THE INTEREST RATE ELASTICITY OF CREDIT DEMAND AND THE BALANCE SHEET CHANNEL OF MONETARY POLICY TRANSMISSION IN SOUTH AFRICA

A thesis submitted in partial fulfilment of the requirements of the degree of

MASTERS IN COMMERCE (FINANCIAL MARKETS)

DEPARTMENT OF ECONOMICS AND ECONOMIC HISTORY

of

RHODES UNIVERSITY, GRAHAMSTOWN

by

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Estimated date of submission: February 2012

ABSTRACT

It has long been accepted that changes in monetary policy have real economic effects; however, the mechanism by which these policy changes are transmitted to the real economy has been the subject of much debate. Traditionally the transmission mechanism of monetary policy has consisted of various channels which include the money channel, the asset price channel and the exchange rate channel. Recent developments in economic theory have led to a relatively new channel of policy transmission, termed the credit channel. The credit channel consists of the bank lending channel as well as the balance sheet channel, and focuses on the demand for credit as the variable of interest. The credit channel is based on the notion that demanders and suppliers of credit face asymmetric information problems which create a gap between the cost of external funds and the cost of internally generated funds, referred to as the wedge. The aim here is to determine the size and lag length effects of changes in credit demand, by both firms as well as households, as a result of changes in interest rates. A secondary, but subordinate, aim is to test for a balance sheet channel of monetary policy transmission. A vector autoregressive (VAR) model is used in conjunction with causality tests, impulse response functions and variance decompositions to achieve the stated objectives. Results indicate that the interest rate elasticity of credit demand, for both firms and households, is interest inelastic and therefore the monetary policy authorities have a limited ability to influence credit demand in the short as well as medium term. In light of the second aim, only weak evidence of a balance sheet channel of policy transmission is found.

DECLARATION

This masters thesis represents my own work and due acknowledgement is given in the references whenever information is derived from another source. No part of this master's thesis has been or is being concurrently submitted for another qualification at any other university.

Gregory Graham Doig

Signed……

Date: 2 September 2012

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Empirical literature on the monetary policy transmission mechanism has generally found that there is a relationship between the actions of the central bank and the state of aggregate demand within an economy. The mechanism through which the repurchase rate affects aggregate demand has, however, largely been neglected, which has led to what has been termed the "black box" of monetary policy transmission (Bernanke and Gertler, 1995:27). The primary purpose of the present study is to determine the size and lag length effects of a change in interest rates and the resultant changes in the demand for credit by firms as well as households. A second, but subordinate, aim of the study is to determine if a balance sheet channel of monetary policy is operative in South Africa and possibly shed some light on the "black box" of policy transmission. It is noted at the outset that the balance sheet channel is one sub-channel of the broader credit channel of policy transmission; however, the focus here is only on the identification of a balance sheet channel and not to determine which of the two sub-channels is operative.

When considering the demand for credit by firms only short term credit demand will be considered, but both short as well as medium term credit demand will be considered in relation to households. Following Post-Keynesian theory an endogenous money supply is assumed to operate within the economy and the demand for short term credit by firms is influenced by factors which influence the working capital needs of firms. One implication of assuming an endogenous money supply is that credit demand becomes the variable of interest when analysing the transmission of monetary policy, rather than the demand for money as has traditionally been used (Hannsgen in Arestis and Sawyer, 2006:205). The demand for credit by households is influenced by factors such as consumption, income and expected future income. Post-Keynesians focus on how a change in interest rates affects the demand for credit because it is the demand for credit that is thought to be influenced by real variables,

such as output. Real variables are the focus of attention rather than inflation, which is seen as indirect and not of primary importance (Hannsgen, 2006:205).

Traditionally three main channels have been identified through which a change in interest rates is thought to impact aggregate demand and output; these channels include the money channel, the asset price channel and the exchange rate channel. More recently a credit channel has been thought to transmit the effects of interest rate changes to the real economy. The credit channel is made up of two sub-channels, namely the balance sheet channel and the bank lending channel. Bernanke (1993:56) asserts "… that in addition to affecting short term interest rates, monetary policy affects aggregate demand by affecting the availability or terms of new bank loans". According to theory surrounding the credit channel, specifically the balance sheet channel, the effects that changes in monetary policy have on the economy are magnified by endogenous changes in the external finance premium. The external finance premium is the difference between the cost of raising capital externally (via debt or equity markets) and the cost of a firms retained or internally generated earnings. Changes in the size of the external finance premium will reflect the degree of asymmetric information present within credit markets (Bernanke and Gertler, 1995:28). When a central bank changes the repurchase rate the value of a firm's net worth will change and this change in net worth will influence the interest rate at which a firm or household can access external funds, due to a change in the external finance premium. A change in interest rates will therefore affect a firm's (and household's) ability to access credit and, in turn, have an effect on aggregate output.

Thus far the theoretical underpinnings of the credit channel are well known but empirical results have been mixed (Angelopoulou and Gibson, 2009:677). There is a vast empirical literature on the demand for money; however there are "surprisingly few studies on the demand for bank credit" (Fase, 1995:99). Similarly Chrystal and Mizen (2005:119) note with respect to the household demand for credit, "extensive literatures have developed over the past 50 years or so on consumption and the demand for money. Credit on the other hand has been largely neglected".

There are several reasons why examining the size and lag length effects of changes in credit demand as a result of changes in interest rates is important. Firstly, in today's environment of

rapid financial innovation it is important to know the size and lag length effects of a monetary policy action and how this policy action is transmitted to real sectors of the economy. Secondly, credit aggregates may be used to measure the stance of monetary policy and finally, the balance sheet channel is closely related to the idea that banks occupy a unique position in the economy because they can create deposits and should therefore be specially regulated (Bernanke, 1993:57). The behaviour of bank lending may also provide some insight into the behaviour of broad monetary aggregates that cannot be explained by the traditional theory based on money demand, which may also have implications for monetary policy (Cuthbertson, 1985:91).

The paper is set out as follows: chapter two discusses the traditional IS/LM model and the transmission of monetary policy before discussing some more general as well as specific problems with the traditional theory. Chapter three then introduces a more Post-Keynesian view of the economy and discusses the theoretical underpinnings of an endogenous money supply. Chapter four deals with the traditional IS/LM model and the assumption of perfect information before dealing with the implications for monetary policy, chapter five then presents an outline of the Post-Keynesian theory of consumption behaviour. Chapter six will review the empirical work on an endogenously determined money supply, the balance sheet channel of monetary policy transmission and household credit demand. Chapter seven discusses the methodology and data used and chapter eight covers the results of the estimated firm as well as household VAR models. A discussion follows in chapter nine and chapter ten concludes.

CHAPTER TWO

LITERATURE REVIEW OF THE TRADITONAL IS/LM MODEL AND AN ENDOGENOUS MONEY SUPPLY

2.1 INTRODUCTION

Traditionally, the standard textbook IS/LM model has used the money view to describe the mechanism by which a change in the repurchase rate by the central bank is transmitted to aggregate output (Gertler and Gilchrist, 1993:44). Channelling of savings to investment is done through the purchase of bonds, where the purchase of bonds is a function of the speculative motive of liquidity preference. It will be argued that the traditional model is based on two limiting assumptions. Firstly, it is assumed that perfect information is present within credit markets and secondly, that the money supply is exogenously determined and under the control of the central bank. The assumption of perfect information in the IS/LM model leads to the theoretical conclusion that savings are efficiently channelled into productive investments, via the purchase of bonds, and thus a Pareto-optimal economic outcome is achieved (Bernanke, 1993:52), while the assumption of an exogenous money supply incorrectly leads a central bank to focus on targeting monetary aggregates as a means to influence aggregate output through the use of open market operations. These two assumptions are challenged here in that markets do not have perfect information and the money supply is endogenously determined. Before dealing with the implications of an endogenous money supply and asymmetric information a brief review of the traditional model is presented with a specific focus on the LM side, i.e. the money and credit markets, followed by a review of the transmission mechanism of monetary policy.

2.2 THE TRADITIONAL IS/LM MODEL AND MONETARY POLICY

2.2.1 Introduction

Before challenging the mainstream assumptions underlying the IS/LM model a brief review of these assumptions is necessary. This section is split into two subsections, the first dealing with the theory underlying the traditional IS/LM model and the second briefly covers the transmission mechanism of monetary policy which is thought to operate within the traditional model.

2.2.2 A Review of the traditional IS/LM model

The textbook model of the Keynesian economy is usually explained in relation to three equilibrium levels which include: the equilibrium between the level of aggregate demand and aggregate output (C+I+G=Y), the equilibrium between the level of savings and investment (S+T=I+G) and the equilibrium between desired and realised investment (Ir=I). It is through the difference between desired and realised inventories that equilibrium is maintained. If aggregate demand exceeds output there will be a shortfall in the level of inventories and a rise in the level of output as firms employ additional resources to increase the level of production, and vice versa. These equilibrium conditions can all be shown in aggregate demand and income space.

The equilibrium level of output/ income is determined endogenously and it is assumed that the level of investment, government spending and taxes are given (autonomous). A change in any of the autonomous variables in the model will lead to a change in income which will, via the multiplier effect, increase the level of savings within the economy to a higher level which is just sufficient to finance the increase in autonomous spending and an induced increase in consumption expenditure. The multiplier gives rise to a greater increase in the level of income (output) for any given level of exogenous expenditure due to the “ripple effect” (Froyen, 1996:96). This basic model does not, however, take into account the effects of interest rates and money but can be extended to include the effects of interest rates and money demand by using the now familiar IS/LM model developed by Hicks (1937).

The IS curve is derived from independent savings and investment functions for given rates of interest. The level of investment is a negative function of the interest rate and the level of savings is positively related to income. The negatively sloped IS schedule shows equilibrium levels of output such that savings is equal to investment at a given rate of interest. The schedule has a negative slope because an increase in interest rates will lead to a reduction in the present value of expected cash flows from a given investment and thus fewer investments will be profitable (Dornbusch and Fischer, 1990:110-111). The LM curve gives points of equilibrium between the demand for real money balances and the exogenously determined money supply within the money market. More focus is given to the LM schedule than the IS schedule because of the underlying assumption that the money supply is exogenously determined. The discussion on the LM schedule will begin with the demand for money in line with liquidity preference theory and next focus on the supply of money.

The demand for money is seen as a function of Keynes's liquidity preference theory and includes the transactions, precautionary and speculative demand for money. The speculative motive is important for understanding the relationship between money demand, interest rates and the channelling of savings to productive investments and as such will be the focus here. The channelling of savings to profitable investments is done by the issuing of bonds by deficit spending economic units and investors will purchase these bonds at some market rate of interest. Keynes defined the speculative motive as "the object of securing profit from knowing better than the market what the future will bring forth" (Keynes, 1936:170). In other words an investor will make speculative funds available (decrease in money demand) when he/she expects to make a profit from the purchase of a financial asset, given expectations about future interest rate movements relative to some "normal" level, which is subjective to every investor. According to this view the interest rate will change endogenously in response to a change in liquidity preference and it is the demand for money that is the relevant economic variable. It will be argued below that the focus on the demand for money in traditional theory is misplaced as it is the demand for credit that is the more relevant economic variable when analysing macroeconomic policy. This is due to the endogenous nature of the money supply within a credit money economy.

Mainstream Neo-classical theory assumes the money supply is fixed exogenously by the central bank and controlled through the use of open market operations, which changes the amount of money available for lending to consumers by the banking sector (Bernanke, 1993:55). This view of an exogenous money supply gives rise to the familiar vertical money supply schedule and at any point on the LM curve money demand will equal the fixed money supply. The conclusion reached is that the targeting of a monetary aggregate is the most appropriate way to conduct monetary policy; however, the assumption of an exogenous money supply does not hold in a credit money economy as the money supply is endogenously determined and the central bank then seeks to control the price of credit by setting interest rates rather than targeting an aggregate quantity of money. Equilibrium in the money market will indirectly bring about equilibrium in the bond market, which is essentially a market for surplus funds (Wells, 1983:523). This channelling of funds from investors to borrowers happens efficiently because of perfect information.

The economy as a whole is in general equilibrium at the point where the IS curve (product market) intersects with the LM curve (money market) in interest-income space. The traditional model does not recognise any finance motive for credit demand and no banking system is necessary to satisfy credit demand. The role of convenience lending is also obscured and, as a result, the supply process of credit money is ignored (Moore, 1988:321). Monetary policy is assumed to work via the central bank's use of open market operations which will lead to an increase or decrease in the monetary base. The change in the monetary base together with the money multiplier will influence the money supply and ultimately aggregate output. It will be argued that the central bank targets the repo rate, and due to the practice of liability management by banks the money supply is endogenously determined and therefore the variable of interest should be the demand for credit rather than the demand for money.

2.2.3 The IS/LM model and the transmission of monetary policy

The transmission of monetary policy within the traditional IS/LM model is best described as the "money view" of policy transmission (Gertler and Gilchrist, 1993:44). The money view theorises that, in order to change the level of aggregate demand within an economy, the central bank will indirectly influence interest rates by "changing the supply of the medium of

exchange relative to the demand" (Bernanke, 1993:55). Assume, for example, that the monetary authorities pursued an expansionary policy action, increasing the money supply by buying bonds from the banking sector and causing an excess supply of money. The excess supply of money will then lower the rate of interest because people will attempt to reduce their money holdings by buying bonds, thereby increasing bond prices and reducing rates of interest. The drop in rates will stimulate investment demand, leading to an increase in income and induced consumption expenditure. A new equilibrium is achieved when the fall in the rate of interest and rise in income both increase money demand by an amount equal to the larger money supply, via the speculative motive of liquidity preference. The process would work in reverse if the central bank undertook a contractionary policy stance.

The money view is a combination of Keynesian and Monetarist theories; with Friedman being one of the leading proponents of Monetarism, believing that monetary policy operates in an economy which can be described by the quantity equation. The quantity equation states that in the long run an increase in the money supply by the monetary authorities will ultimately only have an influence on the general price level (inflation), assuming both velocity and output are stable over the short run. This may also be expressed mathematically as MV = PY where M is the exogenously determined money supply, V is the velocity of money over some given period, P is the price level and Y is real output (Brewster, 1982:357). Controlling the growth rate of the money supply is seen by the central bank as the primary means by which to influence the growth rates of prices, wages and money income. The textbook model sees monetary policy transmission as operating via the liability side of a banks' balance sheet through the central banks open market operations, and the effects this has on the amount of base money the banking system holds (Kashyap, Stein and Wilcox 1993:78).

The theoretical basis for an exogenously determined money supply is flawed because the exogeneity of the money supply is based on the operation of a commodity money economy. An exogenous money supply cannot be assumed to apply to a credit money economy, discussed further in section 3.2.4 (Moore, 1988:3).

2.3 GENERAL PROBLEMS WITH THE TRADITONAL MODEL

2.3.1 Introduction

The traditional IS/LM model was developed by Hicks (1937) and has become the framework through which Keynesian economics is explained. The model is two dimensional and depicts a Walrasian equilibrium between three markets incorporating Say's law (Moore, 1988:319). Hicks has since, however, noted that the monetary part of his model is not adequate because the real and monetary sectors of the economy are independent of each other and the financial structure which supplies credit money is ignored (Moore, 1988:321). This section discusses three of the broader problems with the traditional theory, leaving more specific aspects to the next section. The section begins with a discussion of the differences between commodity and credit money economies and the implications this has for an exogenous money supply. Next the common misconception that full employment would be achieved if wages and prices are perfectly flexible (Pigou or real balance effect) is dispelled and finally a critique on the nature of general equilibrium analysis is given.

2.3.2 Commodity versus credit money

The dominant view in economics is that money developed as a way in which to economise on barter transactions and thus money served as a store of value as well as a medium of exchange. Credits and debits followed the development of precious metal coins because these precious metal coins were deposited with a custodian (early banker) and either a debit or credit was issued, depending on whether an economic agent was borrowing money from the custodian or lending money to the custodian. This view of the history of money sees money as a commodity. Within commodity money economies the stock of money at any point in time can be regarded as fixed exogenously and an independent supply and demand for money relationship exists. Any increase in the money supply can come from a new gold discovery or a balance of payments surplus (Moore, 1988:10). It will be seen that the dominant view ignores the possible existence of an early central authority which had the power to enforce tax laws and has been challenged on a number of grounds based on evidence suggesting that credits and debits are at least two thousand years older than precious metal coins as well as

evidence that early coin denominations were too high to have been used for early transactions purposes (Tymoigne and Wray in Arestis and Sawyer, 2006:7).

Tymoigne and Wray (2006) have proposed an alternative history of money which recognises the unit of account function of money and emphasises that money originated as a result of debits and credits rather than as a way to economise on commodity holdings. Within this framework the medium of exchange function becomes secondary as debits and credits can exist without a medium of exchange (Tymoigne and Wray, 2006:1). It is argued that the origins of debt can be traced back to past societies and took the form of tributes or fines to other specific individuals. As debts were originally negotiated and settled between two individual parties a key development in the history of money was the payment of individual debts to a central authority using a standardised unit of account which eventually led to the development of government taxation. According to this view it was the creation of a central authority able to impose taxes and thereby place individuals in debt that led to the need for a monetary unit, and not the utility maximising behaviour of individuals (Tymoigne and Wray, 2006:2). Fullwiler (2006:495) also notes that as long as tax liabilities must be settled in state money there will be a demand for the state's money to exist. Coins are then seen to have developed as tokens used to measure debt (Tymoigne and Wray, 2006:8).

In this alternative interpretation of the history of money the monetary system did not start with precious metals replacing pure barter economies; it is also incorrect to place too much emphasis on the operation of a gold standard, which was only a brief deviation from the normal historical monetary system of debits and credits, regulated by a central authority (Tymoigne and Wray, 2006:12).

For current purposes the key point to note between a commodity money economy and a credit money economy is that commodity money is an asset to its holder and there is no accompanying liability, whereas credit money represents a financial claim with both an asset and liability coming into existence when the financial claim is created (Moore, 1988:13). In modern financial economies credit money is created when a financial institution (bank) creates a liability against itself, and the supply of credit money is a function of the demand for credit as borrowers attempt to increase money holdings by increasing their demand for credit. The ability of a bank to create a liability against itself leads to an endogenously

determined money supply, rather than the exogenous money supply assumed under a commodity money economy (Moore, 1988:14).

2.3.3 Real balance effect

A common misconception about the Keynesian theory of aggregate demand is that full employment will be achieved if wages and prices were perfectly flexible, assuming that the marginal propensity to consume is greater than zero and the money stock is fixed. If prices and wages were perfectly flexible then a decrease in the price level would, according to traditional theory, raise the real incomes of economic units. The increase in real money balances will lead to an excess supply in the money market as economic agents rebalance their ratio of money holdings to income due to a stable transactions demand for money. The excess supply of money that is generated by the price level reduction is spent on newly produced goods and services as consumption expenditure increases and in this way full employment equilibrium is maintained. This view again sees the economy as operating under a commodity money paradigm and the argument does not apply when considering a credit money economy (Brown, 1992:101). Moore (1988:14) notes that, when considering a credit money economy, an excess supply of money is in fact not possible as any excess supply of bank money is reduced simply by repaying bank credit.

Within a credit money economy both an asset and liability are created when a bank creates money and thus any increase in the value of creditor's assets will be accompanied by a decrease in the wealth of debtors. The decrease in the net wealth of debtors increases the likelihood of default because the real cost of debt increases and this increased probability of default is not taken into account within the real balance effect framework. Thus a price deflation may actually lead to a decrease in the net financial wealth of the aggregate economy (Brown, 1992:103).

2.3.4 General equilibrium analysis

The traditional Neo-classical model above is built on both Say's and Walras' laws which together lead to a full employment general equilibrium outcome, around which the economy

will move over the long term. In order to arrive at a general equilibrium solution it is assumed that a commodity economy is operative and thus economic agents can only exchange current output for other current output, as in a barter exchange economy. Within a credit money economy however entrepreneurs can borrow money to finance the production process and as a result both Say's law and Walras' law do not hold as a credit money economy allows aggregate expenditure to be greater than that allowed only by income (Moore, 1988:316).

The traditional IS/LM model (and all modifications) are all a set of simultaneous equations models and leave no room for time in the decision making process of entrepreneurs, in addition to leaving no place for uncertainty (Moore, 1988:324). Due to the problems of measuring an individual's expectations, uncertainty and given that economic events take time to unfold there can be no unique future general equilibrium solution (Moore, 1988:324).

2.4 SPECIFIC PROBLEMS WITH THE LM SCHEDULE

2.4.1 Introduction

In this section a discussion of the more specific problems with the IS/LM approach is undertaken with a focus on the LM schedule, specifically the money supply and money demand schedules which are used to construct the LM schedule. The money supply schedule is discussed in terms of the money multiplier and the money demand schedule is analysed in terms of the Keynesian liquidity preference. This IS schedule is left for a later section.

2.4.2 The LM schedule and monetary policy

In the traditional model the LM schedule is upward sloping because the money supply schedule is vertical and is derived by varying the level of income (transactions demand for money) relative to an exogenously fixed money supply. As discussed above in section 2.2.3, Friedman's quantity theory (MV=PY) states that an increase in the money supply by the central bank will only lead to inflation given that velocity and output are fixed in the short run. Monetary policy is conducted by influencing the money supply, via the high powered monetary base and the accompanying money multiplier. Mathematically the relationship

between the high powered money base, the money multiplier and the money supply can be expressed as M = m x MB, where M is the money supply (as in the quantity equation), m is the money multiplier and MB is the high powered monetary base (Brewster, 1982:169). In this view it is the deposits of surplus economic units which are lent out to deficit units and the money supply is increased by a multiple of deposits, therefore deposits create loans.

Traditional theory is built on the assumption of a commodity money economy; however, both the concept of the money multiplier and the manipulation of the monetary base are flawed when applied to a credit money economy and it will be shown below that loans actually create deposits. Given that loans create deposits the traditional view of a vertical money supply schedule loses its significance. The money demand schedule also loses its significance when analysed within a credit money setting and each will be discussed in turn, beginning with the money multiplier and monetary base and then turning to the demand for money.

2.4.3 The money multiplier and high powered money base

In the Neo-classical view of monetary policy a central bank will act to manipulate some monetary aggregate and can achieve this by manipulating the high powered monetary base or some component of the money multiplier. The money multiplier is made up of the ratio of currency holdings to deposits and the ratio of bank reserves to total bank deposits (Brewster, 1982:202). It can be shown that when monetary policy is conducted in this way it may actually act to cause large movements in interest rates, which is in opposition to the intended outcome.

If monetary policy authorities undertake a tightening of monetary policy, for example by increasing reserve requirements, an individual bank may either cut back on new lending or sell marketable securities to cover any increases in legislated reserve requirements (Moore, 1988:79). A bank's primary defence against insolvency due to a bank run is the sale of marketable securities and banks therefore always maintain some minimum reserve level of currency to ensure that it can meet all deposit obligations as they fall due (Moore, 1988:52). The policy action will force banks to decrease their assets and liabilities by some multiple of any shortage of high powered money, which will lead to a rise in interest rates. Any attempt to control the monetary base would lead to volatile swings in interest rates as financial

markets provide the liquidity for banks to adjust their portfolios, as the central bank will not provide the base money (Moore, 1988:79). The multiplier approach is in direct contradiction with reality and can be regarded as a mathematical identity which has no causal implications for economic theory (Moore, 1988:85).

2.4.4 Money demand and liquidity preference

Keynes views the demand for money as a function of income as well as liquidity preference, and the interest rate is seen to adjust endogenously to bring about equilibrium in the money market. In Keynes' original theory an investor will either be invested in all bonds or all money. Two extensions to this theory came from Tobin (1956) and Baumol (1952) in an attempt to modify the theory to explain why investors would hold money as well as bonds. These models, however, still view economic agents as demanding money relative to a fixed money supply and are thus holding onto commodity money principles. These are not the only studies which make such an assumption as much research has sought to explain the effects of financial innovation on the demand for money in light of Hicks' (1937) IS/LM model.

The mainstream argument is that if alternative forms of payment develop then the central bank will have a limited ability to influence interest rates by controlling banks' reserve balances (Fullwiler, 2006:495). One example is given by Wells (1983:526), who argues that in modern financial economies there are a number of highly liquid short term assets which pay interest and therefore dominate money as a store of value; accordingly, due to financial innovation, there is no reason to hold any wealth in the form of non-interest bearing money and the role of money becomes that of a medium of exchange, with all the implications of the quantity theory (Wells, 1983:527). Another example of trying to apply commodity money principles to a credit money economy is given by Gertler and Gilchrist (1993:45) who suggest that control over shorter term rates of interest by the central bank, via the use of open market operations, should diminish as close money substitutes become available due to financial innovation becoming more prevalent. It will be argued that within a credit money economy (endogenous money economy) liquidity preference as viewed by Keynes has no relevance (Lavoie, 1992:193).

Within an endogenous money economy the theory of liquidity preference no longer plays any role in the determination of the market rate of interest (Lavoie, 1992:193). However Lavoie (1992:193) still sees liquidity preference as playing a role, provided the definition of liquidity preference is broadened to include all agents within the economy and all financial securities. Three interest rates must be considered, which include a short term rate, a long term rate and the central bank discount rate. The central bank sets the discount rate which reflects societal factors which cannot be measured (Lavoie, 1992:193). The spread between short and long term rates is determined by investors and reflects preferences between liquid and illiquid positions and represents preferences that cannot be explained. Interest rates are exogenous and the liquidity preference of investors sets all market rates in relation to the discount rate set by the central bank. Liquidity preference is seen to set the term structure of interest rates and, if rates are not expected to change, there should only be a slight difference between short and long term rates. In conclusion liquidity preference only plays a causal role in the short run and no role in the long run (Lavoie, 1992:196).

2.5 SUMMARY

The traditional model developed by Hicks (1937) has been the standard framework by which Keynesian economics has been taught. In this framework any increase in autonomous spending will increase income by some multiple of the autonomous spending, and monetary policy operates by influencing the high powered money base through the use of open market operations and ultimately the money supply. The money supply is seen as exogenously determined and under the control of the central bank in line with a commodity money economy and the variable of interest in economic policy analysis is the demand for money following Keynes' liquidity preference theory. The traditional model suffers from a number of shortcomings in that it assumes the operation of a commodity money economy, asserting that the economy can achieve a state of general equilibrium and maintaining that the solution to unemployment is price and wage flexibility.

Modern financial economies operate under a credit money paradigm and as such full employment equilibrium may not be reached owing to the real world observations that economic agents operate under conditions of uncertainty as well as the fact that economic processes take time. Within a credit money economy the money supply is endogenously

determined and the money multiplier no longer has any significance, while the concept of money demand as theorised by Keynes' liquidity preference still holds significance in that it sets relative interest rates between short and long term financial securities. Given these shortcomings a theory of the economy must be adopted which recognises the importance of a credit orientated money economy, as found in the Post-Keynesian macroeconomic approach.

CHAPTER THREE

A POST-KEYNESIAN VIEW OF THE IS/LM MODEL AND ENDOGENOUS MONEY

3.1 INTRODUCTION

A central tenet in Post-Keynesian macroeconomic theory is the endogeneity of the money supply based on the implicit assumption of a credit money economy. The money supply originates endogenously due to the demand for credit and the practice of liability management by banks. Monetary policy is made effective by the targeting of interest rates by central banks which in turn will influence the borrowing behaviour of firms and consumers. Briefly, liability management allows banks to extend loans to firms or consumers in the retail market and borrow any needed reserves in the wholesale money market. The resultant non-independence of the savings and investment functions has implications for the income multiplier process in the traditional IS/LM model.

