.924823	0.0572
HDI	-0.062578	0.028614	-2.186973	0.0311
HNW	0.002100	0.006537	0.321332	0.7487
HNS	-0.150805	0.088283	-1.708198	0.0908
GDP	0.764812	0.340344	2.247173	0.0269

R-squared	0.525199	Mean dependent var	0.182075
Adjusted R-squared	0.461298	S.D. dependent var	1.495886
S.E. of regression	1.369943	Akaike info criterion	3.548499
Sum squared resid	182.0442	Schwarz criterion	3.774640
Log likelihood	-179.0704	Hannan-Quinn criter.	3.640155
F-statistic	3.524172	Durbin-Watson stat	1.814268
Prob(F-statistic)	0.001282		

A5 ARDL results

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	16.33186	(2, 100)	0.0000
Chi-square	32.66372	2	0.0000

Null Hypothesis: C(4)=C(5)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	-0.732062	0.128347
C(5)	0.177065	0.185832

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	7.485037	(2, 91)	0.0010
Chi-square	14.97007	2	0.0006

Null Hypothesis: C(10)=C(11)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(10)	0.612262	0.158685
C(11)	0.040096	1.416059

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	8.578632	(2, 93)	0.0004
Chi-square	17.15726	2	0.0002

Null Hypothesis: C(9)=C(10)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(9)	0.580223	0.149252
C(10)	0.249965	0.212448

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	18.88114	(2, 85)	0.0000
Chi-square	37.76229	2	0.0000

Null Hypothesis: C(14)=C(15)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(14)	0.349054	0.187417
C(15)	0.244370	0.080656

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.666153	(2, 100)	0.0745
Chi-square	5.332306	2	0.0695

Null Hypothesis: C(4)=C(5)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	0.315319	0.137187
C(5)	-0.001913	0.003867

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	12.07839	(2, 88)	0.0000
Chi-square	24.15677	2	0.0000

Null Hypothesis: C(12)=C(13)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(12)	0.776964	0.158992
C(13)	0.068836	0.057723

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	8.798004	(2, 94)	0.0003
Chi-square	17.59601	2	0.0002

Null Hypothesis: C(8)=C(9)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(8)	0.332170	0.177970
C(9)	0.747123	0.362175

Restrictions are linear in coefficients.

A6 VECM long-run results

Dependent Variable: D(DHHD)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 12/06/17 Time: 12:29
Sample (adjusted): 1990Q4 2016Q4
Included observations: 105 after adjustments
D(DHHD) = C(1)*(DHHD(-1) - 2.34265392232*DINT(-1) - 0.42569396366) + C(2)*D(DHHD(-1)) + C(3)*D(DINT(-1)) + C(4)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.241978	0.077092	-3.138833	0.0022
C(2)	-0.377862	0.087876	-4.299952	0.0000
C(3)	-0.200735	0.178876	-1.122198	0.2644
C(4)	-0.000447	0.157405	-0.002840	0.9977

R-squared	0.326109	Mean dependent var	0.011429
Adjusted R-squared	0.306093	S.D. dependent var	1.935961
S.E. of regression	1.612677	Akaike info criterion	3.831018
Sum squared resid	262.6733	Schwarz criterion	3.932122
Log likelihood	-197.1285	Hannan-Quinn criter.	3.871987
F-statistic	16.29198	Durbin-Watson stat	2.347695
Prob(F-statistic)	0.000000		

Dependent Variable: D(DINT)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 12/06/17 Time: 13:00
Sample (adjusted): 1990Q4 2016Q4
Included observations: 105 after adjustments
D(DINT) = C(1)*(DINT(-1) - 0.426866294877*DHHD(-1) + 0.181714405019) + C(2)*D(DINT(-1)) + C(3)*D(DHHD(-1)) + C(4)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.567719	0.100306	-5.659863	0.0000
C(2)	0.073885	0.099349	0.743694	0.4588
C(3)	-0.127254	0.048807	-2.607308	0.0105
C(4)	-0.003999	0.087424	-0.045747	0.9636