This section begins by discussing the unique role played by banks in a credit money economy. This is followed by a discussion of the nature of interest rates with the dominant schools of economic thought. Finally the role of credit and increases in aggregate output is discussed.

3.2 BANK INTERMEDIATION WITHIN A CREDIT MONEY ECONOMY AND AN ENDOGENOUS MONEY SUPPLY

3.2.1 Introduction

It is argued here that the money supply is not exogenous because banks occupy a unique role in the financial system due to their ability to create credit money. Banks serve a special role within the financial system because bank deposits serve as a generally accepted means of

payment for goods in most transactions, thus banks have the unique ability to monetize non-negotiable primary market securities created when banks extend loans to borrowers (Moore, 1988:46). As a result the money supply schedule is horizontal rather than vertical and loans are seen to create deposits.

3.2.2 Bank intermediation in a credit money economy (circuitist approach)

A prominent feature of Post-Keynesian macroeconomics is the theory underlying the practice of bank liability management. The theory states that banks can borrow any funds needed to meet minimum reserve requirements from the wholesale money market; this approach can be closely related to the "circuit" or circuitist approach first proposed in eighteenth century France. The circuit sees production as starting with bank advances and ending with the sale of produced goods. This theory has influenced many writers, including Marx and Keynes, and was more generally accepted in the second half of the twentieth century, as evidenced in the French and Italian circuit theories as well as the Post-Keynesian approach (Gnos in Arestis and Sawyer, 2006:87). The commonality between all three approaches is the belief that credit money is necessary to accommodate production and is seen as both a financial as well as monetary variable (Lavoie, 1992:151). This discussion will err on the side of the Post-Keynesian school, where the granting of credit by banks to firms in order to start the production process is what Keynes described as the finance motive and applies to both consumption and investment goods (Lavoie, 1992:153). The need to borrow in the form of credit in order to undertake production creates a discrepancy between a bank's retail assets and liabilities and wholesale assets needed to maintain a certain level of liquidity.

For simplicity it is assumed that banks use two inputs, retail and wholesale deposits, and two outputs, retail and wholesale loans. In the retail market (both loans and deposits) banks are seen as price setters and quantity takers because they set their deposit and loan rates and then accept all cash forthcoming in the form of deposits as well as meet all loan demands up to a set maximum credit limit, provided all minimum credit requirements have been satisfied (Moore, 1988:57). Banks make a profit from the difference in the spread between deposit and lending rates in line with their function as an intermediary (Moore, 1988:49). Retail bank loans and bank overdrafts are priced on a floating rate of interest and a customer-specific mark-up (or mark-down). Bank customers usually have prearranged lines of credit

(overdrafts), with credit limits being a function of the interest rate, the borrower's net worth and any expected future income flows (Moore, 1988:295). Within the wholesale money market, however, banks are seen as price takers and quantity setters. The wholesale assets of banks are made up of marketable securities which act as a defence against any unexpected withdrawal of deposits and serve to maintain the banks' liquidity, thus marketable assets must exceed required reserves (Moore, 1988:58).

Liability management allows banks to increase the level of their loans without having to sell marketable securities in order to maintain minimum reserve requirements (Moore, 1988:27). Banks can then extend credit to customers and borrow the additional money required to meet any shortage in required reserves in the wholesale market, allowing banks to supply credit to their customers almost indefinitely (Moore, 1988:52). The use of liability management has led to an increase in the level of risk in commercial banking because banks increasingly finance risky illiquid assets (bank loans) with an unstable, liquid liability structure (Moore, 1988:38). Any change in the cost of borrowing funds in the wholesale market will be passed on to borrowers in the retail market and it is for this reason that the central bank implements its' monetary policy stance through the wholesale money market.

3.2.3 Wholesale money market and the operation of monetary policy

In the course of granting loans and taking deposits there is no reason for loans to equal deposits in the retail banking market since borrowers and lenders are different economic units and banks face a leakage of deposits (Moore, 1988:58).. Over the long run a bank will attempt to maintain approximate equilibrium between the quantity of loans and deposits through the adjustment of the respective interest rates. However, owing to the interest inelasticy of short term credit demand and the stickiness of interest rates, the short term adjustment of interest rates is not enough to keep approximate equilibrium between retail loans and deposits. Over the short run deposit leakage will force a bank into the wholesale money market to borrow funds in order to make up any shortage between outstanding loans and the level of legislated required reserves (Moore, 1988:60). Any individual bank may be either a net debtor or creditor in the wholesale market due to any net surplus or deficit in the retail market as a result of new deposits and the granting of new loans. Banks with a net

deficit must borrow any required funds in the wholesale market and the marginal cost of funds to banks is then equal to the wholesale market rate (Moore, 1988:61).

It is in the wholesale money market that the central bank implements monetary policy by ensuring that banks are always indebted to the central bank (Moore and Smit, 1986:83). As already noted, legislation imposes certain required reserve ratios on banks to ensure the liquidity of the banking system, and the central bank acts to set the wholesale rate at which banks can borrow reserves to support any level of deficit incurred through their business of granting credit, thereby allowing banks to maintain legislated reserve requirements (Lavoie, 1992:178). Banks can obtain the needed funds from two primary sources; the interbank market or the central bank. The interbank market is a wholesale market in which banks can lend surplus funds to deficit banks at the interbank-overnight rate in order to meet their increased liabilities (retail loans) and is often cheaper than borrowing at the repurchase rate from the central bank (Lavoie, 1992:161). The implication of the above analysis is that the central bank will manipulate the repurchase rate in order to influence the borrowing behaviour of retail borrowers, and the money supply is endogenously determined by the demand for retail credit (this is left to the next section). As a result of liability management and the existence of overdraft facilities, banks have a limited ability to control their rate of loan expansion and thus view the volume of loans and deposits as non-discretionary variables (Moore, 1988:51).

Within the Post-Keynesian framework of liability management, the mainstream view that the central bank can influence the money supply via open market operations is only partially correct because this view maintains that the marketable and non-marketable securities of banks are homogenous. The central bank can increase the money stock via open market operations but it cannot decrease the money stock in the same way due to the asymmetry between marketable and non-marketable bank securities (Moore, 1988:28). The traditional conclusion that banks will adjust their ratio of loans and deposits to any changes in the high powered money base assumes that banks behave like portfolio managers. Banks may only adjust their asset and liability holdings at their own discretion if bank assets consist mainly of marketable securities. If the Central bank wishes to increase the money stock it will buy securities from the banking system and thereby increase the excess reserves held at the central bank; however, excess reserves do not earn interest and banks will therefore purchase

interest earning marketable securities. The central bank cannot, however, decrease the money supply in the same way because banks cannot adjust their portfolios at their own discretion; they hold a large amount on non-marketable assets such as consumer loans for which there exists no secondary market (Moore, 1988:23). Attention will now turn to the creation of these non-marketable assets and their role in an endogenous money economy.

3.2.4 Bank deposits and an endogenous money supply

It is the unique ability of a bank to create deposits, by creating a claim against itself, which leads to the money supply being endogenously determined because banks are not limited to creating deposits based on a limited amount of some physically available commodity, such as gold. Keynes (1930:24) noted, however, that there is a limit to the level of deposits a bank can create and that limit depends on the level of passively created deposits. If, however, a closed banking system with no physical currency is assumed, such that all transactions are done via cheque and banks do not hold any excess reserves, then theoretically there is no limit to the amount of deposits a bank can create, provided they all work in tandem with each other (Keynes,1930:26).

One of the major sources of the demand for bank credit comes from the short term working capital requirements of firms. It is the productive activities of entrepreneurs and their expectations of future effective demand that introduces money into the economic system, via the creation of bank deposits, which in turn leads to income generation when these loans are used to pay factors of production. This is why Post-Keynesians are more concerned with the asset side of a banks' balance sheet than the liability side because it is credit rather than money by which deficient economic units bridge the gap between current income and current expenditure (Lavoie, 1984:774). Moore (1983:538-539) notes, "The evidence suggests that the quantity of bank intermediation is determined primarily by the demand for bank credit". The recognition that it is the demand for credit that leads to changes in the money supply implies that it is the borrowing requirements of firms that will be the primary reason for any changes in the money supply; however, it has been proposed that there may be other important components of credit demand.

Howells and Hussein (1999:441) recognise that the source of the endogeneity of money has traditionally been the costs and volume of production determined by the current state of the economy, and argue that the generally accepted meaning of the state of trade (costs and volume of production) is too narrow. The meaning should be broadened because money is required to finance all types of transactions and not just transactions on newly produced goods. A second argument for a broader definition is because there has been a shift in the components of credit demand as households have contributed to a greater portion of credit demand in recent years (Howells and Hussein, 1999:442).

If it can be shown that the demand for credit is influenced more by total transactions than by GDP then an endogenous money supply does not necessarily need to follow GDP, but rather provides the additional liquidity required to finance extra production, and may have more of an active role than traditionally thought (Howells and Hussein, 1999:442). Evidence suggested that the demand for credit is better explained using a measure of total transactions than a measure of spending on final output alone and thus credit may provide the additional liquidity needed in the production process (Howells and Hussein, 1999:453).

Referring to the money supply as being endogenously determined implies that there is a "reverse" line of causation to that asserted by the quantity theory as a banks cash reserve holding will be some fraction of monetary liabilities, rather than some multiple of cash reserves as in the traditional Friedman type analysis (Moore and Smit, 1986:83). Nell (2001:314) analyses the money supply process in South Africa over the period 1966-1997, breaking the period under review into two sub-periods ranging from 1966-1979 and 1980-1997. The 1966-1979 period represents a more direct approach by policy authorities to control credit growth and the money supply. Instruments used by the SARB included credit ceilings, cash reserve requirements and interest rate controls (Nell, 2001:317). The 1980-1997 period represented a shift by the SARB towards a more market orientated approach to monetary policy (Nell, 2001:314). Results suggest that the money supply was endogenously determined over the whole period and the inability of the Reserve Bank to achieve monetary growth targets is due to the endogenous nature of the money supply (Nell, 2001:325).

There is, however, some disagreement between proponents of the endogenous money hypothesis as to the interest-elasticity of the horizontal money supply function. The two

schools of thought can be broadly categorised into the horizontalist and structuralist schools, to which the discussion turns next.

3.2.4.1 Horizontalists versus structuralists

There are two main branches of thought as to how a central bank is able to influence aggregate demand and aggregate output under the Post-Keynesian notion of an endogenous money supply. The first is the accomodationist position, which sees the loan supply schedule of banks as being horizontal and the supply of credit completely satisfies the demand for credit. The second branch is known as the structuralist position, under which there is a positively sloped loan supply schedule such that both the demand for, and supply of, credit determines the amount and price of new loans. The central bank can influence the supply schedule using the discount rate, and the slope of the supply schedule is influenced by policies of the central bank (Palley, 1991:398). The structuralist position focuses mostly on the changes in the velocity of circulation (Garcia, 2006:37). Lavoie (1992:203) asserts that this distinction is artificial as both descriptions, despite their disagreement of the interest rate elasticity of loan supply, agree that the broad causation is from bank lending to growth in the money supply, and not the reverse.

A key point to note within the theory of an endogenous money supply is that it is the increased desire to buy more goods in each period by firms, households and governments that induce entrepreneurs to borrow from the banking system. In what Davidson (2006: 146) calls the "income-generating finance process" (it is the process by which entrepreneurs expand investment, seek finance and thus generate income) the quantity of money in circulation is always determined endogenously. The starting point is the recognition that loans create new deposits as a desire on the part of borrowers to increase their current expenditure over current income (Howells, 1995:92). Davidson (2006:141) sums up the endogenous money supply argument when he says:

> "Although mainstream economists have not given explicit recognition to Moore's important contribution, is fair to say that central bankers in the twenty-first century have discarded the exogenous money supply concept and instead explicitly developed monetary policies that are more compatible with Moore's

endogenous money concept. Basil Moore deserves a niche in the Economist's hall of fame for wresting central bank policy from the dead hand of Friedman's Monetarist analysis"

3.2.5 Post-Keynesians and interest rates: exogenous or endogenous, real or monetary

Traditionally there have been three main theories of interest rate determination which include the loanable funds theory, liquidity preference theory and the more recent horizontalist theory (Smithin, in Arestis and Sawyer, 2006:279). The loanable funds theory is a classical theory and makes use of the full employment assumption; the liquidity preference theory and the horizontalist view are both Keynesian. The loanable funds theory will be covered here and the more Keynesian views left to the next sub-section. The loanable funds theory is derived from classical theory and views the real interest rate as being determined endogenously by the equilibrium between savings (time preference) and investment (the marginal productivity of capital) (Smithin, 2006:280). Classical economists saw the real interest rate as determined by the interaction between real forces affecting the demand for, and supply of, a fixed amount of available saving. The nominal rate of interest is determined by the real rate plus the inflation rate (Moore, 2006:239). The interest rate prevailing at equilibrium is known as the natural rate of interest, which is consistent with full employment (Smithin, 2006:280).

The loanable funds theory views the economy as that of a barter economy where the amount of savings to finance investment is limited and as a result money is only seen as a means of exchange between the buying and selling of real goods (Smithin, 2006:273). Within a credit money economy however current production can be bought with bank credit and thus economic agents are not restricted to a fixed savings constraint (Moore, 2006:240). Therefore the loanable funds theory does not apply to a credit money economy and a more appropriate theory must be found, leading to both the liquidity preference theory and the horizontalist view of interest rate determination.

3.2.5.1 Liquidity preference theory and the horizontalist view

Keynes challenged the classical loanable funds theory by developing the liquidity preference theory; however, the way in which the theory was presented in the IS/LM model did not

adhere to the more philosophical components outlined by Keynes (Smithin, 2006:280). For Keynes, interest rates are determined in the money market and are thought of as the rate at which economic agents will part with liquidity in the face of uncertainty (Moore, 2006:241). In the Hicksian (1937) IS/LM model the downward sloping money demand curve is a function of liquidity preference and is presented alongside a vertical money supply function, which is the result of Keynes' assumption in the *General theory* that the central authority can set the money supply (Moore, 2006:255). In this theory of interest rate determination the interest rate adjusts endogenously to changes in liquidity preference and the interest rate is seen as a monetary (rather than real) variable (Moore, 2006:256). In Keynes' later writings he acknowledged that the interest rate is an exogenous policy variable set by the central bank but failed to differentiate between an endogenous and exogenous money economy in the *General theory,* as the purpose of the General theory was to explain the theory of aggregate demand (Moore, 2006:257).

Kaldor (1986) builds on the liquidity preference theory framework of Keynes and modifies the approach to take into account an endogenously determined money supply (Docherty, 2005:142). Under this view the central bank is seen to determine a short term rate of interest and provide all liquidity demanded (Docherty, 2005:168). It is argued that a higher level of expenditures automatically creates the necessary saving to finance the higher expenditures via Keynes' income multiplier process (Docherty, 2005:150). The modified theory also took into account the insight that in the short run savings may not equal investment and this additional financing is obtained from the central bank (Docherty, 2005:168). This modified theory allowed Kaldor (1986) to argue against the loanable funds position that higher government borrowing will raise the level of interest rates and crowd out private investment as well as explain why the economy may operate at below full employment (Docherty, 2005:152).

The crowding out of private investment occurs because the traditional IS/LM model assumes that there is a fixed money supply and therefore a fixed supply of savings. One implication of this analysis is that any attempt by government to increase spending financed by borrowing will crowd out private investment spending because the increased demand for funds will increase the endogenously determined interest rate. Within a credit based economy however banks can create credit and as a result there is no fixed supply of savings constraint and thus

there is no crowding out of private investment. When a credit money economy is acknowledged a convincing argument can be made to increase government spending to increase aggregate production (Lavoie, 1992:166).

The third school is the horizontalist school which extends Keynes' insight that interest rates are a monetary phenomenon and Kaldor's endogenous money supply argument. Horizontalists view the interest rate as being determined exogenously by the central bank and the money supply then adjusts endogenously as economic agents adjust their levels of debt due to any change in the price of credit (Smithin, 2006:281). The horizontalist school differs from Kaldor's (1986) modified liquidity preference theory in one important respect in that there is no income multiplier process operative to ensure savings will equal investments, discussed below in section 3.3.2

3.3 THE ENDOGENOUS MONEY SUPPLY AND AGGREGATE OUTPUT

3.3.1 Introduction

Within a credit money economy it is the expectations of entrepreneurs as to the future state of effective demand that injects money into the economy based on hiring and production decisions. Thus, for the economy to reach a steady state of growth, entrepreneurs must expect a constant rate of growth in effective demand into the future and also that these expectations are consistently realised (Davidson, 1972:111). It is the expectations of increases in profits which will encourage entrepreneurs to undertake net investment; however, these expectations are not likely to be realised in the long run due to an uncertain future and as a result the economy will follow a "wobbly" growth path (Davidson, 1972:114). If total aggregate demand is to increase over time then it is necessary for economic agents to deficit-spend and by implication there must be an increase in the net assets and liabilities for the whole economy (Moore, 1988:297). The increase in net assets and liabilities is achieved via the ability of banks to grant credit by creating a deposit against themselves, and this has implications for the traditional assertion that the savings and investment functions are independent as well as rendering the income multiplier process inapplicable.

3.3.2 Increases in aggregate demand

For total aggregate demand to increase over time there must be a net increase in financial assets and liabilities for the whole economy and this requires economic agents to deficit-spend, resulting in a higher level of aggregate demand relative to last period's income (Moore, 1988:297). The increase in aggregate demand does not necessarily lead to a reduction in unemployment and it is possible to have a situation in which there is growth in aggregate demand but no growth in employment due to, for example, technological improvements which increase productivity at the expense of labour (Davidson, 1972:116).

There are two possible sources of funds that can be used for deficit spending, the first being drawing down previously accumulated money balances, either by spending directly or by borrowing from non-bank intermediaries. The second is the creation of new money balances by banks which result from the purchase of new or existing financial assets. Banks can be contrasted to nonbank intermediaries in that nonbank intermediaries channel a fixed amount of surplus savings to deficit units and no new credit money is created. Banks on the other hand have the unique ability to monetise non-marketable debt (Moore, 1988:295).The contrast between bank and non-bank intermediaries has important implications for the balance sheet channel of monetary policy transmission under conditions of asymmetric information and this point will be returned to in the next chapter.

If an economic unit borrows money from a bank in order to purchase goods and services then there will be an increase in the level of income of the seller (Moore, 1988:296). The increase in deposit balances at banks by producers as a result of sales is known as "convenience lending". This does not require a simultaneous act of voluntary savings because bank money is generally accepted as a means of payment and there is no sacrifice of current consumption that needs to be rewarded. The accumulation of bank deposits by sellers does not represent a decision to save, and such convenience lending may be short term for an individual; however, for the economy as a whole convenience lending is long term and lasts as long as the net increase in the money stock (Moore, 1988:298). The idea of convenience lending is closely related to Keynes' finance motive in which an increase in the level of spending is financed by an increase in the demand for additional liquid resources (Wells, 1981:586).

Firms require credit mainly to finance increases in working capital and the level of working capital finance is for the most part independent of the supply of savings in an economy. The new working capital finance needed to increase production comes from the increase in bank credit financed by depositors' increase in convenience lending to the banking system (Moore, 1988:299). The recognition of convenience lending has implications for both the savings and investment schedules as well as the income multiplier process within the IS/LM model.

As pointed out by Moore (1988), the supply of bank credit for investment purposes is independent of the supply of savings. The demand for credit is a function of the expectations of entrepreneurs as to the future state of the economy and the investment schedule can be drawn as a horizontal line in interest-savings space (Moore, 2006:292).Since the saving to finance the new investment is created when the loan is created there is no independent supply of savings schedule and thus the savings schedule falls away (Moore, 2006:293). The simultaneous creation of a deposit (savings) and loan (investment) by a bank when extending credit to the private sector means that an autonomous increase in investment does not lead to an equal amount of savings created via an increase in household income and the income multiplier process. Instead the savings are created when the loan is granted and thus the multiplier process plays no role (Docherty, 2005:197).

3.4 SUMMARY

From the above discussion it can be seen that there are serious theoretical deficiencies in the mainstream IS/LM model. First dealing with the IS curve, it was shown that the investment and savings schedules are not independent and as a result the Keynesian income-savings multiplier does not have any significance because investment creates its own savings when banks create deposits (Moore, 2006:295).

Moore (2006:295) notes there can never be an equilibrium combination of investment and savings that brings about equilibrium in the product market and the traditional investment saving relationship "should be banished from the textbooks". The role of the IS curve becomes that of a downward sloping aggregate demand schedule due to the inverse relationship between aggregate investment and the rate of interest (Moore, 2006:295). Secondly, the LM curve suffers from the severe criticisms that the money supply is not

exogenously determined and that the central bank does not target monetary aggregates in practice. There is also a reduced role for liquidity preference in terms of money demand.

The above leads to the conclusion that there is in fact no IS schedule because the construction thereof is not consistent with endogenous money principles. Similarly the LM curve is no longer upward sloping because the central bank sets the discount rate which influences all other rates and therefore the interest rate is determined exogenously and not endogenously. The LM curve then becomes a horizontal line (Moore, 2006:297). Moore (2006:297) sums up the analysis when he says "the IS-LM diagram should be banished from the textbooks as a confused GE fantasy."

CHAPTER FOUR

THE ROLE OF ASSYMETRIC INFORMATION AND THE CREDIT CHANNEL OF MONETARY POLICY TRANSMISSION

4.1 INTRODUCTION

This section will begin with an overview of the traditional IS/LM model in terms of the channelling of savings to investment under the assumption of perfect information. Next the credit channel and the transmission of monetary policy is discussed. Thirdly, attention is focused on an influential paper by Bernanke and Blinder (1988), which extends the traditional IS/LM model and accounts for asymmetric information. Following this another influential paper by Bernanke and Gertler (1989) is considered which specifically focuses on the effects of asymmetric information, the balance sheet channel of policy transmission and the effects the balance sheet channel may have on firms of different size within an economy.

4.2 THE TRADITIONAL IS/LM MODEL AND ASYMMETRIC INFORMATION

4.2.1 Introduction

The traditional IS/LM model described in the second chapter assumes that markets are complete and therefore information is perfect. The assumption of perfect information was the dominant paradigm among the economics profession during the 1970's (Bernanke, 1993:52). One of the major works to come out of this school of thought was a paper by Modigliani and Miller (1958) which showed that under a number of simplifying assumptions, including that of perfect information, economic decisions by firms depend only on the level of technology within an economy as well as consumer tastes and preferences. The implication of these simplifying assumptions is that the decision as to how and what to produce does not depend on the capital structure of the firm. Thus how much debt to equity a business undertakes in its

financial operations, and whether this financing is obtained in either the debt market (directly or indirectly) or equity market is irrelevant. The traditional approach implicitly assumes that non-money assets such as government bonds, commercial paper, equities and bank loans (among others) are perfect substitutes, lumped into the category "bonds" and treated as homogenous (Bernanke, 1993:55).

A firm can therefore choose to borrow directly in the money market or indirectly via a financial intermediary and the only relevant decision in which type of debt to use is the relative cost of the funds borrowed. Perfect substitutability between different forms of debt is however not realistic because economic agents do not have perfect information within credit markets and it is this asymmetry of information which gives rise to the credit channel of monetary policy.

4.2.2 Asymmetric information and the credit channel of monetary policy transmission

During the 1970's there was an internal shift within the economics profession due to a new theory of imperfect markets which later became known as the theory of asymmetric information. The theory of asymmetric information is concerned with the financial structure of a firm and the effect this has on economic activity (Mishkin, 1991:70). The theory focuses on differences in information between different parties to a contract. Borrowers have an informational advantage over lenders which results in adverse selection and moral hazard problems, and it is asymmetric information that gives rise to the credit channel of monetary policy transmission.

First, adverse selection arises if a lender cannot tell the difference between good and bad quality borrowers. If this happens the lender will make a loan at a rate which reflects the average quality of all borrowers. An implication of this average rate charged on loans is that high quality borrowers may drop out of the market because the average loan rate is too high and thus profitable investment projects may not be undertaken, leaving a proportionally higher level of bad quality borrowers (Mishkin, 1991:71). Secondly, moral hazard arises when borrowers have an incentive to engage in risky activities that may benefit the borrower;

however, these risky activities increase the probability of default which may harm the lender. Moral hazard is seen to affect the efficiency of financial markets (Mishkin, 1991:72).

The credit channel focuses on the channelling of savings by economic agents to the most productive investments, taking into account asymmetric information within credit markets as well as the effects that asymmetric information has on the amount of credit a firm can access. This is particularly relevant if an endogenous money economy is assumed, because firms must first borrow money in order to undertake production.

4.2.3 Implications of asymmetric information

One implication of asymmetric information within credit markets is that transactions between borrowers and lenders based only on price (the interest rate) are unlikely to lead to a Pareto-optimal outcome and the development of institutions may be required to mitigate the asymmetric information problems to arrive at a fair price (Bernanke, 1993:52). Whenever a borrower takes out a loan an asymmetric information problem exists and the incentives of the borrower must be aligned with that of the lender. The cost of aligning as well as monitoring the incentives of management or borrowers are known as agency costs, and it is these costs which give rise to the external finance premium (discussed below), defined as the difference between the cost of external funds and the cost of internally generated funds (Bernanke, 1993:54).

Credit markets have developed a number of ways to help minimise the degree of asymmetric information. One solution comes in the form of financial contracts which have developed to limit moral hazard incentives on the part of the borrower by the lender. Another solution to the asymmetric information problem is the information gathering and monitoring activities of financial intermediaries. Financial intermediaries gather information on the creditworthiness of borrowers as well as monitor their activities, and both functions serve to reduce the level of asymmetric information between borrower and lender. Financial intermediaries are suited to this purpose because of factors such as economies of expertise, economies of scope and economies of scale. It has been suggested that banks play a particularly important role in the economy because they channel savings from relatively uninformed economic agents to uses that are information-intensive and hard to evaluate (Bernanke, 1993:53)

Asymmetric information has two effects when considered in relation to credit markets. The first effect is the wedge created between the cost of uncollateralisable external funds and the cost of funds generated internally through retained earnings. This wedge is otherwise known as the premium for external funds, which can be thought of as the cost of monitoring and evaluating the creditworthiness and actions of a borrower by lenders. The second effect of asymmetric information is the indirect relationship that is created between the value of collateralisable debt to loan size and the premium for external funds. If, for example, the lender contributes a greater amount of collateral, then for a given loan size the smaller will be the premium for external funds because there will be a smaller incentive on the part of the borrower to misrepresent information to lenders (this is the basic idea behind the balance sheet channel by Bernanke and Gertler (1989) below).

Studies on the effects of asymmetric information within financial markets have shown results in line with theoretical predictions, assuming a range of informational structures. The balance sheet channel of policy transmission arises because of asymmetric information and can be thought of as having an effect on the net worth of a borrower through economic disturbances. It is the change in net worth which will affect a borrower's access to credit, via the external finance premium, and this increased inability to access credit will have real economic consequences via output fluctuations (Gertler and Gilchrist, 1993:48).

4.3 THE BROAD CREDIT CHANNEL AND THE TRANSMISSION OF MONETARY POLICY

4.3.1 Introduction

The credit channel is a relatively new channel of policy transmission and is made up of the bank lending channel as well as the balance sheet channel. The credit channel is concerned with the asset side of a bank's balance sheet, in line with Post-Keynesian theory, and affects output through changes in a firm or households ability to access credit. The discussion will briefly cover the general theory relating to the credit channel and then focus on the balance sheet channel.

The credit channel is primarily concerned with the demand for credit, rather than the demand for money as in the traditional money view of policy transmission. This should not, however, be taken to imply that the credit channel is opposed to the money channel; rather the credit channel is seen as complimenting the money, exchange rate and asset channels of monetary policy transmission (Bernanke and Gertler, 1995:28). The credit channel recognises that credit markets do not operate with perfect information and thus different categories of assets and liabilities are not perfect substitutes, which implies that banks occupy a unique role in the financial system. The ability of banks to reduce asymmetric information is seen in their ability to provide credit at lower cost than would otherwise be the case, which is the primary reason that the majority of firms use banks as their credit provider rather than entering the market for direct credit. The credit market is considered efficient if the costs of credit creation are minimised and the market is channelling an economy's funds into the most productive uses (Bernanke, 1993:51).

The credit view hypothesises that monetary policy has an effect on real output by changing the terms of new bank loans and thereby affecting a firms (or households) access to credit; this effect on new bank loans is in addition to the effect the central bank has on short term rates and the resulting influence on output (Bernanke, 1993:56). An important implication of the dependence of economic agents on indirect access to credit, via banks, is that a disturbance to the flow of bank credit has important consequences for real output. The credit view sees monetary policy as having an effect by influencing the flow of bank credit (Gertler and Gilchrist, 1993:45). As noted, the credit channel is comprised of the bank lending channel as well as the balance sheet channel of policy transmission; in light of these two sub-channels the discussion will begin with a brief discussion of a paper by Bernanke and Blinder (1988) which incorporated asymmetric information into the traditional IS/LM model and more recent research on the bank lending channel. Following this attention will turn to the balance sheet channel and its role in policy transmission.

4.3.2 Extending the IS/LM model and the credit channel of policy transmission

Bernanke and Blinder (1988:435) extend the basic Keynesian IS/LM model by taking into account the heterogeneous nature of bank assets and bank liabilities and thereby take into account asymmetric information. A graphical representation of the extended model shows a

negatively sloped “CC curve” (commodities and credit curve) which gives points of equilibrium between the money and loan markets. The Bernanke and Blinder (1988) model is discussed because it was one of the first models to incorporate the presence of asymmetric information within credit markets into the Neo-classical IS/LM model; however, the model is based on the assumption of an exogenous money supply and thus the transmission of monetary policy occurs through changes in the amount of bank reserves (the bank lending channel) which are directly under the influence of the central bank. This is evident in the model’s use of the money multiplier through which the central bank influences the reserve base of the banking system (Bernanke and Blinder, 1988:436).

In modern financial economies a central bank will predominantly set the level of a short term nominal interest rate, rather than target a monetary aggregate, and thus the idea of a money multiplier no longer has any significance (Disyatat, 2010:5). In a credit money economy the money supply is endogenously determined and thus Bernanke and Blinder (1988) are adhering to the traditional IS/LM model described in chapter two. Recent research by Disyatat (2010) however argues for the existence of a bank lending channel that is in line with Post-Keynesian endogeneity theory.

Disyatat (2010:2) argues that there is indeed room for a bank lending channel within an endogenous credit money economy by arguing that an alternative interpretation of the bank lending channel is that the cost of borrowing funds in the money market will lead to changes in the supply of bank lending. It is noted that loans drive deposits and that the money multiplier is a flawed concept in a credit money economy, in line with Moore (1988). It is also recognised that there is no exogenous limitation to the supply of bank credit except through regulatory requirements, and that the banking system can always fulfil the demand for loans in line with a horizontalist approach. In this alternative approach it is the changes in the underlying values of bank assets and bank liabilities as well as changes in risk perceptions of lenders to banks in the money market which transmit changes in monetary policy (Disyastat, 2010:2).

The bank lending channel is seen to operate through changes in the external finance premium faced by banks when seeking to acquire funds to cover any shortfalls in loans according to regulatory requirements in the money market. The external finance premium is a function of

the balance sheet strength of the firm and comes about as a result of asymmetric information (Disyastat, 2010:8). Disyatat (2010:8) notes "The underlying mechanism at work is thus largely one and the same as that of the balance sheet channel. But instead of focusing on the impact of policy on financial frictions at the firm level, the emphasis is instead on the bank level". The model is developed by focusing on policy induced changes in a bank's cost of external funds and not changes in the supply of funds, therefore a bank lending channel is plausible even when banks have full access to money markets (Disyastat, 2010:8). A change in interest rates by the policy authorities will be transmitted via changes in required rates of return and not through changes in the quantity of deposits, which is in line with Moore's (1988) argument that interest rates are exogenous, as discussed above. The only limitation to credit expansion is bank capital in that it affects a bank's assets expansion and investors' perceptions about the riskiness of investing with the bank (Disyastat, 2010:9).

In light of the theoretical complexity of the balance sheet versus bank lending channel of policy transmission, a full discussion and review is outside of the scope of the study. The focus here will be on testing for a balance sheet channel of policy transmission from the viewpoint of the firm and no attempt is made to distinguish between the two channels. Either a balance sheet channel is operative at firm level, or it is not.

4.3.3 The balance sheet channel and an endogenous money supply

The balance sheet channel is concerned with the channelling of funds to productive investments, while taking into account the heterogeneous nature of assets and liabilities as a result of asymmetric information. Given that asymmetric information is present within credit markets the channelling of funds to productive investments may not be done as efficiently as predicted by the traditional IS/LM model, and may even break down, which will lead to changes in output and employment due to changes in investment spending (Bernanke, 1993:51).

The balance sheet channel is otherwise known as the "propagation mechanism" (Gertler and Gilchrist, 1993:47) or the "financial accelerator effect" (Bernanke and Gertler, 1989:28) because the balance sheet channel is a mechanism which amplifies the impact of economic

disturbances to a borrower's spending decisions by altering an economic agents net worth via changes in the values of assets and liabilities on their balance sheet. The change in net worth will in turn affect the premium for external funds charged by lenders (the bank) in a way that will magnify the impact of a shock to the economy, which implies that it is the level of liquidity that effects investment spending (Gertler and Gilchrist, 1993:48).

Bernanke and Gertler (1989) wrote an influential paper on the role of a borrower's balance sheet over the business cycle. The objectives of the study were twofold; firstly to analyse the connection between the relative strength of a borrower's balance sheet and changes in agency costs (monitoring costs), and secondly to determine if the connection between the net worth of an economic agent and the level of agency costs is a factor that influences the business cycle (Bernanke and Gertler, 1989:16). It is assumed that it is costly for lenders to monitor the activities of borrowers and it is this assumption which makes the Modigliani-Miller theorem inapplicable, because information is not perfect and the role that financial factors play in the production of output becomes important (Gallegati, 2005:1925). These monitoring costs result in a higher cost of external finance relative to internally generated finance, such as retained earnings, because when asymmetric information is present in credit markets the equilibrium reached by the market will not be Pareto-optimal (Bernanke and Gertler, 1989:14).

Results suggest that a borrower's balance sheet plays an important role in the business cycle. A key insight is that agency costs involved in the undertaking of physical investments are inversely related to net worth. Another insight is that the agency costs which should be accounted for when analysing the relationship between different economic variables (such as investment and lending) go further than only those of monitoring costs, and should include any deviation from a Pareto-optimal outcome within the credit market (Bernanke and Gertler, 1989:28).

The traditional IS/LM model views savings as being channelled into productive investments through the selling of bonds by deficit economic units and the required level of savings is generated by the income multiplier so that savings is equal to investment. As argued above, the investment and savings relationship is not independent because the required level of savings is generated when credit is granted by the banking system in the form of loans, thus

the Keynesian income multiplier no longer plays any role. The balance sheet channel is still seen to play a role within the Post-Keynesian theory in that banks will grant new credit to borrowers based on the strength of their balance sheets by adjusting either the loan rate, collateral requirements or both. Thus a change in a borrower's balance sheet strength will lead to changes in aggregate demand as a result of changes in the ability to access credit.

4.3.3.1 Implications of the balance sheet channel

One of the implications of this analysis is that financial accelerator effects are stronger the deeper the economy is in recession because the ability of a firm to fund investment projects out of internally generated funds is at its lowest. A second implication is that there will be a "flight to quality" in credit markets because investors will shift their wealth into safer assets during an economic downturn and these safe assets include only larger, more well-established, firms with a large amount of collateral (Bernanke *et al,* 1996:4). The impact of the balance sheet channel on the access to credit will be larger for smaller borrowers, under the expectation that differences in the cyclical behaviour of firms should differ between firms depending on their ability to access credit (Gertler and Gilchrist, 1994:310). One possible reason for this is that small firms have higher bankruptcy costs due to the proportionately greater fixed costs associated with evaluation and monitoring by the lender. Another possible reason is that large borrowers have a greater amount of collateral to pledge than smaller firms. Small borrowers rely mostly on internally generated funds, as well as indirect debt, for the financing of a new project; large firms also have access to direct forms of credit in addition to indirect forms of credit (Gertler and Gilchrist, 1993:49).

Assume, for example, that the monetary authority undertakes a tightening of monetary policy by increasing the repo rate. This increase in rates will increase the cost of external funds faced by any firm because the value of liabilities increases and the value of assets decreases, which in turn decreases the value of collateral that can be put up against any loans. This leads to an increased inability on the part of an economic agent to access credit for working capital or investment purposes because the firm is now seen as more likely to default if a loan is granted. The increased inability of the firm to access credit to begin production will have real economic effects because the firm will lack access to credit in order to pay the factors of

production needed to produce output. A credit hierarchy will emerge within debt markets and firms may be forced to give up on investment projects which have a positive net present value because of financing constraints (Gallegati, 2005:1925). Firms and households will therefore have more limited access to credit when the net position of their balance sheets is relatively weaker.

4.4 SUMMARY

The traditional IS/LM model assumes that information is perfect; however, during the 1970's, there was a shift in economic thought towards a recognition that markets are not perfect and are characterised by imperfect or asymmetric information. An implication of imperfect credit markets is that transactions based only on price are unlikely to lead to a Pareto-optimal outcome. It is asymmetric information that gives rise to the credit channel of monetary policy transmission and the credit channel is made up of the bank lending channel as well as the balance sheet channel; the focus here is on the balance sheet channel.

The balance sheet channel is otherwise known as the "propagation mechanism" or the "financial accelerator effect" because it magnifies the effects of an economic shock by altering an economic agent's net worth. The main implication of the balance sheet channel is that there will be a flight to quality and a credit hierarchy will emerge between small and large firms as investors move towards safer assets. The flight to quality will make it harder for small firms to access credit in order to undertake production and thus the balance sheet channel may have real economic consequences.

CHAPTER FIVE

LITERATURE REVIEW OF CONSUMTPION BEHAVIOR

5.1 INTRODUCTION

Post-Keynesians have made few efforts to describe the process of consumer choice. There are however a number of papers that, taken together, form a coherent picture on consumption behaviour (Lavoie, 1994:539). Post-Keynesians do not accept the traditional Neo-classical principles of utility maximisation and rational expectations but instead propose an approach that is based more on psychological and philosophical than on economic grounds. The sections begins with an overview of some of the more important theoretical flaws in mainstream microeconomic theory, including rational expectations, utility maximisation, uncertainty as well as the concept of general equilibrium. Following this an alternative theory to consumer behaviour is proposed, in line with Post-Keynesian thought.

5.2 NEO-CLASSICAL ANALYSIS AND KEYNES

5.2.1 Introduction

As mentioned above in section 4.2.2, there was a shift in economic thought around the late 1960's to the early 1970's, from a predominantly Keynesian approach in the early sixties to a predominantly New-classical approach in the late seventies. The shift from Keynesian economics to New-classical economics can be attributed to a rise in inflation and unemployment as well as a change in economic methodology over the period (Ackerlof, 2007:5). New-classical economists use a macroeconomic theory that makes policy prescriptions on the basis that firms seek to maximise profits and consumers utility. The theory is built on five separate neutrality ideas which include, firstly, the life-cycle/permanent income hypothesis in which consumption does not depend on current income. Secondly, the Modigliani Miller theorem which states that current profits have no effect on investment, thirdly, the natural rate theory, fourthly, the rational expectations hypothesis and finally the

Ricardian equivalence theorem, in which taxes and deficit spending do not influence consumption. These ideas were in contrast to Keynesian ideas and offered radically different policy prescriptions. The new theory emphasised economic equilibrium of competitive markets under conditions of perfect information, regardless of an individual's preferences (Ackerlof, 2007:6). The aim of this section is to give a brief overview of Neo-classical economics and its relation to consumption, and is broken down into three broad sections which include individual expectations, utility maximisation and risk versus uncertainty.

5.2.2 Individual expectations

Neoclassical theory states that all endogenous variables can be explained as the result of rational choices made by economic agents to maximise utility (Boland, 1979:959). Gerchev (2007:313) has defined expectations as "the unobservable opinions about the future that individuals form in their minds" and has identified two mainstream economic theories of how individuals form expectations, namely those formed based on adaptive expectations and those based on rational expectations. Both theories are fundamentally flawed as adaptive expectations does not, in fact, deal with expectations and rational expectations does not recognise the human element behind the economic consumer. Under adaptive expectations an individual's expectation of future prices is equal to an arithmetic average between the *current* realised price and the *previous period's* price (Gerchev, 2007:314). According to this approach it is only the value of past prices that influences supply and thus the forward looking behaviour of suppliers is lost. Therefore under adaptive expectations history affects the future rather than expectations (Boland, 1979:315). With the loss of the significance of expectations under the adaptive expectations hypothesis an alternative theory of expectations formation has been widely adopted, that of rational expectations.

Under the rational expectations hypothesis an individual is assumed to use all relevant information when formulating expectations about future economic phenomena. The original definition of a rational person provided that an individual's expectation, on average, must coincide with economic theory because there is a profit to be made from possessing specialised knowledge about the economy and theory is a good description of reality (Gerchev, 2007:317). This meaning has since been expanded into a number of different interpretations; however, for present purposes only an individual's beliefs about the future are

always correct (Gerchev, 2007:318) need be acknowledged. The rational expectations hypothesis ultimately comes down to the assumption that thoughts determine reality (Gerchev, 2007:324), which is not the case and a better theory of expectations formation must be found.

A consumer will endeavour to maximise his level of utility given any expectations about future economic variables and these expectations lead to the theoretical conclusion that monetary policy is neutral within a rational expectations framework because any change in the money supply by the central bank (exogenous money) will be correctly anticipated by economic agents and wages, as well as prices, will change in proportion to the change in the money supply. Wages and prices change in proportion because both are assumed perfectly flexible and economic agents have perfect information on all wages and prices. Thus monetary policy has no effect on the stability of the macro-economy (Ackerlof, 2007:8).

5.2.3 Utility maximisation

The five ideas of neutrality identified with the Neo-classical view are based on the assumption that individuals seek to maximise utility according to their rational and therefore correct expectations (Ackerlof, 2007:8). Mainstream microeconomics views consumers as rational agents who behave according to six axioms which include completeness, transitivity, reflexivity, non-satiation, continuity and convexity, and it is these six axioms which give rise to the familiar continuous, convex indifference curves seen in most textbooks. The utility function is then added to these well behaved indifference curves and the rational person is assumed only interested in maximising utility (Drakopoulos, 1990:183).

Neo-classical theory assumes that all endogenous variables can be explained by the utility maximising behaviour of agents given some exogenous consumption constraints, thus there must then be an assumption made as to which variables are exogenous. In Neo-classical economics there are a number of different variables which may be considered as exogenous depending on what is being explained, such as cultural traditions and social institutions (Boland, 1979:960). The problem with this Neo-classical view of utility maximisation is that it does not allow for a psychological basis of the individual (the human element) (Drakopoulos, 1990:184).

The overall psychological basis implied by Neo-classical theory is one that can be described as "quantitative egoistic hedonism" (Drakopoulos, 1990:195) or what Samuelson (1938) describes as the behaviouristic foundation to utility theory (Hollander, 2001:233).The hedonistic approach views an individual's quality of life as a balance sheet with respect to all pleasure (increase in assets) and pain (increase in liabilities) experienced in one's life; however, it has been proposed that the direction of influence of pain and pleasure on happiness is ambiguous and that these are not the only factors that influence an individual's quality of life (Hollander, 2001:241).

The behaviouristic foundation to utility measurement regards an individual's preferences as stable and consumers choose different consumption baskets from given opportunity sets (Hollander, 2001:233). Hollander (2001:233) has pointed out two serious shortcomings of the mainstream theory; firstly the definition of utility, in terms of choices and preferences, is a definitional chain and implies nothing about the relationship between utility and an individual's emotional states. The traditional behaviouristic definition does not have any empirical validity and a more appropriate definition of utility may be expressed in terms of psychological wellbeing (Hollander, 2001:228). Secondly, utility cannot be directly measured and thus observed behaviour must be relied upon in order to determine an individual's preferences. However, the inability to measure utility directly means that any welfare statements concerning individuals cannot be related to experience and are thus not testable (Hollander, 2001:228), therefore the behaviorist approach is empirically inadequate (Hollander, 2001:241).

5.2.4 Probabilities, uncertainty and risk

Probability and uncertainty are widely used terms in economics. However, their meaning is often altered between authors and thus an incoherent picture seems to emerge between the ideas of risk, probability and uncertainty (Lawson, 1988:38). Lawson (1988:39) has proposed that in order to understand the similarities and differences between the various approaches an epistemological approach (branch of philosophy that investigates the nature of human knowledge) should be taken. This is an approach which has widely been ignored by

economists because economists are primarily concerned with practical matters (Lawson, 1988:39). A realist approach is put forward in which probabilities can be understood in terms of either objects of knowledge or as forms of knowledge. The theories of Friedman (adaptive expectations) as well as Keynes can be understood in terms of knowledge as a form and the rational expectations hypothesis is associated with knowledge as an object (Lawson, 1988:40).

For Friedman, probabilities are seen as the "degree of belief in a given proposition or event, held by an actual individual at some specific point in time."(Lawson, 1988:41). These probabilities are generated internally by the individual and are dependent on specific individual knowledge or belief. Probabilistic knowledge does not necessarily conform to any external reality (Lawson, 1988:41). For Keynes probability is a form of rational belief and not something that can be learned through experience as is the case for Friedman (Lawson, 1988:42). Keynes viewed probabilities as either known or unknown. For a probability to be unknown an individual must not possess the skills to determine a rational belief even after obtaining all available information; however, a probability is known but numerically immeasurable if further information is needed in order to arrive at a decision (Lawson, 1988:43). Finally, rational expectations assumes that external reality can be represented by a joint probability distribution. The difference between Keynes and Friedman is that Keynes assumed probabilities are objectively determined, while Friedman believed that probabilities are subjectively determined (Lawson, 1988:44). The rational expectations hypothesis will be discussed further in section 5.3.2.1, however the concern here is the different interpretations of probabilities and uncertainty by Friedman and Keynes.

For Friedman probabilities were assigned to different and mutually exclusive states of the world and the outcome is seen as uncertain; all states of the world are known but it is uncertain as to which state of the world will come about (Lawson, 1988:47). Keynes, on the other hand, viewed uncertainty as the absence of probabilistic knowledge, a situation in which probabilities cannot be calculated (Lawson, 1988:48). Keynes did not agree with the mainstream theory of uncertainty but instead viewed probabilities as either indeterminate or indefinable and saw the traditional interpretation of probability as philosophically incorrect. For Keynes uncertainty means a situation in which probabilities are not numerically measurable and thus a probability distribution is not known (Drakopoulos, 1992:323). In the

General Theory Keynes provides evidence for considering the human element in consumption as opposed to only viewing consumers as robots attempting to maximise utility.

5.2.5 General equilibrium theory

The micro foundations of Neo-classical theory discussed above underlies mainstream economic theory and has traditionally assumed that the economy reaches a point of general equilibrium, and to which the economy will return given any deviations. Followers of this general equilibrium approach believe that the point is fast approaching where economics can be viewed as a science and is thus able to generate empirically testable propositions (Kirman, 1989:126). The dominant theoretical basis for consumption is Gary Becker's household production approach to consumption activity (Fuller, 1996:595). This approach is made up of three elements which include global rationality (rational expectations), competition-driven social relations and household centred production (Fuller, 1996:596). Mainstream microeconomic theory uses stable and unique indifference curves to represent different levels of utility; however, the underlying assumptions of uniqueness and stability that lead to an equilibrium solution have no theoretical justification (Kirman, 1989:137).

One criticism of the traditional approach is that its' focus on the individual and social relations only serve to increase utility, thus social interactions are ultimately reducible to increases in individual utility and there is no other reason to engage in social relations (Fuller, 1996:598). Kirman (1989:126) has argued that if mainstream theory continues to focus on an individualistic approach when building economic models there can be no testable predictions and the model will not be a very good description of reality. A second criticism of the Neo classical general equilibrium is that the evolution of any institutional setting (such as societal influences) can be explained as the sum of all logical utility maximising choices, which will maximise an individual's consumption bundle given fixed budget constraints (Boland, 1979:957). Boland (1979:958) has argued that since the neoclassical view is that an institution is static, any proposed position will run into methodological failures because the Neo-classical view considers an economy between two equilibrium points and thus does not take the dynamics of economic progress into account (Boland, 1979:958).

A number of propositions, including those given above, have been put forward for the failure of the general equilibrium model, including assumptions about an individual's optimising behaviour as well as mathematical constraints. These propositions, however, do not address the source of the problem which goes further than just optimising assumptions; the underlying problem is that traditional theory does not recognise that individuals actually make decisions interdependently with other individuals and do not act as if in a vacuum (Kirman, 1989:137). Kirman (1989:138) concludes that economists should not make strong assertions about the aggregate behaviour of individuals based on traditional general equilibrium theory, as these models have "no basis in economic theory as it stands".

5.2.6 Keynes and the traditional theory

The view that individuals attempt to maximise utility implicitly assumes that an individual is by nature hedonistic; however, Keynes argued that an individual will pursue the good rather than pursue pleasure (Drakopoulos, 1992:322). Keynes did not explicitly formulate a theory of consumption and it is sometimes thought that this lack of focus is taken to mean that Keynes was in agreement with the foundations of microeconomic theory put forth by classical economics. This is evident in a number of studies that have attempted to incorporate marginal utility theory into the consumption function as viewed by Keynes, an example of which is given by Tobin (1956) when explaining an individual's demand for transactions balances (Drakopoulos, 1992:319). There are however a number of insights offered by Keynes that suggest he rejected the classical marginal utility approach (Drakopoulos, 1992:318).

Drakopoulos (1992:322) argues that there is ample evidence that Keynes rejected the hedonistic ideas on which Neo-Classical consumer theory is based. Keynes viewed the object of life from a somewhat philosophical point of view and thought that life was about the pursuit of good, rather than pleasure as under the hedonistic approach. The hedonistic approach is criticised because it has illogical foundations. Keynes (1936:91) recognised that consumption is dependent on income, current objective circumstances and "the subjective needs and the psychological propensities and habits of the individuals composing and the principles on which the income is divided between them". The psychological component is composed of human nature and social practices and is not expected to change over the short

run; however, "it is necessary to take account of the manner in which changes in the subjective factors may affect the propensity to consume" (Keynes, 1936:91). For Keynes habits were an important part of dealing with uncertainty in the short run and a hierarchy of consumption can also be implied by Keynes as he suggests that an individual will attempt to satisfy basic needs first, given some level of income, and then only attempt to satisfy higher needs (Drakopoulos, 1992:326).

Post-Keynesians have built on Keynes' initial insights and developed a somewhat eclectic theory of consumer behaviour which incorporates the human element of consumption using theories from a variety of social sciences such as philosophy, psychology and sociology.

5.3 A POST-KEYNESIAN VIEW OF CONSUMPTION AND CREDIT

5.3.1 Introduction

Post-Keynesians see a number of theoretical deficiencies in the mainstream paradigm of utility maximisation, rational expectations and definition of uncertainty. Although there is no concrete theoretical outline of consumption behaviour in the Post-Keynesian school there are a number of propositions which can be agreed upon as being a necessary part of the construction of such a theory (Lavoie, 1994:539). Post-Keynesians reject the assumption of global rationality and advocate a more central role for the effects of socialisation processes on individuals (Fuller, 1996). Due to the eclectic nature of the theories, which can be thought of as comprising the possible beginnings of a Post-Keynesian theory of consumption, a framework for the analysis is borrowed from Lavoie (1994) to give some structure to the discussion. This study agrees with the general theoretical ideas proposed by Lavoie (1994); however, it will be argued that social habits and customs are equally or even more important in consumption behaviour than income as Lavoie (1994) proposes. The concepts presented below are by no means mutually exclusive. Following the discussion on consumption the role of credit will be discussed in section 5.3.3.1 and its relation to this study.

5.3.2 Framework for analysis

The theory of Post-Keynesian consumer choice can be categorised into six principles, including procedural rationality, satiable needs, separability of needs, subordination of needs, growth of needs and non-independence (Lavoie, 1994:543). Each will be discussed in turn.

5.3.2.1 Procedural rationality

The idea of procedural rationality developed out of a dissatisfaction with the traditional theory of rational expectations, or what Simon (1955:99) refers to as the "economic man". The view of rational expectations formation is consistent with a positivist economic methodology in which assumptions do not need to be empirically proven in order to have valid scientific content (Gerchev, 2007:323). Gertchev (2007:323) has pointed out that since rational expectations assumes that the individual always anticipates the future correctly nothing could be learned and nothing would be worth knowing because the future is known at the moment any action is taken. Thus the rational expectations hypothesis is self-contradictory because the purpose of research is to acquire knowledge. Evidence provided by tests of the rational expectations hypothesis suggests that the hypothesis does not hold (Gerchev, 2007:324).

Simon (1955:114) proposes an alternative to the traditional theory of rationality with what he calls "administrative man" who only has limited knowledge of his/her environment as well as a limited computational capacity, in contrast to the assumed full information and complete computing capacity under Neo-classical rational expectations. Lavoie (1994) builds on the idea that an economic agent has limited knowledge and computational capacity and proposes that consumers are procedurally rational. Consumers will develop an ability to avoid complex calculations in an uncertain world which may include rules of thumb, social conventions or seeking other people's opinion to make decisions. Procedural rationality goes beyond the problem of utility maximisation based on computational capacity because it is concerned with a satisfying solution rather than an optimal solution, because in an uncertain world it is impossible to know the optimal solution (Lavoie, 1994:544). A procedurally rational economic agent is no less rational than the Neo-classical counterpart; however, the

environment and rationality adopted to function within this environment are simply different (Lavoie, 1994:545).

5.3.2.2 Satiable wants and separate needs

The Neo-classical idea of utility can be linked to the satiation of needs because an individual will maximise utility and thereby gain satisfaction. In the Neo-classical behaviouralist framework satisfaction can only be obtained if prices are zero or income is infinite because there is always some level of utility to be gained from extra consumption (Lavoie, 1994:546). This adherence to the maximisation style of analysis is similar to that of classical physics and ignores the biological and cognitive sciences that attempt to understand the brain (Camerer, Loewenstein and Prelec, 2004:556). Two such approaches are presented below, namely Camerer, Loewenstein and Prelec (2004) in respect of a biological approach and Hollander (2001) in respect of a more cognitive approach to understanding satisfaction.