R-squared	0.277157	Mean dependent var	0.000000
Adjusted R-squared	0.255687	S.D. dependent var	1.038199
S.E. of regression	0.895692	Akaike info criterion	2.654910
Sum squared resid	81.02868	Schwarz criterion	2.756014
Log likelihood	-135.3828	Hannan-Quinn criter.	2.695879
F-statistic	12.90869	Durbin-Watson stat	2.090226
Prob(F-statistic)	0.000000		

Dependent Variable: D(DHHD)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/15/18 Time: 12:35
Sample (adjusted): 1991Q3 2016Q4
Included observations: 102 after adjustments
D(DHHD) = C(1)*(DHHD(-1) - 46.3331389876*DCPI(-1) - 1.19904527366) + C(2)*D(DHHD(-1)) + C(3)*D(DHHD(-2)) + C(4) *D(DHHD(-3)) + C(5)*D(DHHD(-4)) + C(6)*D(DCPI(-1)) + C(7) *D(DCPI(-2)) + C(8)*D(DCPI(-3)) + C(9)*D(DCPI(-4)) + C(10)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.010099	0.031118	-0.324542	0.7463
C(2)	-0.816031	0.103795	-7.861945	0.0000
C(3)	-0.650663	0.131414	-4.951226	0.0000
C(4)	-0.348577	0.128719	-2.708034	0.0081
C(5)	-0.172540	0.098041	-1.759870	0.0818
C(6)	-0.331355	1.171559	-0.282833	0.7779
C(7)	-0.751087	1.018199	-0.737663	0.4626
C(8)	-0.138233	0.853681	-0.161926	0.8717
C(9)	0.422462	0.626832	0.673963	0.5020
C(10)	-0.017799	0.143558	-0.123986	0.9016

R-squared	0.458517	Mean dependent var	0.012745
Adjusted R-squared	0.405546	S.D. dependent var	1.879049
S.E. of regression	1.448762	Akaike info criterion	3.672191
Sum squared resid	193.1000	Schwarz criterion	3.929541
Log likelihood	-177.2817	Hannan-Quinn criter.	3.776401
F-statistic	8.655988	Durbin-Watson stat	1.895531
Prob(F-statistic)	0.000000		

Dependent Variable: D(DHHD)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/15/18 Time: 13:14
Sample (adjusted): 1991Q2 2016Q4
Included observations: 103 after adjustments
D(DHHD) = C(1)*(DHHD(-1) - 0.136265890798*CONS(-1) + 8.1552481259) + C(2)*D(DHHD(-1)) + C(3)*D(DHHD(-2)) + C(4) *D(DHHD(-3)) + C(5)*D(CONS(-1)) + C(6)*D(CONS(-2)) + C(7) *D(CONS(-3)) + C(8)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.422090	0.148330	-2.845619	0.0054
C(2)	-0.543663	0.150289	-3.617450	0.0005
C(3)	-0.386870	0.131960	-2.931726	0.0042
C(4)	-0.064035	0.096932	-0.660621	0.5105
C(5)	0.212148	0.197826	1.072396	0.2863
C(6)	0.457789	0.189378	2.417331	0.0175
C(7)	0.302187	0.194117	1.556724	0.1229
C(8)	-0.010930	0.135007	-0.080956	0.9356

R-squared	0.531668	Mean dependent var	-0.033010
Adjusted R-squared	0.497159	S.D. dependent var	1.926614
S.E. of regression	1.366186	Akaike info criterion	3.536411
Sum squared resid	177.3141	Schwarz criterion	3.741050
Log likelihood	-174.1252	Hannan-Quinn criter.	3.619297
F-statistic	15.40679	Durbin-Watson stat	1.930040
Prob(F-statistic)	0.000000		

Dependent Variable: D(DHHD)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/15/18 Time: 13:58
Sample (adjusted): 1992Q1 2016Q4
Included observations: 100 after adjustments
D(DHHD) = C(1)*(DHHD(-1) - 0.589732456515*HDI(-1) + 1.7252974398) + C(2)*D(DHHD(-1)) + C(3)*D(DHHD(-2)) + C(4) *D(DHHD(-3)) + C(5)*D(DHHD(-4)) + C(6)*D(DHHD(-5)) + C(7) *D(DHHD(-6)) + C(8)*D(HDI(-1)) + C(9)*D(HDI(-2)) + C(10)*D(HDI(-3)) + C(11)*D(HDI(-4)) + C(12)*D(HDI(-5)) + C(13)*D(HDI(-6)) + C(14)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.430370	0.137985	-3.118965	0.0025
C(2)	-0.338164	0.147244	-2.296623	0.0241
C(3)	-0.315089	0.145581	-2.164356	0.0332
C(4)	-0.246016	0.140293	-1.753587	0.0831
C(5)	-0.242113	0.130071	-1.861398	0.0661
C(6)	-0.153709	0.120132	-1.279507	0.2042
C(7)	-0.024567	0.101409	-0.242256	0.8092
C(8)	-0.171172	0.072541	-2.359651	0.0206
C(9)	-0.064733	0.065962	-0.981362	0.3292
C(10)	-0.105976	0.058110	-1.823714	0.0717
C(11)	-0.103231	0.050712	-2.035635	0.0449
C(12)	-0.094160	0.039115	-2.407275	0.0182
C(13)	-0.035406	0.026236	-1.349514	0.1807
C(14)	0.004782	0.115375	0.041451	0.9670

R-squared	0.591715	Mean dependent var	0.014000
Adjusted R-squared	0.529998	S.D. dependent var	1.669574
S.E. of regression	1.144605	Akaike info criterion	3.237174
Sum squared resid	112.6705	Schwarz criterion	3.601898
Log likelihood	-147.8587	Hannan-Quinn criter.	3.384785
F-statistic	9.587478	Durbin-Watson stat	1.997877
Prob(F-statistic)	0.000000		

Dependent Variable: D(DHHD)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/16/18 Time: 15:06
Sample (adjusted): 1991Q2 2016Q4
Included observations: 103 after adjustments
D(DHHD) = C(1)*(DHHD(-1) - 1.9270150799*GDP(-1) + 0.989230440298) + C(2)*D(DHHD(-1)) + C(3)*D(DHHD(-2)) + C(4)*D(DHHD(-3)) + C(5)*D(GDP(-1)) + C(6)*D(GDP(-2)) + C(7)*D(GDP(-3)) + C(8)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.545120	0.162706	-3.350330	0.0012
C(2)	-0.398360	0.160705	-2.478833	0.0149
C(3)	-0.287810	0.137440	-2.094088	0.0389
C(4)	-0.040185	0.098835	-0.406588	0.6852
C(5)	-0.453250	0.610671	-0.742218	0.4598
C(6)	0.065557	0.613046	0.106937	0.9151
C(7)	0.312440	0.611983	0.510536	0.6109
C(8)	-0.032866	0.137678	-0.238719	0.8118

R-squared	0.510335	Mean dependent var	-0.033010
Adjusted R-squared	0.474254	S.D. dependent var	1.926614
S.E. of regression	1.396956	Akaike info criterion	3.580956
Sum squared resid	185.3911	Schwarz criterion	3.785595
Log likelihood	-176.4192	Hannan-Quinn criter.	3.663841
F-statistic	14.14429	Durbin-Watson stat	1.965355
Prob(F-statistic)	0.000000		