Camerer *et al* (2004) analyse the implications of consumer behaviour within standard theory from the physiological brain perspective and note that "the human brain is basically a mammalian brain with a larger cortex. This means human behaviour will generally be a compromise between highly evolved animal emotions and instincts, and more recently evolved human deliberation and foresight" (Camerer *et al*, 2004:559). Therefore, from the viewpoint of neuroscience, behaviour is a function of logic as well as emotions and as a result an individual's preferences may not be as stable as predicted by standard theory. One reason offered for the instability of consumption preferences is due to the brain constantly acting to maintain a state of homeostasis, thus the brain will maintain a stable condition and attempts to restore this stability if there is a departure for any reason (Camerer *et al*, 2004:562). The implication of the brain maintaining a state of homeostasis is that an individual's preferences will be state-dependent, in that internal body states affect preferences as well as act as signals to restore equilibrium. Therefore a consumer's consumption behaviour will change in accordance with his/her internal state and the consumption bundle which will achieve the most satisfaction will change over time, which is in contrast to the stable preferences and satiation assumptions made in Neo-classical theory (Camerer *et al*, 2004:563).

Hollander (2001:240) argues from a more psychological perspective and has proposed an alternative concept of satisfaction known as subjective well-being, based on literature in the areas of social psychology and philosophy, and defines subjective well-being as "an attitude towards one's life as a whole or some particular domain of one's life" which is experienced as a sense of happiness or well-being. Evidence is also provided that suggests empirical data can be better described by a theory based on an approach which highlights the sociological aspects of an individual's environment and not only focuses on a behaviouralist approach (Hollander, 2001:227). Post-Keynesians tend to see consumer behaviour as in line with Hollander (2001) in that the behaviouralist approach to satisfaction is not considered adequate and a more sociological perspective should be adopted.

Post-Keynesian consumption theory views satiation as obtainable with positive prices and a finite income; satiation is achieved when an individual reaches a threshold level of consumption beyond which additional consumption of a good will bring no more satisfaction. This view of consumption leads to the development of a hierarchy of consumption preferences such that basic needs are fulfilled first, in line with Keynes' original insights discussed above. Wants are seen as arising out of needs (Lavoie, 1994:546). Within a hierarchy structure different categories of needs can be identified which allows a consumer to break the decision making process down into a series of small decisions (Lavoie, 1994:547).

5.3.2.3 Subordination of needs and growth of needs

Lavoie (1994:550) uses Maslow's hierarchy of needs together with Keynes' assertion that consumption is dependent on psychological and habitual factors to explain how consumers form a hierarchy of consumption preferences, such that more basic needs will be fulfilled before higher needs can be satisfied. He then uses this approach to explain why consumers will move up the hierarchy with an increase in income, which is in contrast to Neo-classical theory which focuses more on substitution effects (Lavoie, 1994:551). Income allows more goods to be purchased and thus consumers can satisfy lower order needs as well as higher order needs.

Trigg (2004:397) sees Maslow's approach as being problematic because it focuses exclusively on the individual and the need for social interaction must be overcome to reach

self-actualisation, in line with Kirman (1989) above. Another criticism of Maslow's theory is that it assumes preferences are innate; however, as consumers move away from their basic needs they rely more on knowledge than instincts in making decisions and it is in this way that consumers must first discover their preferences before acting upon them. Maslow's theory thus views an individual as developing from within rather than being the product of his/her environment (Trigg, 2004:399).

An alternative theory is put forth by Trigg (2004) following work by Bourdieu (1984) based on two key elements. The first views individuals as holding an endowment of economic capital (money and wealth) and cultural capital. Cultural capital is seen as the acquired knowledge of artistic and intellectual pursuits and is a function of social origin and educational background. These two types of capital give rise to a "social space" within which the lifestyles of individuals can be categorised by the size and composition of capital (Trigg, 2004:399). The social space describes both vertical and horizontal dimensions, unlike Maslow who only considers a vertical dimension. The second element is known as the *habitus* and is used to categorise individuals within the social space. The *habitus* firstly sees the individual as unconsciously developing behaviour patterns from society and secondly, society is shaped by the way individuals learn and adapt their specific tendencies to that society (Trigg, 2004:400). Consumption is mainly determined by income when income is low; however, the relationship between income and consumption weakens with increases in income because it is the *habitus* that is the primary determinant of consumption behaviour (Trigg, 2004:401). There are similarities between Maslow and Bourdieu in that there is a hierarchy to climb; however, Bourdieu's theory provides for the analysis of luxury tastes as a social phenomenon, unlike Maslow who sees social phenomena as something to be overcome (Trigg, 2004:403).

Following the work by Trigg (2004) a more socially orientated approach to the subordination of needs is advocated here, as opposed to the income orientated approach proposed by Lavoie (1994). This is not to say that Lavoie is in any way wrong; this is indicated by a quote taken from Lavoie (1994:540) stating that "the principles put forth to reflect a possible Post Keynesian approach to consumer choice reflect my own views of the matter. Others interested in the field might find a different set of principles". This approach is not in contrast to Keynes' (1936:96) original thoughts as he recognises consumption will increase with an

increase in income as a fundamental psychological law, which is in line with Lavoie (1994), Keynes (1936:97) however also states that "a man's habitual standard of life usually has the first claim on his income" which supports the above argument by Trigg (2004).

5.3.2.4 Non-independence and social norms

Post-Keynesians view consumption behaviour as being dependent on social norms, in contrast to the Neo-classical view that individuals are independent when making consumption decisions (Menz, 2008:6). Akerlof (2007:6) suggests that there is a missing motivation in Neo-classical economics in the sense that preferences are too narrowly defined and do not take into account the norms of individuals, which reflect their beliefs about how they, and others, should or should not behave. Sociologists emphasise that the major determinant of consumption is what people believe they should consume in relation to different social groups within the society within which that individual lives, and is a function of a particular individual's situation as well as how that individual perceives himself or herself relative to others. (Ackerlof, 2007:15).

Neo-classical theory does allow for individuals to derive utility from relative comparisons (such as social comparisons); however the traditional theory views this social reference standard as being given exogenously. One problem with treating the reference standard as exogenous is that it does not take into account the finding of social psychology which suggests that people consciously choose a certain social reference standard (Falk and Knell, 2004:418). Falk and Knell (2004:418) argue that social reference standards are in fact endogenous so that people choose their social group in a predictable way according to the motives of both self-enhancement and self-improvement. Self-enhancement refers to the tendency for people to compare themselves with others that they feel belong to a lower social reference group. Self-improvement on the other hand refers to choosing a higher reference group than the one within which the individual currently finds himself or herself (Falk and Knell, 2004:418). They provide evidence that an individual's abilities shape their goals and reference standards (Falk and Knell, 2004:432). This is taken to imply that an individual's consumption behaviour is influenced by different social contexts or systems (Menz, 2008:6).

5.3.3 Possible Extensions to the Post-Keynesian framework

The first area of interest that may offer a guide to future Post-Keynesian consumption theory is that of neuroscience, and specifically modern technological breakthroughs in neuro-scientific research equipment. There has been a long history of the reliance of classical economists on revealed preferences to infer some underlying utility measurement and stable preference ordering, but utility cannot be directly measured. Camerer *et al* (2004:556) propose that the thought process underlying different consumption choices can in fact be measured directly using recent breakthroughs in neuroscience and suggest that new evidence in this field can be used to better guide economic theory. Interestingly the human mind is referred to as the "black box" which is similar to Moore's (1983) reference to the "black box" of monetary policy, as it attempts to shed light on the internal mechanisms of economic behaviour. Among the possible areas suggested in which neuroscience could play a key role include the direct measurement of variables such as consumer confidence or expectations because measurements are taken directly from brain activity, rather than asking the individual consumer (Camerer *et al*, 2004:573). Neuroscience may also help provide data in support of certain consumption theories (across all the social sciences) and lend support to a more unifying theory of consumption behaviour (Camerer *et al*, 2004:574).

Fuller (1996:600) proposes a second extension to the framework outlined above by Lavoie (1994) by suggesting that Post Keynesians should focus more on the role that social relations play in consumption behaviour. He argues that Post Keynesians should view consumption as "a process of cooperation-seeking behaviour through interpersonal communication in which goods have a facilitating role". The procedural rationality outlined by Lavoie (1994) above is seen as a necessary but not sufficient condition for a theory of consumption activity, however Fuller (1996:605) offers an alternative definition such that individuals will be procedurally rational when investing their non-work time as well as using goods in "communicative, cooperation-seeking relations with specific others, while circulating within a functional consumption infrastructure, of which the household is but one component".

Fuller (1996:601) puts forward four components which should be included in the construction of a theory of consumption behaviour: firstly consumption should be viewed as a process of social relations in which goods are used; secondly consumption activity involves actively

pursuing cooperative and non-monetary personal encounters; thirdly, within such personal relationships word-of-mouth communication occurs and, fourthly, physical goods are used to facilitate these interpersonal relationships (Fuller, 1996:601). Lastly, the household as the unit of consumption activity should be done away with and it should be assumed that individuals interact with each other in a variety of different environments beyond the household (Fuller, 1996:604).

5.3.3.1 Post-Keynesian consumption and credit demand

Up to this point in the discussion the Post-Keynesian theory of consumption has not considered the role of credit in the consumption behaviour of individuals. Dutt (2006) incorporates consumer debt into a model developed by Steindl (1952) to determine if consumer borrowing can help an economy out of stagnation (Dutt, 2006:341). The model developed by Steindl (1952) analysed how the growth of large firms can reduce aggregate demand as a result of higher prices due to a higher degree of monopoly power. The rise in profits will be seen in conjunction with a reduction in consumption expenditure and lead to a reduction in investment spending (Dutt, 2006:339). This model was later developed to explain stagnation in semi-industrialised, less developed, economies and has been used to model Post-Keynesian theories of growth; however, these models do not allow consumers to borrow to finance consumption (Dutt, 2006:340). Evidence has been presented that suggests consumption expenditure which is financed by borrowing has played a significant part in the contribution to aggregate demand in countries such as the U.S, Germany, France, Canada and India (Dutt, 2006:341-342).

The analysis shows that an increase in consumer borrowing has an expansionary effect on economic output in the short run; however, the effect of borrowing in the long run is ambiguous in terms of the effects on investment as well as income distribution. The long run ambiguity stems from the increased debt burden incurred by consumers in order to consume current output (Dutt, 2006:357). If the increase in consumer debt redistributes income towards the rich there may be a drop in aggregate demand and growth due to the higher propensity of the rich to save. This decrease in aggregate demand may be intensified by the increased interest rates which accompany an increased level of indebtedness, which is in line

with the theoretical predictions made by the balance sheet channel of monetary policy transmission (Dutt, 2006:362).

The present discussion makes two contributions to Post-Keynesian theory, the first being that it analyses the effects of changes in short and medium term credit demand as a result of changes in interest rates and thus adds to the current literature on the ability of the central bank to influence household spending via manipulation of interest rates. Secondly the study adds to the study by Dutt(2006) in that the significance of credit on consumption is analysed and from this an inference is made about the ability of consumers to deficit spend and thus help an economy to achieve growth, which is also in line with Moore (1988) above.

5.4 SUMMARY

Keynes did not agree with the mainstream classical economic ideas of rational expectations, utility maximisation and general equilibrium. Keynes viewed the object of life as the pursuit of good and not the hedonistic pursuit of pleasure. Post-Keynesians have recognised the theoretical deficiencies in the mainstream microeconomic approach and instead propose that consumption behaviour is determined more by social influences than individual pursuit of utility. Within the Post-Keynesian approach individuals are seen as procedurally rational in that an individual will seek a satisfying solution rather than an optimal solution. Needs are satiable and subject to a hierarchy of preferences according to Maslow's hierarchy of needs.

Given that an individual has made a choice as to some consumption good, the question then arises as to the means of payment used to purchase the item and from this standpoint the role of credit is important in the financing of consumption. It is noted here that the purpose of the study is not to test a Post-Keynesian theory of consumption *per se* but rather, firstly, to determine if changes in the prime rate of interest will affect the level of credit demanded by households and secondly, to determine if credit plays an important role in the financing of consumption and by implication plays a role in aggregate spending activity.

CHAPTER SIX

REVIEW OF EMPIRICAL WORK

6.1 INTRODUCTION

The review of empirical work will be discussed in three broad sections. The first section reviews literature on the theory of an endogenously determined money supply and serves two purposes. Firstly, the review is conducted to identify possible variables which may influence the level of a firms short term credit demand and secondly, the review serves to identify the historical findings of the interest rate elasticity of credit demand. Next, literature on the balance sheet channel is considered with a specific focus on studies which have used a mix variable to identify a balance sheet channel of monetary policy, in line with the approach followed here. Briefly, the mix variable is defined as the ratio of short term bank debt to total short term debt by all monetary institutions, and is discussed below. Lastly, empirical literature on the effects that interest rate changes have on household credit demand will be discussed.

6.2 EMPIRICAL EVIDENCE OF AN ENDOGENOUS MONEY SUPPLY AND FACTORS INFLUENCING SHORT TERM CREDIT

6.2.1 Introduction

The factors that affect the short term demand for credit by firms are the same factors which influence the working capital needs of firms. The discussion will thus begin by identifying the variables which, according to Post-Keynesian theory, are thought to best explain the level of short term credit demand by firms in order to finance production in a credit money economy. Following this the relationship between the level of short term credit demand and changes in the level of interest rates is considered.

6.2.2 Variables affecting short term bank credit demand by firms

Moore (1983) was one of the first to empirically test the validity of the endogeneity of money hypothesis using data for the United Kingdom. The choice of variables used to explain changes in bank lending to firms are in line with theory underlying an endogenously determined money supply and by implication a demand determined money supply. Firstly, it is assumed that production costs must be incurred before the receipt of sales proceeds. Secondly, firms are assumed to set prices over some historical level of unit production costs and finally, it is assumed that banks are price setters and quantity takers, which implies that banks have a limited ability to control actual bank lending (Moore and Threadgold, 1985:67).

Total working capital needs of the firm are a function of employment costs, materials costs, stock-building costs and corporate tax payments (Moore, 1983:547). All explanatory variables are modelled as first differences because it is only increases in input costs which lead to an increased demand for working capital finance, while existing costs are financed out of current sales proceeds (internally generated finance). The variables used to explain changes in total lending by firms are (Moore, 1983:548):

$$\Delta TLCIC = \Delta TLCIC\ (\Delta WB, \Delta MBill, \Delta PS, \Delta TYC) \qquad (1)$$

Where TLCIC is total bank loans to commercial and industrial companies (CIC), WB represents a proxy for the wage bill of CIC's, MBill is proxy for the materials costs of CIC's, PS represents the current price value of stock levels of CIC's, TYC is the tax bill of CIC's and finally "Δ" is the change in the relevant variable from the previous period. The general equation modelled found that the one quarter lagged changes in the materials bill (MBill) and stock building (PS) variables were not statistically significant and the tax variable (TYC) is either insignificant or wrongly signed. After dropping the insignificant or wrongly signed variables a number of interest rate variables were added separately, which is discussed in the next sub-section. The final equation is shown to explain around 49 percent of the variation in bank lending to CIC's (Moore, 1983:449).

Moore (1983:552) also considered a second equation which used the total amount of commercial bank loans as the dependent variable, rather than modelling the demand from

individual credit segments (such as bank lending to CIC's). Commercial loans also include real estate loans and loans to individuals that are determined mainly by changes in household financing demand for homes and consumer durables respectively. An index of consumer confidence is included and is expected to vary positively with household demand for houses and consumer durables. The second equation explained around 60 percent of the variation in total bank lending and it is concluded that it is possible to identify a single equation that has a relatively high level of explanatory power when considering changes in credit demand (Moore, 1983:553). The behaviour of money wage rates as a component of both working capital demand and disposable income play an important role in the demand for bank credit by the private sector (Moore, 1983:555).

Another influential study was undertaken by Moore and Threadgold (1985), similar to Moore (1983) above, to identify the operation of an endogenously determined money supply in the U.K. The demand for working capital is a function of employment costs, the cost of raw materials (including the costs of imported basic materials and semi-manufactured goods) and corporate tax payments. The equation explained around 60 percent of the total variation in the flow of bank lending to CIC's, which is greater than the 49 percent found by Moore (1983). Some lag lengths for the different explanatory variables were, however, not statistically significant (Moore and Threadgold, 1985:69).

Moore and Smit (1986) use South African data to determine the relationship between bank credit and production costs such as wages, inventories and interest rates in a similar manner to Moore (1983). Bank credit is assumed to be a function of working capital demand, which is in turn a function of the wage bill, the change in inventories and the real interest rate (Moore and Smit, 1986:88). The change in the wage bill is the largest component of working capital demand and, when using aggregate data, accounts for over 90% of the variation in bank credit. The wage bill coefficient is 1.04, indicating that wage increases lead to an increase in bank credit on a one-for-one basis (Moore and Smit, 1986:87). Adding a change in inventories variable does not increase the explanatory power of the model (Moore and Smit, 1986:89). The study showed that there is evidence that the wage bill of companies is an important variable in influencing the level of bank credit; however the change in inventories does not seem to significantly influence the level of bank credit.

6.2.2.1 Adding a round tripping variable

Moore and Threadgold (1985) differ from Moore (1983) in that a "round tripping" variable (RT) was added to the modelled equation. Round tripping occurs in periods when CIC's can earn more on deposits than the costs of borrowing (Howells, 2005:5). The round tripping variable is defined as the three month CD rate less the banks' prime rate, where the prime rate is calculated as the banks' base rate plus one percent. The RT variable was added to the general equation including wage and input costs as well as tax payments and found to be highly statistically significant, improving the overall statistical results. After dropping all insignificant variables the inclusion of a round tripping variable explains about 66 percent of the variation in bank lending to CIC's, as opposed to 60 percent without the RT variable. Results indicated that raw materials, employment costs and corporate tax payments are important in determining the level of bank borrowing by firms and bank lending is primarily demand determined (Moore and Threadgold, 1985:74).

Cuthbertson (1985) follows Moore and Threadgold (1985) in that a round tripping variable is included to help explain movements in short term credit demand as a result of changes in the short term financing requirements of firms. Cuthbertson (1985) goes further than Moore and Threadgold (1985), however, in that the round tripping variable is defined in two ways, rather than just one as in Moore and Threadgold (1985). A nested model was estimated and tests were done on the effects of the variables N and RT, where N= (RLA-RBL) and RT = max ((0, (RLA-RBL)), to determine the effects of modelling a round tripping variable using two different definitions. RLA is the 3 month local authority rate and RBL is the bank lending rate. It was found that the effect a round tripping variable on the demand for bank credit may take place when the interest rate differential between the 3 month local authority rate and the bank lending rate is negative as well as positive, this supports the use of N over RT. (Cuthbertson, 1985:101). The net borrowing requirements of firms are found to have a strong short run impact on lending (Cuthbertson, 1985:108).

In the United Kingdom the theoretical framework set out by Moore (1980) led to three different models of the demand for bank lending by 1985. The first was used by the Bank of England (BOE) (Howells, 2005:7). The second model was developed by the UK Treasury

Department (HMT) and is expressed in real terms, except for the interest rate. The final model was developed by the National Institute of Economic Research (NISER) which sought to explain the flow of bank lending in real terms (using nominal interest rates) (Howells, 2005:8). The major differences in these three approaches are in their treatment of interest rates. The BOE model uses an own real rate of interest and has a low interest elasticity, the NISER uses nominal rates and an interest rate spread, defined as the return on assets less the cost of borrowing and the HMT model uses a single nominal interest rate on bank lending (Howells, 2005:7). Focus will now turn to the interest elasticity of credit demand and will focus mostly on the BOE model, however the extended model of Cuthbertson (1985) will also be considered.

6.2.3 The empirically observed interest rate elasticity of short term credit demand

Interest rates used by Moore (1983:545) included a nominal interest rate (proxied by the bank prime lending rate), the change in the nominal interest rate, an expected inflation rate, a real interest rate and finally, the change in the real interest rate. All the above rates were added separately to equation (1) as well as the equation estimating the total amount of commercial bank loans. With respect to short term bank lending to CIC's all attempts were unsatisfactory; however, the change in the real interest rate variable proved to be the best, showing a weakly statistically significant coefficient, with an expected negative relationship to total lending to CIC's. The results of the nominal interest rate will be discussed further because the approach adopted here uses a nominal interest rate to identify the size and lag length effects of a change in the repo rate on credit demand by firms.

The coefficient estimates of the interest elasticity of loan demand imply that the monetary authorities' ability to restrict the growth in company borrowing is limited because the estimates are not statistically significant, thus loan demand appears to be highly interest inelastic to short run changes in interest rates (Moore, 1983:550). Results with reference to total commercial bank loans showed all results to again be unsatisfactory, suggesting that the interest inelasticity of total bank lending is quite high for both consumers and firms (Moore, 1983:553). The limited ability of interest rates to help explain bank lending is taken as an

indication that the monetary authority has a limited ability to control the amount of credit expansion, especially over the short term as a result of a positive expectations effect (Moore, 1983:554). Moore and Threadgold (1985) analyse the relationship between different measures of the interest rate and the level of bank credit in the same way as Moore (1983) and results suggest that interest rates were statistically significant, but did not have much of an effect on changes in bank lending (Moore and Threadgold, 1985:70).

The studies by Moore (1980) and Moore and Threadgold (1985), among others, initially established two cornerstones of the Post Keynesian view of the money supply. The first being that it is previous changes is the operating conditions of firms that give rise to changes in the flow of new loans. Secondly, the interest elasticity of the demand for credit is low, which is taken to imply that the ability of a central bank to control credit and influence money growth is limited (Howells, 2005:5). The above studies have found evidence that the working capital needs of firms are an important determinant of short term bank lending. The present analysis will use variables that influence the working capital needs of firms to determine the size and lag length effects of a change in the repurchase rate on short term lending by firms.

6.3 REVIEW OF EMPIRICAL WORK ON THE BALANCE SHEET CHANNEL OF MONETARY POLICY AND THE MIX VARIABLE

6.3.1 Introduction

A number of authors have studied the credit channel, and more specifically the balance sheet channel, and there have been two main approaches followed to identify a credit channel of monetary policy transmission. The first is the use of a mix variable and the second is with the use of Romer dates following a study by Romer and Romer (1989). The focus here will be on studies using the mix variable; however, a few studies which have used Romer dates are included to give a broader view of empirical findings. Generally, using disaggregated data is more appropriate for analysing the effects of a balance sheet channel because disaggregated data is better suited to measuring a firm's movement between bank debt and non-bank debt as well as the movement of funds between small versus large firms. The discussion will begin with the pioneering study by Kashyap, Wilcox and Stein (1993) (KWS hereafter) using

aggregate data and move on to other measurements of the mix variable, as well as the effects that interest rates have on credit demand in different countries. The studies chosen for discussion relate to the United States and Europe and results are in line with a balance sheet channel of policy transmission. Next the results of two studies using South African data are discussed.

6.3.2 The mix variable and credit demand in the U.S

Kashyap, Wilcox and Stein (1993) recognise that there may be independent effects originating from the asset side of a bank's balance sheet, which in turn implies that some borrowers rely on bank credit (indirect credit) to a larger extent than direct credit (Kashyap *et al,* 1993:78). Firms are assumed to have two sources of financing, indirect debt in the form of bank loans and direct debt in the form of commercial paper (Kashyap *et al,* 1993:80).

The major contribution of KWS (1993) is the construction of a mix variable in an attempt to distinguish between a bank lending channel and the traditional money channel of monetary policy transmission. The mix variable is defined as the ratio of bank loans to the sum of bank loans and commercial paper. The logic behind using this ratio is that a fall in the mix variable will imply that a bank lending channel is operative as opposed to the operation of the more traditional money channel (Kashyap *et al* 1993:84). If the money channel is operative a tightening of monetary policy should not have a large influence on the mix variable because a tighter monetary policy has an output induced effect on all credit demand and both direct and indirect sources of finance will decrease in proportion, thus the mix variable will be unchanged (Gertler and Gilchrist, 1993:51-52). If, however, a tighter policy stance leads to a reduction in the supply of bank credit and an increase in direct credit extension the mix variable is expected to decrease, which is interpreted as evidence of a bank lending channel because there is an excess demand for credit as a result of a decrease in bank loans (Kashyap *et al,* 1993:79).

The analysis performed causality tests between a variable of interest (including the mix variable) regressed on itself and an interest rate indicator. The mix variable was found to be influenced by the Fed funds rate and decreases significantly when the Fed funds rate rises.

Results of the effect of interest rates on loan demand showed that the influence of the Fed funds rate on loan demand was the weakest (Kashyap *et al,* 1993:88).

It is noted that the paper by KWS (1993) identifies a bank lending channel through which monetary policy operates, under the more traditional assumption of an exogenously determined money supply. The KWS (1993) study is examined however because the methodology used (i.e. the inclusion of a mix variable) is followed by many subsequent authors in testing for a balance sheet channel of policy transmission. One such study was done by Oliner and Rudebusch (1996) which calculated the mix variable differently to that of KSW (1993).

The calculation of the mix variable as defined in KWS (1993) has been criticised by a number of authors, including Oliner and Rudebusch (1996), who argue that the definition of the mix variable is limited in its application to firms. The study by Oliner and Rudebusch (1996) will be discussed for three reasons. Firstly, the definition of the mix variable is altered slightly and this new definition is used to calculate the mix variable in the econometric model below. Secondly, the mix variable was used to find evidence of a balance sheet channel and finally a VAR model was used in conjunction with impulse response analysis to identify the response of the mix variable to a shock in the Fed funds rate, which is in line with the approach adopted here.

Oliner and Rudebusch (1996) review the KWS (1993) study and make some observations about the methodology and data used. Specifically, Oliner and Rudebush (1996) investigate the mix variable for bank and non-bank debt separately using disaggregated data for small as well as large firms, rather than aggregate data as in KWS (1993). For small firms the debt mix is essentially set at one because almost no commercial paper is issued and thus the mix variable defined by KWS (1993) cannot capture the relative shift in the financing mix for small firms. This is a serious shortcoming because it is thought that small firms will experience the effects of a contractionary monetary policy shock to a greater extent than large firms. The mix variable is modified from the one used by KWS (1993) in that the mix is defined as the ratio of short term bank debt to total short term debt, where total short term debt includes bank loans, commercial paper and other debt (such as loans from finance and insurance companies) (Oliner and Rudebusch, 1996:301-302).

The study finds that when using disaggregated data the results suggest that following a monetary policy contraction there is a shift in all types of financing from small to large firms, which suggests the existence of a "broad credit channel" (Oliner and Rudebusch, 1996:301). Here the broad credit channel is seen to emphasise the presence of asymmetric information between borrowers and lenders and recognises that this asymmetric information may increase the cost of all types of debt after a monetary contraction, which is in line with the theory underlying the balance sheet channel. Given that information asymmetries are worse for small firms, the external finance premium is likely going to be significantly higher (Oliner and Rudebusch, 1996:301).

The study concludes that bank debt does not behave very differently to non-bank debt after a monetary policy shock and, based on disaggregated data, it appears clear that a contraction in monetary policy does not influence the supply of bank debt relative to other forms of finance. Rather the interpretation of the mix variable results suggest that there is a broad credit channel operative which recognises asymmetric information and results in a redirection of credit from small to large firms, in line with the balance sheet channel (Oliner and Rudebusch, 1996:308).

Gertler and Gilchrist (1993) analyse the financial accelerator mechanism, which states that the balance sheet channel will amplify the impact of disturbances to a borrowers net worth as discussed above. A VAR model is estimated and the financial variables of interest include total bank loans, consumer loans, business bank loans, commercial paper and a mix variable (calculated as in KWS (1993)), among others (Gertler and Gilchrist, 1993:55-56). Impulse response functions are used to determine the effects of a one standard deviation increase in the Fed funds rate on different variables in order to capture shifts in exogenous monetary policy actions (Gertler and Gilchrist, 1993:53).

The study concluded that the balance sheet channel of policy transmission is operative. Findings indicate that the sharpest changes in the demand for credit occurred between small and large firms and not between bank and non-bank credit. After a monetary policy contraction bank loans to consumers decline while loans to firms increase slightly. Following a rise in the Fed Funds rate both short term bank and non-bank borrowing by large firms

increases, which may reflect an increased demand for credit to smooth the impact of declining sales. Small firms, however, do not appear to borrow in order to smooth the impact of declining sales as larger firms do (Gertler and Gilchrist, 1993:62). This phenomenon is labelled the "flight to quality" (Gertler and Gilchrist, 1993:60).

Bernanke, Gertler and Gilchrist (1996:1) follow the theoretical ideas set out by Bernanke and Gertler (1989) with respect to the balance sheet channel discussed above, and set out to analyse the "financial accelerator" mechanism by focusing on the principle-agent view of credit markets. The study uses Romer dates and so only a brief review is given. The study focuses on cross sectional data and examines the shift in credit between small and large firms following a monetary policy contraction, in a similar manner to Gertler and Gilchrist (1993) (Bernanke *et al,* 1996:1). Results implied that a balance sheet channel is operative and this conclusion is based on evidence that firms who face relatively higher agency costs struggle more during an economic downturn than firms with lower agency costs and this reduction in output by firms with higher agency costs will magnify the effects of the downturn (Bernanke *et al,* 1996:14). These results are in line with evidence of a balance sheet channel of policy transmission presented in Gertler and Gilchrist (1993) and Oliner and Rudebusch (1996).

All the studies discussed above have used data for the United States and the Federal funds rate as an indicator of monetary policy and results were in line with a balance sheet channel of policy transmission. Attention will now turn to evidence of a balance sheet channel found in the U.K and OECD countries.

6.3.3 The mix variable and credit demand in the U.K. and OECD countries

Iturriaga (2000) explores the way in which monetary policy decisions affect real investment and aggregate output, with a specific focus on the credit channel (Iturriaga, 2000:425). The study compares the reaction of non-financial companies, using aggregate balance sheet data across twelve OECD countries, to changes in the interest rate set by the monetary policy authority. The model used is based upon that developed by KWS (1993) but the traditional mix variable has been altered slightly. The study uses two mix variables including the short term bank finance ratio and the long term bank finance ratio (Iturriaga, 2000:427). Results indicated that a credit channel is operative and the strength of the credit channel depends on

the financial system. Countries which have a more market based financial system tend to have more alternatives to bank financing and thus the ability of monetary policy to effect output via the credit channel is less effective than in countries without strong market based approaches (Iturriaga, 2000:432).

Angelopoulou and Gibson (2007:675) use data for the United Kingdom with the aim of determining whether or not a balance sheet channel is operative. The main contribution of the paper is to investigate the sensitivity of investment to the cash flow position of a firm when monetary policy tightens. A monetary policy indicator is used, similar to Romer dates (tailored to suite the United Kingdom) to test for a balance sheet channel. Firms are classified according to three criteria which include size and firm financial policy, i.e. leverage and dividend policy (Angelopoulou and Gibson, 2007:675). Results suggested that investment is positively related to cash flow. This indicates that smaller firms have much higher investment sensitivity to cash flow than larger firms, which increases in times of monetary policy tightness and the existence of a balance sheet channel in the transmission of monetary policy is confirmed. Furthermore the importance of the balance sheet channel is greater the more market orientated the economy in line with Iturriaga (2000) (Angelopoulou and Gibson, 2007:698).

Overall the mix variable has been used in a number of studies for the United States and Europe. Following the paper by KWS (1993), which uses a mix variable to identify a bank lending channel of monetary policy transmission, a number of authors have used the mix variable to successfully identify a balance sheet channel of policy transmission based on asymmetric information in credit markets which is in line with Post-Keynesian theory. Oliner and Rudebusch (1996) altered the mix variable slightly and used disaggregated data for the United States to identify a broad credit channel. Similar approaches have been used by Gertler and Gilchrist (1993) and Bernanke *et al* (1996) who found that a balance sheet channel is operative within the U.S. Iturriaga (2000) used the mix variable with aggregate balance sheet data for 12 OECD countries and concludes that a balance sheet channel is present and that the strength of the balance sheet channel is greater the more market orientated the economy. The mix variable is thus suited to testing for the presence of a balance sheet channel of policy transmission under an endogenous money supply.

There have been very few studies on the credit channel, and specifically the balance sheet channel, in South Africa and no study was found which makes use of a mix variable to determine if a balance sheet channel of policy transmission is operative. Due to the lack of research the few studies found on both sub-channels will be discussed; however, it is noted that both studies use the underlying model of credit market frictions developed by Bernanke and Blinder (1988) which assumes an exogenous money supply.

6.3.4 Review of the credit channel in South Africa

Ludi, Ground, Joubert and Chen (2005) investigate the possible existence of a bank lending channel in South Africa. The aim of the study is to determine if bank loans in South Africa are supply or demand driven, which is relevant for the testing of both channels of policy transmission. If bank loans are demand driven then an increase in the repo rate will lead to a decrease in bank loans due to the increased cost of borrowing, and it is this increased cost of borrowing that will lead to a drop in aggregate demand (Ludi *et al,* 2005:4).

The results implied that a long run demand equation is estimated because there is a negative relationship between the repo rate and loans with an interest rate coefficient of -0.168 and an estimated long run interest elasticity of bank credit demand of -0.484. This finding disproves a bank lending channel in South Africa because the bank lending channel is most effective when loans are supply driven (Ludi *et al,* 2005:13). A VECM is then estimated to obtain the short run dynamics between loans and interest rates and the results used to conduct impulse response functions over ten quarters, assuming an increase in the repo rate. Loans decrease over the 10 quarters analysed, reaching a maximum decrease of about -0.009 at between 6 and 7 quarters, which is consistent with demand driven loans (Ludi *et al,* 2005:15).

It is concluded that bank lending is demand driven and this "tends to disprove the fact that the bank lending channel has effectively worked as a tool of monetary policy in South Africa, since this would imply supply driven loans" (Ludi *et al,* 2005:17). It is noted that the disproving of the bank lending channel in South Africa does not necessarily prove that a balance sheet channel is operative; however, bank loans were found to be demand driven which is in line with a possible balance sheet channel.

Burger (2008) takes a broader view and tests for a credit channel in South Africa. The model used in the study follows that developed by Bernanke and Blinder (1988), discussed above, which assumes an exogenous money supply. The model is augmented by including a variable to represent the external finance premium (EFP). The EFP is charged by lenders as a result of weaker borrower balance sheets and is therefore a supply side phenomenon. The EFP variable is added to the factors determining the supply of credit by banks in an attempt to distinguish between supply and demand factors affecting aggregate credit movements (Burger, 2008:4). It is concluded that there is evidence of a bank lending channel but only very limited evidence for a balance sheet channel; this is attributed to the central bank not being more tolerant of higher levels of inflation when there is a higher level of risk which affects balance sheets (Burger, 2008:20).

Studies on the credit channel, and specifically the balance sheet channel, have shown mixed results using different approaches to test for such channels. Ludi *et al* (2005) refuted a bank lending channel but opened up the possibility of a balance sheet channel by finding that bank loans are demand determined. Burger (2008) found that there was evidence of a bank lending channel and limited evidence of a balance sheet channel. Both studies are however based on the underlying assumption of an exogenously determined money supply which is not in line with Post-Keynesian theory. This discussion thus serves to add to the existing literature in South Africa by using the mix variable to test for a balance sheet channel of policy transmission in line with Post-Keynesian theory of an endogenous money supply.

6.4 REVIEW OF THE EMPIRICAL LITERATURE OF CONSUMPTION AND CREDIT

6.4.1 Introduction

Since Hall (1978), the academic community has focused on testing the LCH/PIH and its implication that monetary policy can only influence consumption by influencing permanent income. Unlike academic circles, however, central banks acknowledge that consumption is influenced by credit variables and thus ask how monetary policy actions affect various credit variables as well as the effect this policy action will have on aggregate consumption

(Bacchetta and Gerlach, 1997:208). This review will focus on a more Post-Keynesian view of consumption and the LCH/PIH is not considered to hold because of the assumptions of rational expectations and utility maximisation as discussed earlier.

6.4.2 Consumption and credit

Bacchetta and Gerlach (1997) study the relationship between aggregate consumption and different measures of credit conditions, using data for the United States, Canada, the United Kingdom, Japan and France. One of the questions addressed by Bacchetta and Gerlach (1997) is: do credit market variables help in predicting changes in consumption (Bacchetta and Gerlach, 1997:208)? A unique insight was to use a credit "wedge", defined as the difference between the interest rate charged by lenders and that charged to borrowers. The lending rate is proxied by the bank prime lending rate and the borrowing rate is proxied by either a time deposit rate or a T-bill rate (Bacchetta and Gerlach, 1997:211). Results support the hypothesis that credit constraints influence aggregate consumption. Credit is found to be a significant predictor of consumption in all five countries and is often stronger than income. The borrowing/lending wedge was found to be statistically significant for the U.S and Canada and to a lesser extent Japan, which is taken to imply that credit restrictions are reflected in the cost of borrowing (Bacchetta and Gerlach, 1997:235).

Gross and Souleles (2001) test if liquidity constraints and interest rates are practically relevant by analysing a U.S data set containing a panel of thousands of individual credit card accounts. The data is used to answer two questions. Firstly the response of debt to changes in credit limits is analysed and secondly, the sensitivity of debt to interest rates, as well as the interaction of interest rates with liquidity constraints (Gross and Souleles, 2001:2). Liquidity constraints here are defined as quantity constraints rather than as a wedge between borrowing and lending rates (Gross and Souleles, 2001:5).

The long run effect of interest rates on debt levels shows that an individual's borrowing is in fact influenced by interest rates and thus economic agents are interest rate sensitive, in line with liquidity constraints (Gross and Souleles, 2001:22). An impulse response function (using an increase in interest rates) shows that there is an immediate response in the level of debt to an increase in rates and estimates are larger and more significant than in previous studies

(Gross and Souleles, 2001:23). Results also suggest that there is an asymmetric response in credit demand, as a result of increasing and decreasing interest rates. Debt levels are shown to decline when interest rates increase but increase more strongly in response to decreases in interest rates. This asymmetry implies that an individual's total amount of debt may increase over time. Evidence also suggests that consumers transfer balances between credit accounts when interest rates change (Gross and Souleles, 2001:24).

A large part of consumption studies have found the elasticity of consumption with respect to interest rates to be close to zero. New methodologies have however been developed which suggest elasticity's of between -0.73 to below unity in the U.S, Italy and Bangladesh (Karlan and Zinman, 2005:2). Karlan and Zinman (2005) note that these earlier studies were subject to measurement and identification problems and estimate the elasticity of consumer demand for credit with respect to price and maturity, using randomised trials implemented by a South African lender (Karlan and Zinman, 2005:2-3). The lender offers high interest, short term credit with fixed repayments to the working poor, which make up a large part of the South African population (Karlan and Zinman, 2005:5).

Estimation of the extensive price elasticity of loan demand revealed that a 1% increase in the monthly loan rate will reduce loan applications by 0.3%, for loans at a rate below the average lending rate of the borrower. For interest rates charged above the lender's average rate, a 1% increase in the monthly loan rate will decrease loan applications by 1.7%. Borrowers subject to higher interest rates therefore exhibit a loan price sensitivity that is six times larger than borrowers subject to lower rates and there is thus an asymmetry in the loan demand function. The kink exhibited by the credit demand curve is consistent with at least four explanations of asymmetry (Karlan and Zinman, 2005:12). These include selection, competition and contemporaneous substitution, intertemporal substitution as well as behavioural explanations (Karlan and Zinman, 2005:4). Intensive Margin results for unconditional borrowing showed an implied elasticity of -0.32. Estimated coefficients for loan sizes and rates conditional on borrowing showed an implied elasticity of -0.13. These estimates are low compared to recent estimates obtained in other studies (Karlan and Zinman, 2005:14).

6.5 SUMMARY

Bank lending by firms was shown to be highly influenced by the working capital demands of firms, however the interest elasticity of credit demand was shown to be low or statistically insignificant. A balance sheet channel of monetary policy transmission was shown to be operative in the U.S, the U.K and Europe (among others), and it was shown that the mix variable can be used to identify a balance sheet channel. It was also shown that credit variables do in fact play an important role in the determination of consumption behaviour.

CHAPTER SEVEN

METHODOLOGY AND DATA

7.1 INTRODUCTION

Various studies have used VAR models together with past information about central bank operating procedures to examine the effects of monetary policy on the real economy (Bernanke and Mihov, 1998:870). Bernanke and Blinder (1992) use a VAR model to analyse the effects of changes in monetary policy on aggregate demand, as well as determine the transmission mechanism through which policy operates. The Federal Funds rate is the policy variable of interest because it is a good predictor of movements of real macroeconomic variables (Bernanke and Blinder, 1992:901). The effects of a change in the Federal Funds rate on non-policy variables, such as short term bank credit, can be identified with the impulse response function (Bernanke and Blinder, 1992:902). Gertler and Gilchrist (1993:53) follow Bernanke and Blinder (1992) and estimate a VAR model, using a one standard deviation impulse in the Federal Funds rate to capture changes in monetary policy and examine the effects of these changes in the Fed Funds rate on aggregate (and disaggregated) bank and non-bank credit. Following the above studies a VAR model will be estimated to determine the effect that a change in interest rates has on the level of short term credit demand, by firms as well as households.

A mix variable is included when estimating the firm VAR model to test for a balance sheet channel of policy transmission, in line with Gertler and Gilchrist (1993) and Oliner and Rudebusch (1996). The mix variable is defined as the ratio of short term bank debt to total short term debt by all monetary institutions. The studies by Oliner and Rudebusch (1996) and Gertler and Gilchrist (1993) both use aggregated as well as disaggregated data and both studies conclude that there is a shift in financing from small to large firms due to informational asymmetries. Only aggregate data could be obtained for present purposes and thus disaggregated data is not considered, which has implications for the interpretation of the mix variable, discussed below.

The VAR methodology has not been used as frequently when testing consumption, however the model has been used by Bacchetta and Gerlach (1997) as well as Chrystal and Mizen (2005), which is in line with the approach followed here.

7.2 THEORETICAL UNDERPINNINGS OF THE VECTOR AUTOREGRESSIVE (VAR) MODEL

A VAR of the following form will be set out (Brooks, 2008:291). Suppose there are g variables:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \beta_k Y_{t-k} + \mu_t \quad (2)$$

Where - β_0 is a vector of gx1 intercept terms

- β_i is a vector of gxg coefficient matrix for i= 1,2,…,k
- k is lag length
- Y_t is a vector of gx1 dependent variables
- Y_{t-k} is a vector of gx1 variables
- u_t is a white noise error term (has zero mean and constant variance)

The VAR approach is convenient to use here because there is no need to differentiate between endogenous and exogenous variables; all variables are treated as endogenous. By treating each variable as endogenous there is no need to identify a structural system of equations, which is a requirement if a simultaneous equation approach is followed (Brooks, 2008:291). The VAR framework models the variables as a result of their own lagged values and the lagged values of other endogenous variables in the model. An advantage of using a VAR model is that only lagged values of the endogenous variables appear on the right-hand side of the equations and simultaneity is therefore not an issue, thus OLS estimation yields consistent estimates (E-Views, 2008:345). Another advantage of using a VAR model is that it allows the value of a variable to be determined by its own lagged values as well as lagged values of other variables and is thus more flexible than autoregressive models using only one variable, this allows the VAR model to capture more features in the data (Brooks, 2008:291).

7.3 VAR MODELLING PROCEDURE

7.3.1 Introduction

The modelling procedure will start by determining the order of integration of the time series variables used. Following stationarity tests, a VAR model is estimated guided by the recommended lag length selection criteria of the Schwartz, Akaike and Hannan-Quinn information criteria (using stationary variables) and the optimal lag length determined. Thirdly, stability and autocorrelation tests are done to determine the statistical properties of the estimated VAR model and following this the VAR estimates are presented. Lastly block exogeneity Wald tests, impulse response functions and variance decompositions are estimated.

7.3.2 Unit root testing

The first step in the analysis is to determine which time series have a unit root and which do not, i.e. which series are non-stationary. There are several reasons why testing the series for stationarity is important. Firstly if a series is non-stationary a shock to the variable will persist indefinitely, secondly, using a data series that is non-stationary can lead to spurious regressions and finally, non-stationary time series violate the standard assumptions of asymptotic analysis (Brooks, 2008:319-320). Two unit root tests are done to determine the order of integration of each variable. The first test is the Augmented Dickey-Fuller (ADF) test and the second is the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test.

The ADF test, as opposed to the Dickey-Fuller (DF) test, is used to determine the order of integration of a non-stationary time series because the error terms may be correlated at more than two lags (Gujarati, 2003:817). The optimal lag length for the ADF test is determined using the Schwarz information criteria with a maximum lag length of 10, as it is assumed that this lag length will fully account for any non-stationarity in the data. The objective of using an information criterion is to choose the lowest value (Brooks, 2008:232). The ADF test equations used are given below (Gujarati 2003:817):

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + \sum \alpha_i \Delta \delta Y_{t-1} + \varepsilon_t \quad (3)$$

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum \alpha_i \Delta \delta Y_{t-1} + \varepsilon_t \quad (4)$$

where ε_t is a white noise error term and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$. Equation (3) is used if the stochastic process is difference stationary and equation (4) is used if the series is trend stationary.

This test has been widely used in other studies; however, there are a number of shortcomings of the ADF test. Firstly, the failure to reject the null hypothesis of a unit root in the time series depends on the lag length used. The lag length can be chosen using information criteria, such as the Schwarz or Akaike criteria, or can be chosen using the partial autocorrelation function (PACF) (Drake and Chrystal, 1994:484). Information criteria are used here to determine the optimal lag length and the PACF is not considered. Secondly, most Dickey-Fuller based tests will fail to reject the null hypothesis of a unit root more often than is necessary, which may lead to model misspecification (Gujarati, 2003:819). Finally, it has been suggested that the standard ADF test may not pick up a unit root in the data due to a structural break because there is an implicit assumption of time invariance for the intercept and slope coefficients of the time series within the ADF test (Gregory and Hansen, 1996:102).

For these reasons the study will also use the Kwiatkowski, Phillips, Schmidt, Shin (KPSS) test which runs a regression of a dependent variable (say Yt) on an intercept variable and time trend variable using OLS and the residuals are then used to calculate the test statistic. This method has the following advantages: the variance of the error tem can be corrected for autocorrelation using the Newey-West technique (Verbeek, 2004:271), does not suffer from small sample problems (Burger, 2008:11) and is not dependent on lag length selection, as is the ADF test.

$$(5) KPSS = N^{-2} \sum_{t=1}^{N} standard\ deviation\ at\ time\ t / mean\ variance\ (p)$$

Two diagnostic tests are done, the first is concerned with the stability of the VAR model and is conducted using an AR unit roots graph, while the second test is concerned with serial

correlation, and is conducted using an autocorrelation LM test. When analysing the stationarity of the VAR model using the AR roots graph the estimated VAR is stationary if all roots lie inside the unit circle (E-views, 2007:348).

A Lagrange multiplier (LM) test for autocorrelation is used to detect the presence of serial correlation between the residuals in the VAR model and reports test statistics for serial correlation up to a specified lag order. Lagged residuals of the explanatory variables are run against the residuals of a dependent variable and tested for statistical significance following the null hypothesis that there is no serial correlation. The LM test follows the Chi squared distribution asymptotically (E-Views, 2008:350).

Due to the VAR model having several lagged values of the same variables, each estimated coefficient may not be statistically significant. The significance of the estimated coefficient(s) is tested jointly using the standard F-test (Gujarati, 2003:850). The F-test is used to determine the overall significance of the regressions, which can be done because the VAR model is run using the OLS method (Gujarati, 2003:822). Once the above steps are completed, Granger causality/ block significance tests, impulse response functions and variance decompositions are carried out.

7.4 BLOCK SIGNIFICANCE AND CAUSALITY TESTS

It is often difficult to determine which sets of variables have a significant effect on each of the dependent variables within a VAR model when the model includes a large number of lags. The evaluation of the significance of the variables included in the VAR model occurs on the basis of joint tests using the F-test framework on all lags of a certain variable in a given equation (Brooks, 28:297).

One feature of a VAR model is that it allows the testing of correlation between variables. Granger (1969) developed a way to test correlation which is defined as: a variable (y_t) is said to Granger-cause another variable (x_t), if (x_t) can be better predicted by using past values of (y_t) as opposed not including past values of (y_t) (Asteriou and Hall, 2007:281). It must be noted that Granger-causality does not mean that a movement in one variable necessarily

causes movements in another variable, but rather Granger causality means that there is a correlation between the current value of one variable and past values of other variables (Brooks, 2008:298). The estimation procedure is as follows (Asteriou and Hall, 2007:281):

$$Y_t = \alpha 1 + \sum_{i=1}^{n}(\beta_i X_{t-i}) + \sum_{j=1}^{m}(\gamma_i Y_{t-j}) + e_{1t} \quad (6)$$

$$X_t = \alpha 2 + \sum_{i=1}^{n}(\zeta_i X_{t-i}) + \sum_{j=1}^{m}(\delta_j Y_{t-j}) + e_{2t} \quad (7)$$

Where Y_t and X_t are two variables of interest and it is assumed that e_{1t} and e_{2t} are white noise error terms.

The F-test is conducted following the null hypothesis that neither the sum of the β_i or δ_j coefficients are jointly equal to zero (Asteriou and Hall, 2007:282-283). If lagged X terms in equation (6) are statistically different from zero as a group and lagged Y values from equation (7) are not statistically different from zero then X_t is said to Granger-cause changes in Y_t, and vice versa. If both variables are statistically different from zero then there is bi-directional causality between variables, however if both variables are not statistically different from zero then X_t and Y_t are independent (Asteriou and Hall, 2007:282).

7.5 IMPULSE RESPONSE FUNCTIONS AND VARIANCE DECOMPOSITION

The impulse response function traces the effects of an exogenous shock to the different endogenous variables in the VAR model (Brooks, 2007:340). The shock is applied to the error term of each individual equation within the VAR model and this shock can be traced for several periods into the future (Gujarati, 2003:854). If the VAR model is stationary the impulse response function is given as:

$$Y_t = \sum_{i=1}^{n}(\Phi_i \varepsilon_{t-i}) \quad (8)$$

The coefficient Φ_i can be interpreted as the response of one variable to a one standard deviation shock to another variable one period ago (Aziakpono, 2006:7). If the data series are

stationary the shock should die out over time, because there is no unit root in the time series (Brooks, 2008:299). The generalized impulse response function will be used because one of its advantages is that the ordering of the variables within the VAR is invariant, i.e. it does not matter what order the variables are run within the model (Aziakpono, 2006:8). The Impulse response function will be run using a lag length of 24, i.e. two years.

Variance decomposition analysis focuses on the forecast error variance of a variable that results from shocks in other variables. Variance decomposition can be used to determine the relative strength of innovations in a variable and is generally used as a convenient method of providing a breakdown of the change in the value of a variable as a result of changes in both, the same variable, as well as other variables of interest in previous periods (Kasri, 2010:51).

7.6 VARIABLES CHOSEN FOR INCLUSION IN FIRM AND HOUSEHOLD VAR MODELS

The first step in the analysis is to determine which variables should be included in the VAR model for both households and firms. The inclusion of explanatory variables within the VAR is guided by theory and empirical research. Two separate VAR models are estimated, one for the short term credit demand of firms and another for household credit demand.

7.6.1 Variables included in firm model

The present study is primarily interested in the effects of changes in the repo rate on short term credit demand. The money supply is assumed to be endogenously determined and the demand for short term credit is a function of the level of working capital required by firms. Factors affecting the working capital needs of firms include raw material and labour costs and following this line of reasoning the following variables are included in the VAR model:

$$LTL = (LWB, S, PPI, RT, DR, MIX) \quad (9)$$

The equation has been modified to use the log of total short term lending (LTL) to firms by the banking sector, as well as the log of the wage bill (LWB), because the study is interested

in the percentage change in bank lending to the private sector as a result of a change in the repurchase rate and the logarithm of a variable will give the percentage change in that variable. Explanatory variables considered included the wage bill (LWB), stockbuilding (S), secondary tax on companies (TAX) and the Producer Price Index (PPI). The TAX variable is excluded from the list of variables because Moore (1983) found that the tax variable was either not significant or showed the wrong expected relationship with bank lending to ICC's.

A nominal interest rate (DR) is included in models by Moore (1983) and Moore and Threadgold (1985). The inclusion of a nominal interest rate is of primary importance because the effect that interest rates have on credit demand is the primary aim of the study. A round tripping (RT) variable is included following studies by Moore and Threadgold (1985) as well as Cuthbertson (1985), which both found the round tripping variable to help explain movements in credit demand by firms.

Lastly a mix (LMIX) variable is added following studies by Kashyap et al (1993), Gertler and Gilchrist (1993), Oliner and Rudebusch (1996) and Iturriaga (2000) to help identify a balance sheet channel of policy transmission through which changes in interest rates have an effect on credit demand and ultimately real economic activity. As discussed above the mix variable is calculated as the ratio of short term bank debt to total short term debt. Evidence of a balance sheet channel is indicated by a decrease in the LMIX variable because a decrease in the LMIX variable implies that firms are shifting from bank into non-bank debt. The mix variable will be dealt with in more detail in the next sub-section.

Total lending to the private sector is expected to have a positive relationship with wages (LWB), changes in inventories (S), the round tripping variable (RT) and the Producer Price Index (PPI), while the interest rate is expected to have a negative relationship with bank lending to companies. The mix variable (LMIX) has no *a priori* relationship with bank lending, the purpose of the mix variable is to help identify a balance sheet channel via the response of bank and non-bank forms of credit as interest rates change, as explained by Oliner and Rudebusch (1996) above.

7.6.1.1. Interpretation of the mix variable

A secondary, yet subordinate, aim of the study is to identify a balance sheet channel within the transmission mechanism of monetary policy. It is noted at the outset that the credit channel is made up of both the bank lending channel as well as the balance sheet channel of monetary policy transmission, however no attempt is made to distinguish between the two as discussed in section 4.3.2. The underlying approach followed is that there is either a balance sheet channel or there is not. The balance sheet channel will be identified against the more traditional money view of policy transmission. With this in mind attention will now turn to the interpretation of movements in the mix variable.

KWS (1993) were among the first to use a mix variable to identify a bank lending channel of policy transmission using aggregate data. It is noted at the outset that the argument here is that the traditional bank lending channel is theoretically flawed, however the study is considered because the mix variable has been used in other studies which have interpreted the results somewhat differently. The logic behind the mix variable is that a decrease in the mix variable implies that a bank lending channel is operative because a move towards a more contractionary monetary policy by the central bank will decrease the supply of bank loans to firms and firms will then move into the direct debt market to satisfy their demand for funds (thereby increasing the denominator). If however there is no change in the mix variable then the money channel is operative because there will be a proportional decrease in both direct and indirect forms of financing due to a decrease in the total demand for funds as a result of higher borrowing costs. Evidence given by KWS (1993) showed the mix variable to decrease when measured using aggregate data and this implies that a bank lending channel is operative and operates according to monetarist principles. This interpretation is not in line with Post-Keynsian theory and an alternative interpretation of the mix variable is offered which is in line with the evidence presented by KWS (1993). In an economy with heterogeneous agents aggregate results must be treated with caution (Oliner and Rudebusch, 1996:308). Gertler and Gilchrist (1993) as well as Oliner and Rudebusch (1996) follow KWS (1993) by using a mix variable, however movements in the mix variable are interpreted somewhat differently and it is this alternative interpretation that is followed here.