Dependent Variable: D(DHHD)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/16/18 Time: 15:10
Sample (adjusted): 1991Q4 2016Q4
Included observations: 101 after adjustments
D(DHHD) = C(1)*(DHHD(-1) - 0.07057386198*HNS(-1) - 0.15581886392) + C(2)*D(DHHD(-1)) + C(3)*D(DHHD(-2)) + C(4)*D(DHHD(-3)) + C(5)*D(DHHD(-4)) + C(6)*D(DHHD(-5)) + C(7)*D(HNS(-1)) + C(8)*D(HNS(-2)) + C(9)*D(HNS(-3)) + C(10)*D(HNS(-4)) + C(11)*D(HNS(-5)) + C(12)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.267521	0.150562	-1.776822	0.0790
C(2)	-0.538435	0.174905	-3.078449	0.0028
C(3)	-0.347304	0.180208	-1.927239	0.0571
C(4)	-0.095898	0.171677	-0.558595	0.5778
C(5)	-0.008835	0.155757	-0.056724	0.9549
C(6)	-0.149996	0.106747	-1.405157	0.1635
C(7)	0.116100	0.127131	0.913236	0.3636
C(8)	0.241380	0.125627	1.921399	0.0579
C(9)	0.176498	0.136382	1.294142	0.1990
C(10)	0.092177	0.125619	0.733780	0.4650
C(11)	-0.144057	0.112210	-1.283823	0.2025
C(12)	-0.030894	0.128951	-0.239575	0.8112

R-squared	0.537324	Mean dependent var	-0.049505
Adjusted R-squared	0.480140	S.D. dependent var	1.779586
S.E. of regression	1.283105	Akaike info criterion	3.447583
Sum squared resid	146.5259	Schwarz criterion	3.758290
Log likelihood	-162.1029	Hannan-Quinn criter.	3.573366
F-statistic	9.396305	Durbin-Watson stat	1.767742
Prob(F-statistic)	0.000000		

A7 VECM short-run results

Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
t-statistic	-1.122198	101	0.2644
F-statistic	1.259328	(1, 101)	0.2644
Chi-square	1.259328	1	0.2618

Null Hypothesis: C(3)=0

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(3)	-0.200735	0.178876

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.784923	(4, 92)	0.5379
Chi-square	3.139691	4	0.5347

Null Hypothesis: C(6)=C(7)=C(8)=C(9)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(6)	-0.331355	1.171559
C(7)	-0.751087	1.018199
C(8)	-0.138233	0.853681
C(9)	0.422462	0.626832

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.389269	(3, 95)	0.0736
Chi-square	7.167808	3	0.0667

Null Hypothesis: C(5)=C(6)=C(7)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(5)	0.212148	0.197826
C(6)	0.457789	0.189378
C(7)	0.302187	0.194117

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.389269	(3, 95)	0.0736
Chi-square	7.167808	3	0.0667

Null Hypothesis: C(5)=C(6)=C(7)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(5)	0.212148	0.197826
C(6)	0.457789	0.189378
C(7)	0.302187	0.194117

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
t-statistic	-0.692122	101	0.4904
F-statistic	0.479033	(1, 101)	0.4904
Chi-square	0.479033	1	0.4889

Null Hypothesis: C(3)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(3)	-0.009251	0.013367

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.286940	(3, 95)	0.8347
Chi-square	0.860819	3	0.8349

Null Hypothesis: C(5)=C(6)=C(7)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(5)	-0.453250	0.610671
C(6)	0.065557	0.613046
C(7)	0.312440	0.611983

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.770445	(5, 89)	0.1271
Chi-square	8.852226	5	0.1151

Null Hypothesis: C(7)=C(8)=C(9)=C(10)=C(11)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(7)	0.116100	0.127131
C(8)	0.241380	0.125627
C(9)	0.176498	0.136382
C(10)	0.092177	0.125619
C(11)	-0.144057	0.112210

Restrictions are linear in coefficients.

A8 Granger Causality results

Pairwise Granger Causality Tests
Date: 12/11/17 Time: 14:41
Sample: 1990Q1 2016Q4
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DINT does not Granger Cause DHHD	106	1.25898	0.2645
DHHD does not Granger Cause DINT		0.27338	0.6022

Pairwise Granger Causality Tests
Date: 12/12/17 Time: 09:43
Sample: 1990Q1 2016Q4
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DHHD does not Granger Cause DINT	106	0.27338	0.6022
DINT does not Granger Cause DHHD		1.25898	0.2645