Gertler and Gilchrist (1993:54) found that the mix variable declined following a policy contraction when calculated using aggregate data which is in line with KWS (1993); however, the decline in the mix variable is due to an increase in commercial paper and not a decrease in bank loans to firms. When disaggregated data is used it is shown that bank loans to large firms actually increase, whereas bank loans to small firms initially increase (to a lesser extent than large firms) before decreasing. This implies that a greater amount of credit flows to large firms as opposed to small firms following a policy contraction (Gertler and Gilchrist, 1993:58). When only short term credit is considered in constructing the mix variable, results showed that bank loans actually increased following a policy contraction (as did nonbank debt), with a greater amount of credit again flowing to large firms as opposed to small firms (Gertler and Gilchrist, 1993:59). Oliner and Rudebusch (1996) showed similar results to Gertler and Gilchrist (1993) in that more credit flows to larger firms following a tighter monetary policy than it does to small firms when the mix variable is calculated using disaggregated data. When calculating the mix variable using aggregate data evidence showed a decrease in the mix variable, however bank credit to larger firms increased which is not in line with the interpretation by KWS (1993). It was found that there was a reallocation of credit between small and large firms, rather than between bank and non-bank sources of debt (Oliner and Rudebusch, 1996:303).

The interpretation of the decrease in the mix variable offered by KWS (1993) is that the drop in the mix variable is due to a decrease in bank lending and increase in non-bank lending. Both the studies by Oliner and Rudebusch (1996) and Gertler and Gilchrist (1993) also found the mix variable to decrease when measured using aggregate data however, when the mix variable is measured using disaggregated data evidence showed bank lending to large firms actually increases and thus "…it appears clear that one cannot argue monetary contractions limit the supply of bank debt relative to other forms of finance" (Oliner and Rudebusch, 1996:308). The observation in the studies by Gertler and Gilchrist (1993) and Oliner and Rudebusch (1996) was that the aggregate mix variable decreased (as in KWS (1993)) because non-bank forms of debt were increasing, rather than bank forms of debt decreasing (as in KWS (1993)), which opens up the possibility that the behaviour of the mix variable could explain the effect of credit flowing from smaller to larger firms in line with the balance sheet channel (Gertler and Gilchrist, 1993:60). This interpretation is also noted by Oliner and

Rudebusch (1996) who interpret the decrease in the aggregate mix variable as the result of a shift of short term credit away from small firms to larger firms.

In conclusion movements in the mix variable are taken to imply that credit market frictions are present within the economy and a decrease in the mix variable implies that funds are shifting from smaller firms to larger firms and larger firms are in turn increasing their level of non-bank debt. This occurs because during economic downturns large firms can satisfy most of their short term credit needs, while smaller firms may not be able to satisfy their credit needs, and this will result in a decline in the mix variable (Gertler and Gilchrist, 1993:60).

7.6.2. Variables included in the household model

The choice of variables used in the household VAR model is guided by the framework presented by Lavoie (1994) discussed in section 5.3.2 as well as the contribution made by Dutt (2006) and the primary aim of the study. Dutt (2006) recognises the importance of the role of credit in consumption expenditure and aggregate demand. Consumption is seen to be a function of the six principles outlined by Lavoie (1994). The primary aim of the study is to determine the size and lag length effects of a change in the prime rate on the level of household credit extension and therefore household credit and the prime interest rate are included as variables in the VAR model. A credit variable is added following Dutt (2006) to determine if consumption does in fact influence credit extension and by implication provide support for the argument that an increase in credit financed consumption will lead to an increase in aggregate demand.

Consumers are viewed as procedurally rational in the sense that they have a limited computational capacity as well as operate in a highly uncertain world and as a result may not correctly predict future outcomes, for example wage increases. It was proposed above that social influences and background identity affect an individual's consumption habits more than the individual's level of income once a certain income level is reached and all basic needs have been satisfied. The testing of the hypothesis of which of the above two factors influence consumption to a greater degree is outside the scope of the discussion as the aim here is to determine the size and lag length effects of changes in household credit demand as a result of changes in the prime lending rate of South African Banks.

For simplicity consumption is assumed to be a function of income as data is more readily available. The assumption that consumption is a function of income is in line with Keynes' original theory and an income variable is included in the model (Keynes, 1936:90). If credit is found to have a relationship with consumption then this implies that any changes in the ability of households to access credit for whatever reason may have real economic impacts. The following VAR models are considered:

LCREDIT = LCREDIT (LCONS, LINC, PR) (10)

Compared to

LCREDIT = LCREDIT (LCONS, LINC, PR, DUM1) (11)

and

LCREDIT = LCREDIT (LCONS, LINC, PR, DUM2, LINC*DUM2) (12)

where LCONS represents the consumption of real, seasonally adjusted, non-durable goods and services. Similar measures of consumption have been used by Campbell and Mankiw (1990). LINC represents real, seasonally adjusted, household disposable income which follows similar measures of income by Bacchetta and Gerlach (1997) and Chrystal and Mizen (2005). Both variables are modelled in logarithms as this gives changes in percentage value. LCREDIT is represented by total credit by all monetary institutions to the household sector, modelled in logarithmic form, and PR is the prime overdraft rate of South African commercial banks. A credit variable is added following the by Bacchetta and Gerlach (1997), Chrystal and Mizen (2005) and Dutt (2006).

A dummy variable (DUM1) is added to the model to account for the introduction of the National Credit Act on the 1st of June 2007, as in equation (11). The dummy variable (DUM1) will take a value of 1 for the period after the first of June 2007 and zero otherwise. The dummy variable will be added to the above variables and the results of each OLS regression compared. This is an econometrically acceptable method of determining the explanatory significance of a dummy variable within an OLS equation (A VAR is a series of OLS equations) as the equation without the dummy variable (equation 10) can be thought of as an unrestricted version of the equation with the dummy variable and standard F-test used to determine the explanatory power of the dummy variable equation.

After examining the graphical representation of the LCREDIT series (Appendix 2) for the unit root test there is an argument for the inclusion of a second dummy variable (DUM2) within the VAR model, as in equation (12), because of the marked change in the slope of the LCREDIT series. The DUM2 variable will take a value of 1 for the period between December 1999 and December 2007 and zero otherwise. A slope dummy is also included for the LINC variable (LINC*DUM2) because consumers may have formed exponential expectations of future income which led to an exponential increase in credit demand between December 1999 and December 2007.

LCREDIT is expected to have a positive relationship with LCONS and LINC, while PR is expected to have a negative relationship with LCREDIT.

7.7 DATA SOURCES AND TIME SERIES VARIABLES USED

Data were collected from Thompson Data Stream (TDS) and the South African Reserve Bank website for the period January 1995 to March 2011, unless otherwise stated data used were (throughout) collected from TDS. March 2011 was chosen as an end date because some series were converted from a quarterly to a monthly frequency and the first quarter of the year consists of January through March. Adjustment from quarterly to monthly frequency was done using the quadratic match average method of interpolation. Both firm and household data are recorded at current prices and seasonally adjusted using the X11 filter. Current, seasonally adjusted data was used (as opposed to using seasonally adjusted real data) because price effects are assumed to be a factor that determines both the demand for working capital as well as household credit demand given future income expectations. Price effects are retained for firms because when firms borrow for working capital purposes they take into account nominal rather than real factors, such as wage costs or the cost of input prices, while households use prices in determining the nominal amount of credit to borrow today to supplement current consumption based of future expectations of income.

7.7.1 Data used for firm VAR model

The time series data for S and PPI were collected from the South African Reserve bank website. The WB, S and PPI time series were only available at quarterly frequency and converted to monthly frequency. Total short term lending by banks (representing lending for working capital finance) to firms (LTL) is calculated as: advances by South African banks to the domestic private sector less mortgage advances by banks less investment advances by banks, seasonally adjusted and modelled in logarithmic form. Wages (LWB) are seasonally adjusted and modelled in logarithmic form. The Producer Price Index (PPI) is used as a proxy for the price of imported materials variable (MBill) used by Moore (1983). The import price index was considered for inclusion rather than the PPI because it is a closer approximation to the (MBill) variable used by Moore (1983), however the PPI was chosen instead as it represents a broader measure of the cost of inputs than simply considering imported input goods. The stockbuilding variable is proxied by the change in inventories (S) and is seasonally adjusted, as an absolute measure of inventories was not available for South Africa. The round tripping (RT) variable used is calculated as the excess of the three month Treasury Bill rate less the prime overdraft rate charged by banks (Moore and Threadgold, 1985:69) and the interest rate variable included is the Reserve Bank discount rate (DR).

The mix variable (LMIX) follows the definition set out by Oliner and Rudebusch (1996) using short term credit measures because the focus of the study is on short term credit demand, rather than total credit demand, and thus only short term measures of bank and non-bank credit are used in constructing the mix variable. The mix variable is calculated as the ratio of short term bank lending to the private sector (LTL) to total short term domestic credit extension by all monetary institutions. Total short term domestic credit extension is defined as the sum of discount bills, leasing finance, other loans and total loans and advances by all monetary institutions, refer to appendix 1.

7.7.2 Data used for household VAR model

The income variable (LINC) is proxied by nominal, seasonally adjusted household disposable income. Household credit (LCREDIT) is proxied by nominal, seasonally adjusted credit

extended by all monetary institutions to households. Household consumption (LCONS) data was taken from the SARB and is proxied by current, seasonally adjusted consumption of non-durable goods and services. All three variables above are converted to logarithmic form. The interest rate is represented by the SA bank prime lending rate (PR) - refer to appendix 1.

CHAPTER EIGHT

RESULTS

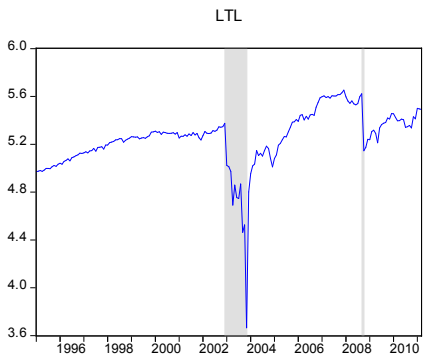
8.1 INTRODUCTION

The results are presented below for firms and households separately as follows: firstly a graphical analysis is done with respect to of the short term bank lending and the mix variable for firms and consumer credit for households. These series are discussed to better understand the possible factors affecting the series and their relationship with each respective interest rate. An informal graphical analysis of time series variables thought to contain a structural break is also conducted to informally determine if the use of the KPSS test is a better statistical test of stationarity than the ADF test because the ADF test does not account for structural breaks. Formal unit root test results are then reported. Thirdly VAR model lag length selection results as well as stability and autocorrelation test results are presented with the VAR estimation results. Finally results of the Granger causality/block exogeneity tests, impulse response functions and variance decompositions are discussed.

8.2 ANALYSIS OF FIRM VAR RESULTS

8.2.1 Graphical analysis of firm data

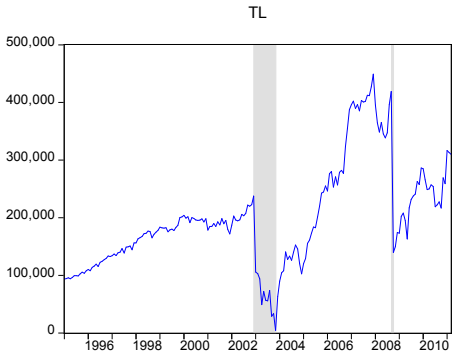
Figure 8.2.1 (a): Short term bank lending



There are two periods in the LTL series where a sharp drop in short term bank lending can be identified. In the first period there is a sharp decrease in short term lending at around December 2002 to around November 2003. Short term bank lending then rises back to its original level at around October 2005. The second noticable drop in short term bank lending is the period between September 2008 and October 2008. To better

understand these movements a graph of the raw, seasonally adjusted data is given below (ie the data before logarithmic convertion):

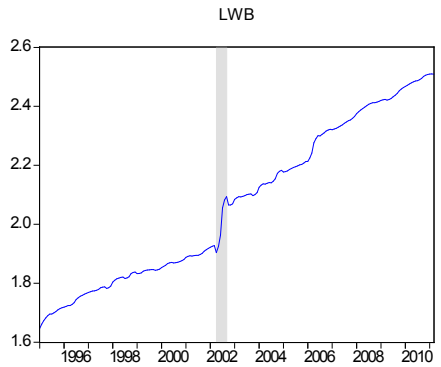
Figure 8.2.1 (a1): Seasonally adjusted short term lending



The decrease in bank lending from December 2002 to November 2003 is likely the result of geopolitical uncertainty and higher interest rates. Two phases of economic development can be identified in 2003. The first half of 2003 was a period of global uncertainty as a result of the US invasion of Iraq, which broke out in March 2003, and other geopolitical issues which tested the strength of the global financial system. The global uncertainty caused by the invasion of Iraq was added to by the SARS outbreak in the Asia pacific region and parts of North America (SARB, 2003:1). The global economic position in 2003 had a significant impcat on the South African economy in two ways. Firstly, there was a reduction in demand for South African exports which in turn lead to a decrease in real GDP growth and secondly, there was an appreciation of the rand which reduced the competitiveness of South African exports (SARB, 2003:2).

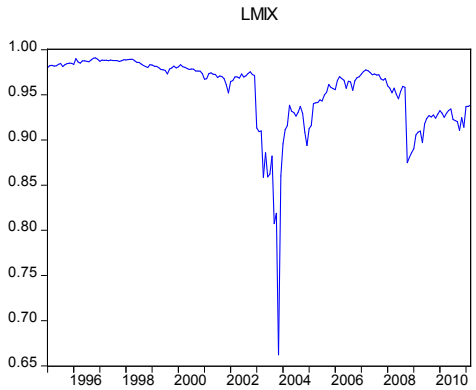
The second period of decline in total lending is in 2008 from September to October. There was a severe downturn in the global economy in the last months of 2008 which had an impact on the South African economy (SARB, 2009:29). The collapse of a major U.S investment bank (Lehman Brothers) in September 2008 led to a drop in the confidence of investors globally and "shock and extreme risk aversion paralysed financial markets and liquidity disappeared as a standard assumption underlying transactions – that the counterparty is a growing concern – was negated" (SARB, 2009:34). This decrease in liquidity may be seen in the drop in short term bank lending, however this was likely the result of a supply side reaction by banking institutions, as opposed to a decrease in demand by firms, as the reason for the decrease in confidence was an increased level of debt, as well as bad debts, by the US consumer and financial institutions.

Figure 8.2.1 (b): Wages



There may be a structural break in the wages series as the series seems to increase sharply between April 2002 and September 2002. The sharp increase is likely the result of human error on the part of Thompson Data Stream. Statistics South Africa shows gross salaries and wages for the second and third quarters to be R84 045 877 and R89 399 049 respectively (Statistics South Africa, 2002:10). It is noted that the third quarter figures differ from earlier releases in that the figures include 11 289 people in the reserve forces (Statistics South Africa, 2002:2). The figures recorded by Thompson Data Stream for the same period show a value of 84 045 877 for the second quarter and a figure of 118 240 327 for the third quarter, which is substantially greater than the third quarter figure given by Stats SA. The TDS series is still used however as there was no comparable series given by the SARB and no attempt is made to correct the suspected measurement error.

Figure 8.2.1 (c): Mix variable



The mix variable shows a sharp decline at around the same time periods as the short term bank lending (LTL) variable. The two seasonality adjusted variables, ie numerator and denominator, are considered below:

Figure 8.2.1 (c.1): Seasonally adjusted raw data

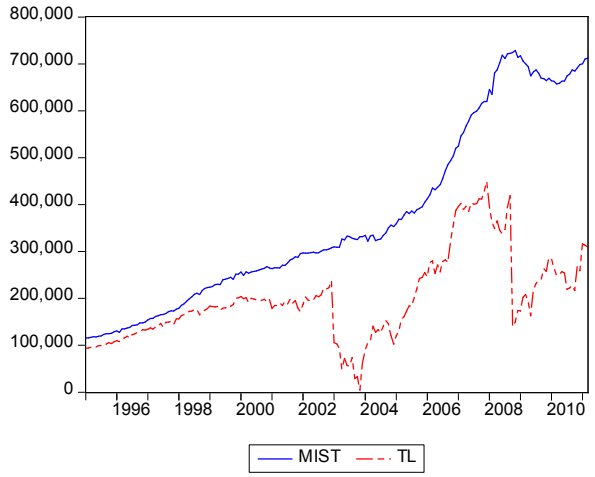
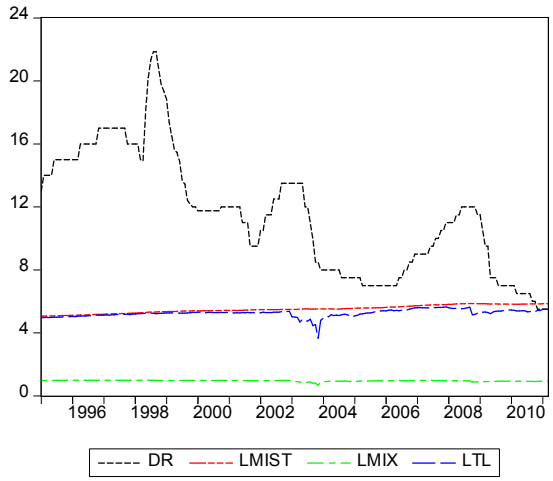


Figure 8.2.1 (c.2): Logarithmic data



Where MIST is short term lending by all monetary institutions to the domestic private sector and LMIST is the logarithm of the MIST variable. Graph (c.1) shows that the decline in the mix variable is likely the result of a decrease in short term bank lending, rather than an increase in short term private sector credit extension by all monetary institutions. Graph (c.2) shows similar results to (c.1), however the logarithm of the mix and total short term lending variables are also compared with the discount rate. The short term credit extension variables show a stable relationship up to December 2002, when bank credit extension dropped. Following this drop the relationship between the credit variables does not seem to be as stable as prior to December 2002. The mix variable does not seem to be very responsive to changes in the discount rate and seems to be influenced more by global economic factors. This lack of response of the mix variable, and therefore the variables used to calculate the mix variable, may imply that short term bank lending does not respond in a meaningful way to changes in monetary policy and thus monetary policy may in fact have a limited ability to curb short term spending within the domestic economy.

8.2.2. Unit root test results using firm data (refer to appendix 2)

Table 8.2.2.1

Variable	ADF test		KPSS test	
LTL	I(1)	None	N/A	
LWB	I(1)	Trend and Intercept	I(1)	Trend and Intercept
S	I(1)	None	N/A	
PPI	I(1)	Trend and Intercept	I(1)	Trend and Intercept
RT	I(1)	None	N/A	
DR	I(1)	None	I(1)	Intercept
LMIX	I(1)	None	N/A	

LWB and PPI are shown to contain a unit root in both the ADF and KPSS tests, and are thus taken to be first difference stationary. The possible structural break in the LWB series was not found to influence the unit root test results. The ADF test showed all variables to be first difference stationary except for the S variable, which was shown to be second difference stationary when assuming a no trend and no intercept functional form.

The KPSS test shows mixed results for the LTL, S, RT and LMIX variables. An informal graphical analysis of these series strongly indicates that the series do not have a trend or intercept and thus the ADF test will be relied on when determining the stationarity of these variables because the KPSS test does not test for a unit root under a no trend and no intercept functional form. All graphs can be seen in appendix 2.

A second ADF test was then run on the S variable using the ADF test; however the test is conducted using an automatically minimised Schwarz criterion, because the lag length of the test influences the estimates of the ADF test and a minimised Schwarz criterion implies an optimal lag length. Using an automatically minimised Schwarz criterion the S variable was shown to be first difference stationary under all assumed functional forms. Thus all variables are modelled as first difference stationary.

8.2.3 VAR estimation results (refer to appendix 3)

The first step in determining the most appropriate VAR model is to select the appropriate lag length. A lag length selection test was done using a maximum lag length of 10. The Schwartz and Hannan-Quinn information criteria suggest an optimal lag length of 1 and the Akaike criterion shows an optimal lag length of 8. A VAR model with a lag length of 1 is estimated and an LM autocorrelation test, with a maximum lag length of 12, is conducted to determine the extent of serial correlation within the residuals and results suggest that serial correlation is present. If there is serial correlation in the residuals one of the assumptions of the Classical Linear Regression Model (CLRM) is violated, this will affect the estimated coefficients within an OLS regression and by implication VAR model coefficients.

One of the assumptions of the CLRM is that the covariance between the error terms over time is zero (Brooks, 2008:139). If there is serial correlation in the residuals the coefficient estimates of an OLS regression are unbiased, however they are not efficient (i.e. the coefficient estimates are not best linear unbiased estimates), so that standard error estimates may be incorrect, which will in turn influence the magnitude of the t-statistics. If the standard error estimate of a variable is not accurate then the wrong inferences could be made about the influence that variable has on an independent variable in an OLS regression (Brooks, 2008:149). If the serial correlation in the residuals is positive then standard error estimates will be biased downward and this will lead to an increase in the probability of a type I error, i.e. the tendency to reject the null hypothesis when it is correct (Brooks, 2008:150).

A VAR model with a lag length of one is estimated as suggested by the Schwarz and Hannan-Quinn information criteria, however due to the level of serial correlation within the residuals at a lag length of 1 a second VAR model is estimated with a lag length of 8, as suggested by the Akaike criteria. Results of the LM test for serial correlation on a VAR model with an estimated lag length of 8 suggest that there is a smaller amount of autocorrelation compared to lag 1.

The problem with going from 1 lag to 8 lags, however, is that an increased lag length consumes degrees of freedom within the VAR model and thus the model is estimated using fewer observations from within the sample data. The lag length can be increased at the

expense of degrees of freedom, but the increase in lag length is likely to decrease the amount of autocorrelation between the residuals and more favourable LM tests results will be obtained. The increase from lag 1 to lag 8 is acceptable because the data used is of monthly frequency and the number of observations included after adjusting for the degrees of freedom required by a model with a lag length of 8 is 186, compared with a total sample of 195 observations, and therefore the sample still includes data for 15, 5 years which is a large enough sample size.

A second reason for the use of the higher lag length, apart from still having a sufficient sample size, is that the reliability of standard error estimates is seen as more important than having a relatively larger sample size because it is argued that more accurate standard error and t statistics estimates in a smaller sample size is better than having a larger sample size with inaccurate standard error estimates. Since lag 8 is indicated as the lag which minimizes the Akaike information criterion, any increase in lag length from lag 8 is seen as an unnecessary use of extra degrees of freedom. Therefore the final VAR model is estimated using 8 lags. An AR unit roots test shows that all unit roots lie inside the unit circle and thus the VAR is stable.

8.2.3.1 Coefficient estimates of firm VAR model

The Schwarz and Akaike criteria for the model as a whole are around -6.33 and -13.25 respectively. Only the individual results for the LTL variable (taken as the dependent variable) will be discussed as the focus here is on the effects of the repo rate on bank lending. The estimates of the VAR model show an R-squared of about 0.42 and an adjusted R-squared of around 0.16. The F statistic is around 1.64, with a critical value of around 1.43 and 1.66 for the 5% and 10% levels of significance respectively. Thus all variables do jointly influence LTL at the 5% level of significance but not at the 10% level of significance. Only three variables were found to be individually statistically significant, these were the fifth lag of the LTL series, the first lag of the DR series and the fifth lag of the LMIX variable, with coefficient estimates of -1.13, 0.05 and 6.37 respectively. The LTL and DR coefficient estimates are not in line with expectations. All other variables and lag lengths were not found to be statistically significant.

The LWB variable showed the correct expected relationship with LTL at lags 1, 3, 4 and 7, with coefficient estimates ranging from between 0.09 at lag 3 to about 4.09 at lag 4, with the first lag showing a coefficient of about 2.33. The S variable shows the correct expected relationship at lags 1, 3, 4, 6 and 7. The coefficient estimates of the S variable with the correct expected relationship with LTL range from around 0.002 at lag 8 to around 0.22 at lag 4, with lag one showing a coefficient of about 0.15. The PPI has the correct expected relationship with LTL at lags 1, 3, 6 and 7 with coefficient estimates ranging between 0.0019 and 0.0105. RT shows the correct relationship at lags 4, 5 and 7 and coefficient estimates range from 0.0030 to 0.0063.

As mentioned above it is difficult to interpret the results of individual coefficient estimates within a VAR model with a large lag length and it is for this reason Granger-causality tests, impulse response functions and variance decompositions are used, to which attention is now turned.

8.2.4 Granger-causality test results (refer to appendix 7)

First the results relating to the influence that changes in the repo rate (DR) have on the level of short term bank lending (LTL) will be discussed. Next the results concerning the LMIX variable will be covered and the implications these results have for a balance sheet channel of policy transmission.

Table 8.2.4.1

Dependent variable: D(LTL)

Excluded	Chi-sq	Df	Prob.
D(LWB)	5.947960	8	0.6531
D(S)	4.512514	8	0.8082
D(PPI)	5.723173	8	0.6782
D(RT)	3.883333	8	0.8675
D(DR)	14.52011	8	0.0692
D(LMIX)	12.92518	8	0.1144
All	57.63259	48	0.1608

There is a unidirectional relationship between DR and LTL, where DR is seen to Granger-cause LTL at the 10% level of significance. Thus the repo rate does have a statistically significant relationship with short term bank lending, in line with expectations.

All variables were not found to be jointly significant in influencing LTL, which is not in line with expectations. LWB, PPI and RT are all independent of LTL implying that none of these variables have a relationship with LTL, which is not in line with expectations because LWB, PPI and RT are expected to positively influence LTL.

There is unidirectional causality between LTL and S, such that LTL is seen to Granger-cause S. This is not in line with expectations because the level of inventories should have an effect on short term bank lending, and not vice versa, because entrepreneurs will increase the level of working capital finance in order to increase the level of inventories. Next, results concerning the LMIX variable are discussed.

Table 8.2.4.2

Dependent variable: D(LMIX)

Excluded	Chi-sq	Df	Prob.
D(LTL)	12.49059	8	0.1306
D(LWB)	5.617179	8	0.6900
D(S)	4.730909	8	0.7859
D(PPI)	5.782416	8	0.6716
D(RT)	3.415110	8	0.9057
D(DR)	14.64514	8	0.0664
All	58.99442	48	0.1328

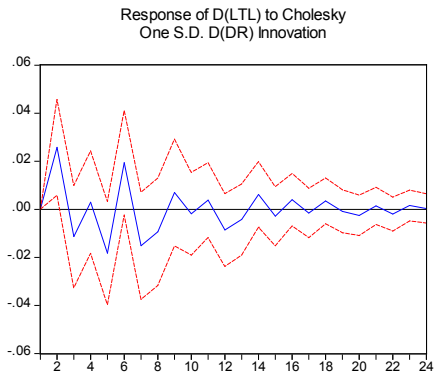
DR is shown to Granger-cause changes in LMIX but not vice-versa, which is in line with expectations. LTL is shown to be independent of LMIX. It is argued that there is indirect and weak evidence of a balance sheet channel of policy transmission which can be inferred from the definition of the mix variable.

If LTL does not have a significant relationship with LMIX but movements in DR have a significant relationship with LMIX, then the movement in the LMIX variable must be the result of movements in non-bank sources of finance brought about by changes in the repo rate. Changes in non-bank sources of finance result from changes in the repo rate and thus there is indirect evidence of a balance sheet channel of policy transmission because firms are shifting into non-bank sources of finance. The shift from indirect to direct sources of finance is possible only for large firms as their creditworthiness relative to other firms makes this form of financing more attractive which indicates that credit is moving from smaller to larger firms.

It must be noted that the direction of the change in non-bank sources of finance cannot be determined using this method and the inference of a balance sheet channel is made assuming that non-bank sources of financing are increasing, in line with the interpretation of the mix variable adopted here. The direction and magnitude of the change in the mix variable will, however, be analysed below using impulse response functions.

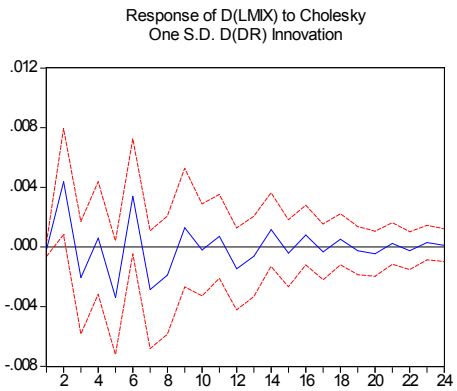
8.2.5 Impulse response function results (refer to appendix 9)

Figure 8.2.5.1:- Effect of a shock to DR on LTL



The LTL variable increases initially to its maximum value of around 0.0258% at lag 2 and drops to around -0.0114% at lag 3, reaching a minimum value of around -0.018223% at lag 5. The initial increase in LTL can be interpreted as being in line with expectations because it was shown by Gertler and Gilchrist (1993:59) and Oliner and Rudebusch (1996:303) above that short term bank lending initially increases following a policy shock. The impulse response function then hovers around zero, eventually dying out at around lag 24. The results show that the magnitudes of the movements in LTL as a result of a shock to DR are not large, although statistically significant as shown by the Granger-causality test. The magnitudes of changes in LTL are small and this implies that the central bank has a limited ability to influence the level of bank credit extension in the short term.

Figure 8.2.5.2:- Effect of a shock to DR on LMIX



The LMIX variable initially increases to a maximum of around 0.0044% at lag 2, before decreasing at lag 3 to around -0.0021%, which follows the LTL impulse response function above quiet closely. The LMIX reaches a minimum decrease at lag 5 of around -0.0034%. Movements in the LMIX variable are not

particularly large, and are smaller than movements in the LTL variable above.

At first there does not seem to be a balance sheet channel of policy transmission because the mix variable initially increases following a contractionary monetary policy shock, which is contradictory to expectations. The mix variable is expected to decrease following a policy contraction because short term funds flow away from smaller firms to larger firms, in line with the interpretation offered above. A balance sheet channel can, however, be indirectly inferred the relative size of the shifts in the LMIX variable compared to the LTL variable is examined, as well as factors influencing the LMIX variable. This inference relies only on the definition of the mix variable and is taken as very weak evidence of a balance sheet channel of policy transmission.

The results indicate that, in response to a contractionary policy shock, the increase in the magnitude of LTL is greater than the magnitude of the LMIX variable to the same shock. It was also seen that Granger-causality tests showed the LMIX variable to be influenced by DR, but not by LTL. Therefore if LTL does not influence the LMIX variable then the change in the LMIX variable must come from changes in non-bank sources of financing. Since the increase in LTL is greater than the increase in LMIX, the smaller increase in the LMIX variable must be the result of an increase in non-bank sources of financing relative to bank credit extension. A simple numerical example will clarify the argument.

It is remembered that the mix variable is calculated as the ratio of short term bank debt to short term debt by all monetary institutions, where short term debt by all monetary institutions is made up of bank as well as non-bank debt. If the level of short term bank debt increases, and there is no increase or decrease in non-bank forms of financing, then there will be no change in the mix variable in line with the money view interpretation of the mix variable offered by KWS (1993). Another way of looking at the same problem is to only look at the relative increases of LTL and LMIX as a result of a contractionary policy shock. If bank debt rises by R3, where bank lending was originally at Y and assuming no change in non-bank sources of financing, then the increase in the mix variable will be equal to 1 because $(3+Y)/(3+Y+0) = 1$. If the mix variable shows a change of less than one, however, it can be interpreted as an increase in the denominator relative to the numerator, i.e. non-bank financing.

An increase in the mix variable is therefore in line with the interpretation that a rise in the short term rate of interest leads to a shift of funds between small and large firms. This is because the change in the LMIX variable following a policy shock is smaller than the change in LTL, following the same policy shock, and since LTL is not found to influence LMIX the change in LMIX must be the result of an increase in non-bank sources of debt.

8.2.6. Firm variance decomposition results (refer to appendix 11)

Table 8.2.6.1

Panel	Period	D(LTL)	D(LMIX)	D(DR)
D(LTL)	1	100	0	0
	2	92.655	0.585	4.209
	6	82.227	5.216	8.234
	12	71.774	11.289	9.212
	18	70.147	11.093	9.384
	24	69.300	11.257	9.337
D(LMIX)	1	97.605	2.262	0.008
	2	90.709	3.081	3.866
	6	80.449	6.836	8.120
	12	69.203	13.173	9.207
	18	67.688	12.919	9.384
	24	66.735	13.121	9.316

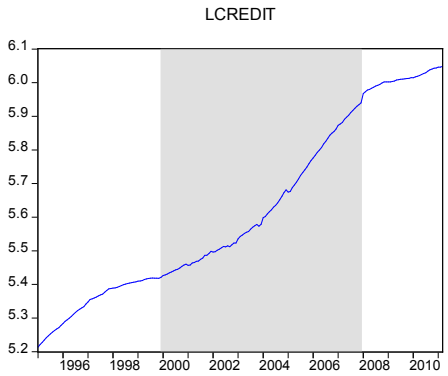
First dealing with the effects of DR in movements of LTL, in the first period all of the variation in LTL is due to itself accounting for 100% of the change in LTL, decreasing to 69.3% at lag 24. The DR variables accounts for around 4.21% of the variation in LTL at lag 2, 9.21% at lag 12 and 9.337% at lag 24. Thus the DR variable accounts for an increasing share of the movement in LTL, reaching a maximum of 9.38% at lag 18, however the magnitude of the influence that DR has on LTL is small in relation to the overall movement in LTL.

Secondly, the relationship between DR, LTL and LMIX shows that the DR variable accounts for 0.008% of the variation in the LMIX variable at lag 1, 3.87% at lag 2 and increasing to 9.32% at lag 24. LTL accounts for 97.61% of the movement in LMIX at lag 1, decreasing to 80.45% at lag 6 and reaching 66.73% at lag 24. Thus DR is found to have a small effect on the movement in the LMIX variable, while the LTL variable by far has the greatest impact on the movements in the LMIX variable. The small influence of DR is found to be statistically significant in relation to movements in LMIX, but the large influence of LTL in movements of the LMIX was not found to be statistically significant, as indicated by the Granger causality tests above. This result again indicates that the central bank has a limited ability to influence the level of short term credit extension to firms.

8.3 ANALISYS OF HOUSEHOLD VAR RESULTS

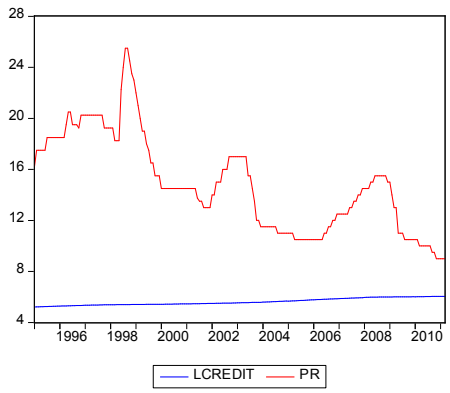
8.3.1 Graphical analysis of household data

Figure 8.3.1 (a): Household credit



Up to around December 1999 the LCREDIT series increases and appears to flatten off, increasing at a decreasing rate. The series then seems to increase at an increasing rate between about December 1999 and December 2007, after which the series starts to increase at a decreasing rate. There are a number of reasons for this increase, which include firstly a strengthening of the overall economy that led to an accelerated increase in private sector credit extension in June 2001 (SARB, 2001:54). There was also a strong household demand for durable as well as non-durable goods which increased from June 2000 to March 2001. Credit extension for durable and non-durable goods reached a record high, up to that point in time, in the first quarter of 2001 (SARB, 2001:58). Finally, during 2005 lower interest rates, favourable lending and borrowing conditions, wealth effects from real-estate and financial markets and strong consumer confidence contributed to the growth in credit extension (SARB, 2005:47).

Figure 8.3.1 (a1): Graphical analysis of LCREDIT and PR



The graph shows that movements in the PR variable do not have a significant influence on LCREDIT which implies that changes in the prime rate of interest does not have a significant effect on household credit demand.

8.3.2 Unit root test results using household data (refer to appendix 2)

Table 8.3.2.1

Variable	ADF test		KPSS test	
LCREDIT	I(1)	Trend and Intercept	I(d) > 2	Trend and Intercept
LCONS	I(1)	Trend and Intercept	I(1)	Intercept
LINC	I(1)	Trend and Intercept	I(1)	Trend and Intercept
PR	I(1)	None	I(1)	Intercept

LINC and PR are in line with expectations and are first difference stationary when estimated under both the ADF and KPSS test. The LCREDIT and LCONS variables however give mixed results.

The ADF test showed LCREDIT to be first difference stationary under both the trend as well as trend and intercept functional forms, but second difference stationary assuming a no trend and no intercept functional form. The LCONS series was shown to be first difference stationary under the no trend no intercept, as well as intercept, functional forms but is shown to be second difference stationary under the trend and intercept functional form.
The KPSS test showed the LCREDIT series to be first difference stationary under the intercept functional form, but stationary at a higher order of integration than two, under the trend and intercept functional form. The LCONS series is shown to be level stationary assuming no trend and no intercept, but first difference stationary using a trend and intercept functional form.

Given these differing results a second ADF test was performed on the LCREDIT and LCONS variables. The ADF test is used, as opposed to the KPSS test, because both the LCREDIT and LCONS series do not seem to exhibit a structural break based on informal graphical analysis. The second ADF test estimated automatically minimises the Schwartz criteria, which implies an optimal lag length. Thus the two problems identified with unit root testing above do not apply, refer to LCREDIT and LCONS graphs in appendix 2. Results showed the LCREDIT

and LCONS series to be first difference stationary under all assumed functional forms and thus all variables are modelled as first difference stationary.

8.3.3 Analysis of household VAR results (refer to appendix 4)

8.3.3.1 Lag length selection and dummy variables

Lag length selection criteria with a maximum lag length of 10 showed the Akaike criteria to be minimized at lag 10. This could mean that the Akaike criteria could not be minimized due to an insufficient maximum lag length. The maximum lag length for the lag length selection criteria was then increased to 14, which showed that the Akaike criterion is minimized at lag 13. Lag length selection criteria suggest that the household VAR model should be run with a lag length of 3 according to the Schwarz criterion, a lag length of 4 according to the Hannan-Quinn criterion, while the optimal lag length suggested by the Akaike criterion is 13.

A first VAR model was then run with a lag length of 3, but the LM autocorrelation test is not satisfactory. A second VAR is run with a lag length of 4 and the LM test was again found to be unsatisfactory. Following this a third VAR model is estimated using a lag length of 13 and the LM test is satisfactory. As already mentioned, there is somewhat of a trade-off between the lag length (degrees of freedom) and the amount of serial correlation in the residuals. Due to the loss of efficiency in the OLS estimates, as a result of autocorrelation in the residuals, the final household VAR model will be estimated with a lag length of 13 as the reliability of standard error estimates is seen as more important than having a relatively larger sample size. Any additional lags beyond 13 are seen as an unnecessary use of degrees of freedom as the LM test was satisfactory. The number of observations included after accounting for 13 lags are 181, which is still a sample size of 15.08 years and the loss of the degrees of freedom is seen as acceptable. The VAR was found to have a stable AR unit roots graph.

Next the two dummy variables were included, i.e. DUM1, DUM2 and LINC*DUM2, and compared to the model not including dummy variables, results are presented in appendix 5 and appendix 6 respectively. The information criterion for the model including the DUM1 variable as a whole showed mixed results. The Schwarz criterion increased to about -22.66 from about -22.71 and the Akaike criterion decreased to about -26.47, from about -26.45. The

model including both DUM2 and LINC*DUM2 showed both information criteria to increase. Both sets of dummy variables were not found to be statistically significant when taking LCREDIT as the dependent variable. It is concluded, mainly from the fact that the DUM1, DUM2 and LINC*DUM2 are statistically insignificant (when the LCREDIT variable is the dependent variable) along with the increase in the Schwartz criterion in both dummy variable models that the final VAR model will not include either of the dummy variables.

8.3.3.2 Coefficient estimates of VAR model

The VAR results indicate that the Schwarz and Akaike criteria for the model as whole are around -22.71 and -26.45 respectively. Next only the results relating to the LCREDIT variable as the dependent variable will be discussed because the focus of the study is on the effect of interest rates on credit demand. The R-squared term was about 0.57 and the adjusted R-squared was around 0.39. The F statistic is about 3.21 with a 5% critical value of around 1.5 and a 1% critical value of 1.76, thus all variables are jointly statistically different from zero at the 1% level of significance. The final VAR model shows that 3 lags of the LCREDIT variable are statistically significant. The LCONS variable is statistically significant at lags 10 and 12 but only lag 10 shows the correct expected relationship with a coefficient estimate of about 1.389. The LINC variable is significant at lag 3 but has the incorrect expected relationship. The PR variable is statistically significant at lag 6 and shows the correct relationship with a coefficient estimate of -0.001.

Next attention is turned to the Granger-causality, impulse response function and variance decomposition results which give a somewhat more meaningful interpretation of the VAR results.

8.3.4 Granger causality test results (refer to appendix 8)

The results are presented in two sections, the first is concerned with the influence that the prime rate (PR) has on household credit demand (LCREDIT) in line with the primary aim and the second deals with the influence of consumption (LCONS) spending by households on the demand for credit (LCREDIT) in order to better understand the role of credit in consumption and possible real economic impacts of restricted access to credit. The

relationship between consumption (LCONS) and income (LINC) will also be analysed in line with the Keynesian assumption that consumption spending is a function of income.

Table 8.3.4.1

Dependent variable: D(LCREDIT)

Excluded	Chi-sq	Df	Prob.
D(LCONS)	50.49846	13	0.0000
D(LINC)	28.69280	13	0.0072
D(PR)	8.784235	13	0.7890
All	77.26037	39	0.0003

Causality tests indicate that both LINC and LCONS Granger-cause LCREDIT, however PR was not found to Granger-cause LCREDIT. All variables were found to jointly influence LCREDIT.

PR was found to be independent of LCREDIT which is not in line with expectations as LCREDIT is expected to be influenced by, but not influence, PR. This result is in line with graph 8.3.1 (a1) which shows that LCREDIT does not react significantly to PR. This implies that the central bank has a limited ability to influence the demand for credit by households and as a result monetary policy may not be effective in the short to medium term.

There is unidirectional causality between LCONS and LCREDIT where LCONS Granger-causes LCREDIT which is in line with expectations. The statistically significant relationship between household credit demand and consumption lends support to the proposition by Dutt (2006) that credit has a role in consumption spending and by implication has real economic effects. Next attention will be focus on the relationship between LCONS and LINC.

Table 8.3.4.2

Dependent variable: D(LCONS)

Excluded	Chi-sq	Df	Prob.
D(LCREDIT)	16.34071	13	0.2312
D(LINC)	7.966908	13	0.8457
D(PR)	18.02979	13	0.1564
All	44.03528	39	0.2669

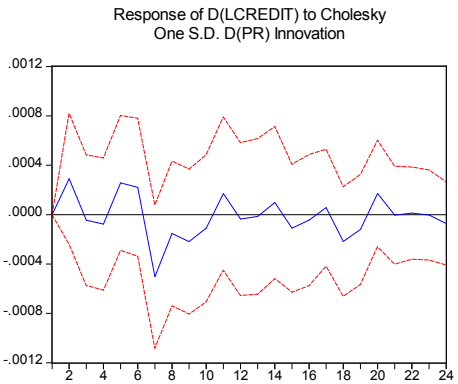
No variables were found to individually Granger-cause LCONS and all variables did not jointly influence LCONS. LINC was found to have unidirectional Granger-causality with LCONS where LCONS Granger-causes LINC, which is

not in line with expectations because the level of income is expected to influence the level of consumption and not vice versa. In light of this evidence the resulting analysis must be read with caution as one of the underlying assumptions of Keynesian consumption theory has not been borne out in the empirical results.

8.3.5 Impulse response function results (refer to appendix 10)

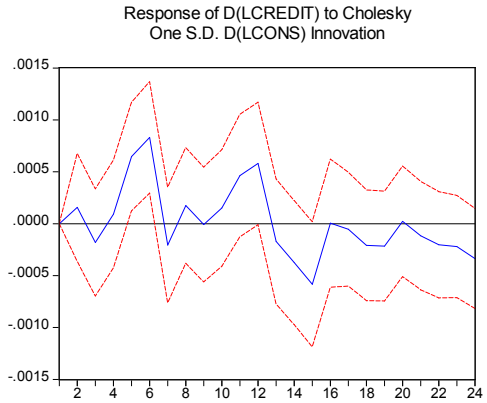
Firstly the effects of a shock to the prime rate of interest is analysed with reference to its effect on credit extension in line witht the main aim of the study. Next the influence of consumption on credit extension is discussed in line with the ideas by Dutt (2006) and finally the relationship between consumption and income is analysed.

Figure 8.3.5.1:- Effect on LCREDIT of a shock to PR



LCREDIT initially increases over the first two months but the magnitude of the increase is only 0.000291%, which is not a large increase. This increase is not in line with expectations as credit demand is predicted to decrease following a policy contraction. The most significant drop in LCREDIT is between month 6 and month 7, decreasing to a minimum value of around -0.0005%. The impulse then moves around 0, with the effect of the shock dying out at around month 24. This result indicates that a change in the prime rate of interest has a very small impact on credit extended by all South African monetary institutions (in line with graph 8.3.1 (a1))), however the movement in credit demand is not in line with expectations.

Figure 8.3.5.2:- Effect on LCREDIT of a shock to LCONS



LCREDIT begins by increasing over two months, dropping during month three and then increasing to its highest level in month 6 of 0.000832%. This result is in line with expectations because an increase in consumption is expected to be in part financed by credit. The series reaches its lowest point of -0.000584% in month 15. The increase in LCREDIT as a result of a shock to LCONS is not large in magnitude, although the shift is statistically significant as shown by the Granger causality results. Thus there is a statistically significant relationship between consumption and credit, however changes in credit demand as a result of changes in consumption are small.

8.3.6 Household variance decomposition results (refer to appendix 12)

Firstly the influence of PR in the movement of LCREDIT will be discussed as this is the main aim of the study. Following this discussion the effects of LCONS on LCREDIT will be considered.

Table 8.3.6.1

Panel	Period	LCREDIT	LCONS	LINC	PR
LCREDIT	1	100.00	0	0	0
	2	97.845	0.266	0.983	0.907
	6	81.604	9.868	6.787	1.741
	12	77.062	11.422	7.925	3.591
	18	75.59	13.2	7.617	3.593
	24	74.474	13.724	8.182	3.619

Estimates indicate that a large proportion of the variation in LCREDIT is due to its own innovations and not due to the PR variable. In the first period all of the variation in LCREDIT is due to itself, reaching a minimum value of 74.47% in month 24. PR influences the movement in the LCREDIT variable by 0.907% in month 2, with a maximum impact of 3.6% in month 24.

The LCONS series seems to contribute a greater portion to the total variation in LCREDIT than both LINC and PR; however LINC contributes towards a greater proportion to the movements in LCREDIT than PR. The LCONS contributes around 0.27% to the movement

in LCREDIT at lag 2, 11.42% at lag 12 and 13.72% at lag 24. It would also seem that LCONS and PR have a one period lag when influencing the change in LCREDIT.

CHAPTER NINE

DISCUSSION

9.1 INTRODUCTION

The results of the empirical tests above are discussed beginning with firms and then focusing on households.

9.2. DISCUSSION OF SELECTED RESULTS RELATING TO FIRMS

9.2.1 The relationship between interest rates and short term credit demand

The central aim of the study is to determine the size and lag length effects of a change in the repo rate by the central bank and the effect this action has on short term credit demand by firms. The results of the Granger-causality tests indicate that the repo rate does influence the level of short term bank lending by firms; however, the impulse response function shows this relationship to be small in magnitude. A shock to the repo rate was shown to increase short term bank lending by a maximum of only 0.03% in the second month, with the shock hovering around zero for about two years, before dying out. This implies that although there is a statistically significant relationship between the repo rate and short term bank lending, the size effect of this relationship is small and the central bank may have a limited ability to influence the degree of short term lending by firms through policy actions. A comparison with (although not strictly comparable) Gertler and Gilchrist (1993) who show (using US data) total short term bank loans to increase by about 2% over 9 months after a shock to the Fed funds rate, before returning to normal after about two years and therefore a shock has a larger effect over a longer period than results presented here.

Variance decomposition results show that the repo rate is responsible for around 4.21% of the movement in short term bank lending in the second month, increasing steadily over two years, reaching a maximum contribution of about 9.38% after a year and a half. This again

indicates that changes in the repo rate do not have a significant influence on the movement in short term bank lending. Next results will be compared to the study by Ludi *et al* (2005) which uses South African data. It is noted that Burger (2008) also performed a study using South African data but none of the results presented are comparable and no comparisons will be made.

Impulse response function results by Ludi *et al* (2005:15) show that a shock to the repo rate will lead to a decrease in loans over two years, reaching its lowest point of around -0.009% after a year and a half; this is not in line with the results found here as it was shown that bank lending initially increases for two months and then decreases over the next three months to a minimum value of -0.018%, thus the results of this study give a larger decrease in loans after a shock to the repo rate over a shorter period of time. The time taken for the shock to die out also differed between studies as any shock to the repo rate will die away after a short period of time according to results obtained here; however, Ludi *et al* (2005) showed a shock to the repo rate to persist after two years.

Variance decomposition results were in line with Ludi et al (2005) in that most of the variation in the movement of loans is accounted for by itself. Ludi *et al* (2005) showed that the contribution of loans to movements in itself to be 100% in the first month, decreasing over two years. Evidence here suggests that loans contribute to a minimum value of 69.3 % to movements in itself after two years while Ludi *et al* (2005) show a value of around 40%. The contribution of the repo rate to overall movements in loans was shown to increase over the period from an initial value of 0 to a maximum value of around 10% after two years, in line with the results in this study.

Therefore results here differ from Ludi *et al* (2005) in that they show loans to reach their minimum decline over a shorter time frame of 5 months as opposed to a minimum decline after a year and a half and remaining low over two years. Variance decomposition results showed loans to have a greater influence on itself than Ludi *et al* (2005) with results here showing a value of 69.3% as opposed to a value of 40%, however variance decomposition results regarding the influence of the repo rate on movements in loans were in line. The results, despite giving different quantitative measurements, both agree that changes in monetary policy have a limited ability to influence the level of bank borrowing.

9.2.2 Evidence of a balance sheet channel of monetary policy transmission

A second question addressed here is if a balance sheet channel of policy transmission can be identified through which changes in the repo rate are thought to influence changes in short term bank lending. The results discussed should be compared to other studies using South African data; however, no such study was found that uses a mix variable and thus no comparisons can be made. These results should rather serve as a comparison for any future studies that might consider the use of a mix variable in conjunction with South African data. Given that the mix variable increases following a shock to the repo rate evidence of a balance sheet channel could not be found. This is because the interpretation of the mix variable followed here predicts a decrease in the mix variable following a policy contraction as being in line with a balance sheet channel of policy transmission. There is, however, indirect and weak evidence of a balance sheet channel of policy transmission.

Granger causality tests indicate that the repo rate does influence the mix variable, but short term bank lending was not shown to have an influential relationship with the mix variable. This may be interpreted as very weak evidence for a balance sheet channel of policy transmission due to the definition of the mix variable. The movement in the mix variable is smaller in magnitude than movements in short term bank lending, where short term bank lending increases to a maximum of around 0.03% in the second month, while the mix variable increases to a maximum of around 0.004% in the same month. Both series hover around zero, eventually dying out after two years. This indicates that the increase in short term bank lending, as a result of a shock to the repo rate, is not accompanied by one-for-one increase in the mix variable. This difference in the magnitude of movements between bank lending and the mix variable implies that there are changes to non-bank sources of debt.

Changes to non-bank sources of finance can be inferred because the mix variable is found to be significantly influenced by the policy shock (DR), therefore the mix variable does not remain unchanged. A smaller movement of the mix variable than in short term bank lending implies that non-bank sources of debt are increasing, due to the fact that the denominator must be greater than the numerator in order for the movement in the mix variable to be less than 1. Thus if the repo rate influences the mix variable but the mix variable is not influenced by short term bank lending then the movement in the mix variable must result from the

effects that changes in the repo rate have on movements in non-bank sources of finance, which is only available to larger more credit worthy firms because of the problems of asymmetric information in credit markets. This logic implies that the mix variable is moving because firms are moving between bank and non-bank sources of finance due to an increase in the repo rate.

Variance decomposition results showed that short term bank lending was the primary determinant of the movements in the mix variable, accounting for 97.61% in the first month, 80.45% after 6 months and 66.74% after two years. The repo rate has an increasing influence on movements in the mix variable, starting with a minimum impact of 0.008% in lag 1, reaching a maximum impact of 9.38 % after 18 months and dropping to 9.32% after two years. As can be seen, the influence of short term lending in movements of the mix variable are the largest, however the influence of short term lending on the mix variable was not found to be statistically different from zero. The repo rate was found to have a statistically significant impact on the mix variable, but the influence of the repo rate on the mix variable is small, with a maximum value of only 9.38%. This implies that changes in the repo rate do have a statistically significant effect on bank versus non-bank sources of finance but the effect of this change in interest rates in small.

9.3. DISCUSSION OF SELECTED RESULTS RELATING TO HOUSEHOLDS

9.3.1 Changes in household credit demand and interest rates

An aim of the present study is to determine the effects that changes in the prime rate of interest, charged by South African banks, have on household credit demand. The inability of the National Credit Act dummy variable (DUM1) to increase the predictive power of the VAR model implies that the Act has not had a significant influence on the level of credit extended to households, while the inability of both income dummy variables (DUM2 and LINC*DUM2) to add explanatory power to the VAR model can be taken as evidence that consumers did not increase their demand for credit exponentially between December 1999

and December 2007 and by implication did not form exponential expectations of income over the same period. Therefore the final VAR model does not include any dummy variables.

Granger causality test results for the final VAR model show that changes in the prime rate of interest are independent of the level of household credit extended by all South African monetary institutions. The inability of the prime rate to influence the level of household credit demand was also seen in figure 8.2.1 (c2) above. Therefore consumers do not take into account the price of credit when making consumption decisions and do not react significantly to changes in the prime rate of interest; this implies an inability on the part of the central bank to influence aggregate consumption by manipulating interest rates.

The impulse response function shows that the response of household credit to a shock in the prime rate is small in magnitude, with the largest increase in household credit being 0.000291% in month 2 (not in line with expectations), while the largest decrease in credit demand occurred between months 6 and 7, decreasing by only -0.0005%, then hovers around zero with the effect of the shock dying out after two years. Thus a shock to the prime rate does not have a sizeable impact on credit demand and the effect of the shock dies out after two years. The movements between credit extension and the prime rate are however, not statistically different from zero as shown by the Granger causality results.

Variance decomposition results show that changes in the prime rate of interest do not greatly contribute to the overall movements in household credit extension. The movement in household credit is entirely due to itself in the first month, but decreases over two years. A change in the prime rate of interest has an increasing effect on movements in household credit over two years, contributing to 0.525% of the movement in household credit in month 1, 1.686% after 6 months and 5.624% after 1 year, having its largest effect after two years with a magnitude of 6.403%. It can be concluded that the effect of the prime interest rate on overall changes in household credit has an increasing influence but the influence is small in magnitude and not statistically significant.

9.3.2 Credit and consumption within a Post-Keynesian framework

A secondary aim is to determine if consumption does indeed play a role in household credit demand and by implication lend support to Dutt's (2006) hypothesis that access to credit will have real economic effects. As was noted above the demand for credit was influenced by consumption spending as indicated by the Granger-causality tests. This implies that credit extension plays a significant role in the consumption process and any changes in credit conditions could potentially have real economic effects as a result of a lack of access to consumption finance. These results also support the view expressed by Moore (1988) that it is necessary for economic units to deficit-spend in order for the economy to grow. These results must be read with caution as Granger-causality results also show that there is uni-directional Granger-causality from consumption to income which is not in line with economic theory.

CHAPTER TEN

CONCLUSION

The primary aim of the present study was to determine the size and lag length effects of changes in credit demand by both firms and households as a result of changes in interest rates. It was argued that the underlying assumption of an exogenously determined money supply as in the traditional IS/LM model does not give the correct relationship between the money supply and output in a modern financial economy. Rather the money supply is seen to be determined endogenously, where it is the demand for short term credit by firms which injects money into the economy and therefore it is the demand for credit which is the relevant variable of interest (as opposed to the demand for money). Changes in the repurchase rate by the central bank will influence the rate at which firms can borrow for working capital purposes and thus influence real output.

A secondary aim was to determine if a balance sheet channel can be identified through which changes in monetary policy are thought to influence real economic variables. Another underlying assumption of the traditional IS/LM model, challenged here, is the assumption of perfect information. The assumption of perfect information leads to the conclusion that bank and non-bank sources of finance are perfect substitutes; it is, however argued that credit markets are characterised by asymmetric information and that banks play a unique role in the economy by reducing the level of asymmetric information and in turn the price of external funds.

The findings related to the interest rate elasticity of credit demand by firms and households will be discussed, and attention then turn to the findings relating to the presence of a balance sheet channel of policy transmission for both firms and households.

The demand for credit is the variable of interest here because the economy is assumed to operate under an endogenously determined money supply. An implication of assuming an endogenous money supply is that the demand for short term credit on the part of firms is a

function of their working capital needs, where working capital needs are in turn a function of labour and raw material input costs. The monetary policy authority can influence the level of economic output by influencing the level of the repurchase rate, which will in turn have an effect on the price of short term credit needed to finance working capital and therefore real economic activity.

The results of the estimated VAR model suggest that a change in the repo rate is found to have a statistically significant influence on the level of short term credit demand but this influence is small in magnitude as shown by the impulse response function. This implies that the central bank has a very limited ability to influence the level of short term borrowing by firms.

The approach adopted in testing the interest rate elasticity of demand for households is based upon a Post-Keynesian view of consumption in that consumers are seen to be influenced more by social factors than seeking to maximise pleasure when making consumption decisions. The study extends the Post-Keynesian framework by considering the role of credit in the consumption process and the implications this may have for the real economy. Results of the household VAR model show that a change in the prime rate of interest by South African banks does not have a statistically significant relationship with household credit and the magnitude of changes in household credit was very small. This implies that changes in the prime rate do not significantly affect household demand for credit. It was also found that both dummy variables did not increase the predictive power of the VAR model and therefore the National Credit Act has not had any statistically significant effect on household credit extension and consumers did not possess exponential income expectations.

A second aim of the study, with reference to households, is to identify if consumption influences the level of household credit demand and lend support to the theoretical proposition of Dutt (2006) that credit spending by households may lead to economic growth in the short term. Results showed that consumption did have a statistically significant relationship with household credit demand and this is taken to imply that increased consumption financed through credit may lead to economic growth, in line with Moore (1988). Another implication of this result is that an increased inability on the part of the

household to access credit may lead to a decrease in consumption spending and in turn leading to real economic consequences.

An underlying assumption of the traditional IS/LM model is that credit markets are perfect, and by implication bank and non-bank sources of finance are perfect substitutes. This assumption was challenged and it was argued that credit markets do not operate under conditions of perfect information implying that bank and non-bank sources of finance are not perfect substitutes and that there is a difference in financing costs between these two sources of finance. One effect of asymmetric information is to drive a wedge between the cost of external versus the use of internal funds which results in the emergence of a credit hierarchy in which credit will flow to relatively large firms, as opposed to relatively small firms, after an adverse economic shock. This is because larger firms are seen as less of a credit risk due to a lower probability of default. A mix variable was used to determine the extent of movements between bank and non-bank sources of financing. If the mix variable decreases following a monetary policy shock it is taken as evidence of a balance sheet channel of monetary policy transmission.

There was mixed evidence of a balance sheet channel of policy transmission. The mix variable was shown to increase following a monetary policy contraction which is not in line with expectations and provides evidence against a balance sheet channel of policy transmission. Due to the way in which the mix variable was defined, however, the variable showed very indirect evidence of a balance sheet channel of policy transmission. The significant influence of the repo rate, as well as insignificant influence of short term bank lending, coupled with the different changes in the magnitude of each variable is interpreted as a movement into non-bank sources of finance.

Areas for further research might include the use of disaggregated data to determine the existence of a balance sheet channel of policy transmission in South Africa, as well as the different elasticities of credit demand between small and large firms.

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APPENDIX 1

CALCULATION OF VARIABLES

Firm variables

Credit (Monthly data):- current prices not seasonally adjusted

= SA bank assets: advances to the private sector less

SA bank mortgage advances less

SA bank investment advances

Then seasonally adjust and convert to logarithmic form

Wage bill (Quarterly data):- Current prices, not seasonally adjusted

SA wages (Methodology break at Q3 2009)

Then seasonally adjust current data

Quarterly data was converted to monthly data

Then converted to logarithmic form

Producer Price Index (Quarterly):- Price index (2000=100), seasonally adjusted

Converted to monthly data

Stockbuilding Variable (Quarterly Data):- Current price, seasonally adjusted

Change in Inventories is converted to monthly data

RT (Monthly):-

= 3month Treasury Bill rate less Prime Lending Rate by SA banks

Interest Rate: South African Reserve Bank discount rate

MIX = SA bank lending to private sector less

SA bank mortgage advances less

SA bank investment advances

(divided by)

Total short term domestic credit

Extension by all SA Monetary Institutions

The log of the mix variable (LMIX)is calculated as the ratio of the log of each individual variable and not the log of the mix ratio.

Where

Total Domestic credit extension by all SA monetary institutions

= discount bills + leasing finance + other loans + total loans and advances

Household Variables

Income Variable (Quarterly) :- current prices not seasonally adjusted

= Household disposable income

seasonally adjusted and then converted to monthly frequency.

The monthly variables were then convert to logarithmic form

Credit (Quarterly):- current prices not seasonally adjusted

=Lending by all monetary institutions to the South African household sector

Seasonally adjusted and converted to monthly frequency

Convert to logarithmic form

Consumption (Quarterly):- current price not seasonally adjusted

= Consumption of non-durable goods plus consumption of servives

Seasonally adjusted and converted to monthly frequency

Convert to logarithmic form

Interest Rate (Monthly):- Prime lending rate charged by South African Banks

APPENDIX 2

UNIT ROOT TEST RESULTS

Firm - ADF test

Null Hypothesis: series contains a unit root

	LTL	LWB	S	PPI	RT	DR	LMIX
Level							
Intercept	0.1836	0.9516	0.4792	0.9977	0.3754	0.9091	0.1849
Trend and Intercept	0.4674	0.7558	0.7682	0.9635	0.1350	0.2031	0.4232
None	0.7265	0.9999	0.1200	0.9991	0.4338	0.2553	0.5780
1st Diff.							
Intercept	0.0001*	0.0015*	0.1851	0.0073*	0*	0.0009*	0.0001*
Trend and Intercept	0.0008*	0.0085*	0.4531	0.0137**	0.0003*	0.0053*	0.0007*
None	0*	0.0227*	0.0313**	0.0849***	0*	0.0001*	0*
2nd Diff.							
Intercept			0*				
Trend and Intercept			0*				
None			0*				

*Where significance levels are * at 1%, ** at 5%, *** at 10%*

Firm – KPSS test

Null: Series is stationary

	LTL	LWB	S	PPI	RT	DR	LMIX
Level							
Intercept	0.623272**	1.719138*	0.261012	1.675759*	0.942710*	1.248978*	0.728621**
Trend and Intercept	0.107201	0.273379*	0.184877**	0.300463*	0.099025	0.120479***	0.108982
1st Diff.							
Intercept	0.053153	0.078387	0.323646	0.272363	0.5**	0.085084	0.053238
Trend and Intercept	0.053231	0.071143	0.143594***	0.042952	0.5*	0.060854	0.051357
2nd Diff							
Intercept			0.106887		0.139467		
Trend and Intercept			0.073584		0.092146		

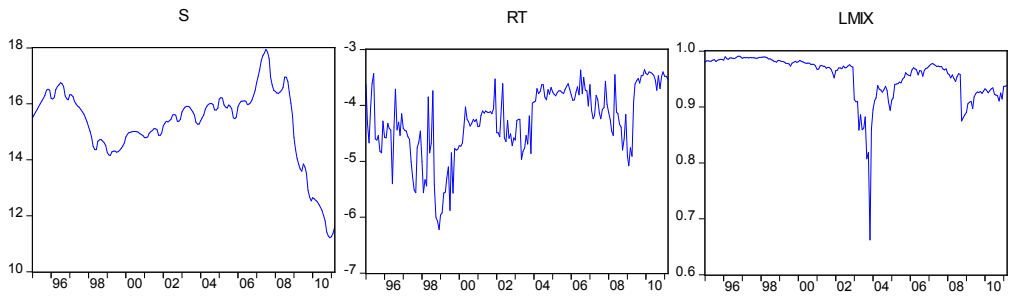
*Where significance levels are * at 1%, ** at 5%, *** at 10%*

Additional ADF test for S when automatically minimizing the Schwartz criterion

	Level	1st Diff
Intercept	0.9986	0*
Trend and Intercept	0.9994	0*
None	0.1200	0*

When the Schwartz criterion is minimized the S variable is shown to be first difference stationary.

Graphical representation of the S, RT and MIX series



Households - ADF test

Null Hypothesis: Series contains a unit root

	LCREDIT	LCONS	LINC	PR
Intercept	0.9855	0.4579	0.7330	0.8879
Trend and Intercept	0.9738	0.2915	0.9991	0.2715
None	0.9680	0.9999	1	0.2791
1st Diff.				
Intercept	0.2920	0.0380**	0.0003*	0.0013*
Trend and Intercept	0.6053	0.1165	0.0009*	0.0079*
None	0.0224**	0.0432**	0.0290**	0.0001*
2nd Diff.				
Intercept	0*	0*		
Trend and Intercept	0*	0*		
None	0*	0*		

*Where significance levels are * at 1%, ** at 5%, *** at 10%*

Household – KPSS test

Null: Series is stationary

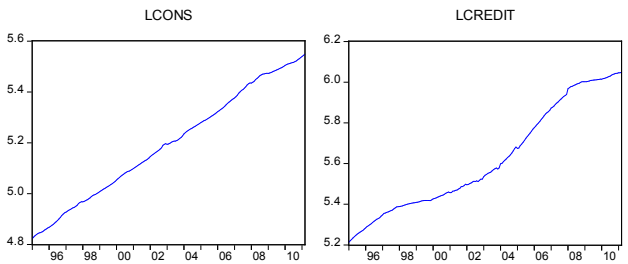
	LCREDIT	LCONS	LINC	PR
Level				
Intercept	1.683561*	1.728848*	1.734396*	1.214028*
Trend and Intercept	0.339480*	0.080744	0.139807***	0.118946
1st Diff.				
Intercept	0.259997	0.143910	0.270956	0.084545
Trend and Intercept	0.227876*	0.073928	0.106880	0.061659
2nd Diff.				
Intercept	0.122982			
Trend and Intercept	0.121118***			

*Where significance levels are * at 1%, ** at 5%, *** at 10%*

ADF test for LCONS and LCREDIT series with a minimized Schwarz criterion

	LCONS	LCREDIT
Level		
Intercept	0.4579	0.9855
Trend and Intercept	0.9707	0.9738
None	1	1
1st Diff.		
Intercept	0*	0*
Trend and Intercept	0*	0*
None	0.0173**	0*

Graphical results of LCREDIT and LCONS series



APPENDIX 3

LAG LENGTH SELECTION CRITERIA AND VAR RESULTS- FIRMS

Lag length selection criteria

VAR Lag Order Selection Criteria
Endogenous variables: D(LTL) D(LWB) D(S) D(PPI) D(RT) D(DR) D(LMIX)
Exogenous variables: C
Date: 12/28/11 Time: 11:43
Sample: 1995M01 2011M03
Included observations: 184

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1097.963	NA	1.67e-14	-11.85829	-11.73598	-11.80872
1	1245.393	282.0413	5.73e-15	-12.92819	-11.94973*	-12.53161*
2	1274.490	53.44941	7.13e-15	-12.71185	-10.87724	-11.96826
3	1342.941	120.5331	5.80e-15	-12.92327	-10.23251	-11.83267
4	1412.453	117.1126	4.69e-15*	-13.14623	-9.599314	-11.70862
5	1453.784	66.48991	5.19e-15	-13.06287	-8.659810	-11.27826
6	1500.934	72.26125	5.43e-15	-13.04276	-7.783541	-10.91113
7	1561.414	88.09084	4.97e-15	-13.16754	-7.052175	-10.68891
8	1612.172	70.06790*	5.13e-15	-13.18665*	-6.215131	-10.36101
9	1647.850	46.53673	6.32e-15	-13.04185	-5.214177	-9.869195
10	1700.572	64.75616	6.59e-15	-13.08230	-4.398480	-9.562640

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

LM test for serial correlation in a VAR model with a lag length of 1

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order
Sample: 1995M01 2011M03
Included observations: 193

Lags	LM-Stat	Prob

1	55.70665	0.2372
2	65.96120	0.0533
3	155.3667	0.0000
4	52.51962	0.3393
5	62.81197	0.0888
6	64.35265	0.0696
7	57.50729	0.1893
8	69.16497	0.0304
9	40.95007	0.7864
10	56.66312	0.2108
11	61.10496	0.1149
12	79.66149	0.0037

Probs from chi-square with 49 df.

The results show that there is serial correlation in the residuals up lag lengths 2, 3, 5, 6, 8 and 12 with the LM test being significant at the 1% level for 2 of these lag lengths.

LM test for serial correlation in a VAR model with a lag length of 8

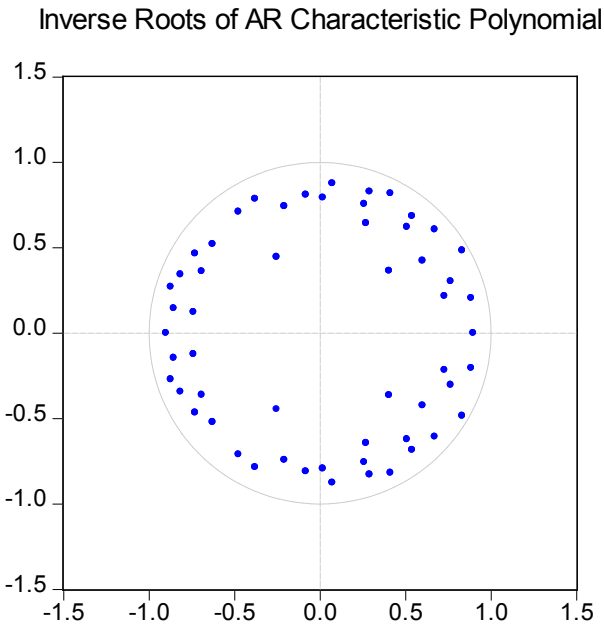
VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 12/28/11 Time: 11:46
Sample: 1995M01 2011M03
Included observations: 186

Lags	LM-Stat	Prob
1	43.73375	0.6859
2	56.17467	0.2240
3	50.02472	0.4325
4	62.14376	0.0984
5	71.90455	0.0182
6	85.06963	0.0011
7	69.58462	0.0281
8	48.40925	0.4970
9	70.57342	0.0234
10	49.64502	0.4474
11	41.58138	0.7651
12	44.00338	0.6754

Probs from chi-square with 49 df.

The LM test shows that there is serial correlation up to lag lengths 4, 5, 6, 7 and 9 with only 1 of these lags being significant at the 1% level. This is the chosen lag length.

AR unit roots graph for VAR at lag length of 8



No unit root lies outside the unit circle

Vector autoregressive estimates for firms

Vector Autoregression Estimates
Date: 12/28/11 Time: 11:48
Sample (adjusted): 1995M10 2011M03
Included observations: 186 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(LTL)	D(LWB)	D(S)	D(PPI)	D(RT)	D(DR)	D(LMIX)
D(LTL(-1))	0.213030	0.022206	0.905911	5.175908	-2.737830	1.471279	0.084287
	(0.55321)	(0.02607)	(0.50442)	(4.63972)	(1.54701)	(2.38156)	(0.09900)
	[0.38508]	[0.85181]	[1.79595]	[1.11556]	[-1.76976]	[0.61778]	[0.85142]
D(LTL(-2))	-0.563663	-0.050023	1.217678	7.064523	-0.841519	-0.893416	-0.084071
	(0.57604)	(0.02714)	(0.52524)	(4.83121)	(1.61085)	(2.47985)	(0.10308)
	[-0.97852]	[-1.84282]	[2.31835]	[1.46227]	[-0.52241]	[-0.36027]	[-0.81558]
D(LTL(-3))	0.604161	0.009558	0.414362	2.643167	-1.511237	2.823396	0.125456
	(0.58248)	(0.02745)	(0.53111)	(4.88523)	(1.62887)	(2.50758)	(0.10423)
	[1.03722]	[0.34823]	[0.78018]	[0.54105]	[-0.92778]	[1.12595]	[1.20359]
D(LTL(-4))	0.022366	-0.037284	-0.153037	5.483840	1.129904	2.764224	0.001132

	(0.56149)	(0.02646)	(0.51198)	(4.70924)	(1.57019)	(2.41724)	(0.10048)
	[0.03983]	[-1.40908]	[-0.29892]	[1.16448]	[0.71960]	[1.14355]	[0.01127]
D(LTL(-5))	-1.131518	0.005048	0.883046	6.153731	-1.923863	2.388442	-0.157780
	(0.55105)	(0.02597)	(0.50245)	(4.62161)	(1.54097)	(2.37226)	(0.09861)
	[-2.05340]	[0.19440]	[1.75749]	[1.33151]	[-1.24848]	[1.00682]	[-1.60005]
D(LTL(-6))	0.649098	-0.012786	1.344400	7.755459	-2.732803	1.385549	0.121924
	(0.55942)	(0.02636)	(0.51008)	(4.69181)	(1.56438)	(2.40829)	(0.10011)
	[1.16031]	[-0.48504]	[2.63566]	[1.65298]	[-1.74690]	[0.57532]	[1.21793]
D(LTL(-7))	0.596732	-0.003594	2.204107	11.66827	0.740291	4.297049	0.146763
	(0.57941)	(0.02730)	(0.52831)	(4.85948)	(1.62028)	(2.49436)	(0.10369)
	[1.02990]	[-0.13164]	[4.17200]	[2.40114]	[0.45689]	[1.72271]	[1.41547]
D(LTL(-8))	0.804135	0.006763	0.031104	1.883857	-0.624970	0.659891	0.198022
	(0.58710)	(0.02767)	(0.53533)	(4.92403)	(1.64180)	(2.52749)	(0.10506)
	[1.36966]	[0.24446]	[0.05810]	[0.38258]	[-0.38066]	[0.26109]	[1.88481]
D(LWB(-1))	2.316019	0.954900	1.730705	27.81716	-0.958001	10.80141	0.415587
	(1.83732)	(0.08658)	(1.67528)	(15.4095)	(5.13796)	(7.90968)	(0.32879)
	[1.26054]	[11.0289]	[1.03308]	[1.80519]	[-0.18646]	[1.36559]	[1.26400]
D(LWB(-2))	-2.846661	0.013648	0.742702	-12.25132	3.443419	-3.061875	-0.557520
	(2.33141)	(0.10986)	(2.12580)	(19.5535)	(6.51965)	(10.0367)	(0.41721)
	[-1.22101]	[0.12423]	[0.34938]	[-0.62656]	[0.52816]	[-0.30507]	[-1.33632]
D(LWB(-3))	0.113276	-1.187201	-3.273412	3.119543	3.708262	5.764199	0.115265
	(2.06190)	(0.09716)	(1.88006)	(17.2931)	(5.76599)	(8.87651)	(0.36898)
	[0.05494]	[-12.2185]	[-1.74112]	[0.18039]	[0.64313]	[0.64938]	[0.31239]
D(LWB(-4))	4.090247	1.065885	2.247458	34.71093	-3.881767	7.709301	0.707054
	(3.04058)	(0.14328)	(2.77243)	(25.5013)	(8.50281)	(13.0897)	(0.54411)
	[1.34522]	[7.43900]	[0.81065]	[1.36114]	[-0.45653]	[0.58896]	[1.29946]
D(LWB(-5))	-3.866601	-0.101275	2.688172	-31.61895	1.115946	-11.10317	-0.746078
	(2.97081)	(0.14000)	(2.70881)	(24.9161)	(8.30770)	(12.7894)	(0.53163)
	[-1.30153]	[-0.72341]	[0.99238]	[-1.26902]	[0.13433]	[-0.86816]	[-1.40339]
D(LWB(-6))	-0.592213	-0.598350	-0.349862	-0.415645	2.024078	9.048804	-0.026944
	(2.07288)	(0.09768)	(1.89007)	(17.3852)	(5.79670)	(8.92378)	(0.37094)
	[-0.28570]	[-6.12550]	[-0.18510]	[-0.02391]	[0.34918]	[1.01401]	[-0.07264]

D(LWB(-7))	1.782083	0.489437	-1.010693	23.66849	5.640872	-0.334075	0.267522
	(2.32994)	(0.10980)	(2.12447)	(19.5412)	(6.51556)	(10.0304)	(0.41694)
	[0.76486]	[4.45771]	[-0.47574]	[1.21121]	[0.86575]	[-0.03331]	[0.64163]
D(LWB(-8))	-3.070547	-0.161652	2.238616	-22.11751	-0.170287	-1.899377	-0.498611
	(1.82398)	(0.08595)	(1.66312)	(15.2977)	(5.10065)	(7.85224)	(0.32640)
	[-1.68344]	[-1.88072]	[1.34604]	[-1.44581]	[-0.03339]	[-0.24189]	[-1.52760]
D(S(-1))	0.147870	0.002672	0.705591	0.841302	-0.221188	0.027507	0.025488
	(0.09687)	(0.00456)	(0.08832)	(0.81242)	(0.27088)	(0.41701)	(0.01733)
	[1.52653]	[0.58537]	[7.98866]	[1.03555]	[-0.81655]	[0.06596]	[1.47037]
D(S(-2))	-0.133192	0.001386	0.174194	-2.008076	-0.059287	-0.396920	-0.017984
	(0.11319)	(0.00533)	(0.10321)	(0.94934)	(0.31654)	(0.48729)	(0.02026)
	[-1.17669]	[0.25976]	[1.68776]	[-2.11523]	[-0.18730]	[-0.81454]	[-0.88786]
D(S(-3))	-0.047532	-0.003607	-0.645148	0.184879	0.265940	-0.117168	-0.010540
	(0.10948)	(0.00516)	(0.09982)	(0.91820)	(0.30615)	(0.47131)	(0.01959)
	[-0.43417]	[-0.69908]	[-6.46287]	[0.20135]	[0.86865]	[-0.24860]	[-0.53801]
D(S(-4))	0.174188	-0.000268	0.522918	1.782948	-0.353737	0.526797	0.027142
	(0.12652)	(0.00596)	(0.11536)	(1.06111)	(0.35380)	(0.54466)	(0.02264)
	[1.37678]	[-0.04497]	[4.53289]	[1.68027]	[-0.99981]	[0.96720]	[1.19881]
D(S(-5))	-0.130129	0.000845	0.005935	-1.853341	0.443002	-0.571841	-0.024491
	(0.12224)	(0.00576)	(0.11146)	(1.02519)	(0.34183)	(0.52623)	(0.02187)
	[-1.06457]	[0.14668]	[0.05325]	[-1.80780]	[1.29599]	[-1.08668]	[-1.11961]
D(S(-6))	-0.015737	0.002676	-0.435601	0.028592	0.160950	0.205798	-0.004817
	(0.10625)	(0.00501)	(0.09688)	(0.89114)	(0.29713)	(0.45742)	(0.01901)
	[-0.14811]	[0.53439]	[-4.49617]	[0.03208]	[0.54168]	[0.44991]	[-0.25333]
D(S(-7))	0.009101	-0.001296	0.340301	0.628996	-1.002065	0.494901	0.002418
	(0.11331)	(0.00534)	(0.10332)	(0.95033)	(0.31687)	(0.48780)	(0.02028)
	[0.08032]	[-0.24277]	[3.29375]	[0.66187]	[-3.16243]	[1.01456]	[0.11926]
D(S(-8))	-0.009769	-0.000471	-0.004786	-0.842963	0.655668	-0.379129	-0.001199
	(0.09466)	(0.00446)	(0.08632)	(0.79395)	(0.26472)	(0.40753)	(0.01694)
	[-0.10319]	[-0.10557]	[-0.05544]	[-1.06173]	[2.47679]	[-0.93030]	[-0.07080]
D(PPI(-1))	0.004706	9.08E-05	0.017647	0.296349	0.025115	0.007346	0.000542
	(0.01032)	(0.00049)	(0.00941)	(0.08652)	(0.02885)	(0.04441)	(0.00185)
	[0.45620]	[0.18676]	[1.87606]	[3.42505]	[0.87056]	[0.16541]	[0.29385]

D(PPI(-2))	-0.006845	0.000123	0.010805	0.120909	-0.015167	0.036858	-0.001218
	(0.01087)	(0.00051)	(0.00991)	(0.09118)	(0.03040)	(0.04680)	(0.00195)
	[-0.62956]	[0.23924]	[1.08993]	[1.32600]	[-0.49885]	[0.78750]	[-0.62615]
D(PPI(-3))	0.001876	-0.000410	-0.010881	-0.001419	-0.000420	0.029013	0.000523
	(0.01096)	(0.00052)	(0.00999)	(0.09193)	(0.03065)	(0.04719)	(0.00196)
	[0.17111]	[-0.79377]	[-1.08866]	[-0.01544]	[-0.01369]	[0.61483]	[0.26662]
D(PPI(-4))	-0.003263	0.000612	0.010280	-0.029138	0.009129	0.012135	-0.001053
	(0.01065)	(0.00050)	(0.00971)	(0.08929)	(0.02977)	(0.04583)	(0.00191)
	[-0.30654]	[1.21942]	[1.05895]	[-0.32633]	[0.30663]	[0.26477]	[-0.55254]
D(PPI(-5))	-0.021608	7.22E-05	-0.000479	0.083456	-0.008951	0.049049	-0.003739
	(0.01096)	(0.00052)	(0.00999)	(0.09193)	(0.03065)	(0.04719)	(0.00196)
	[-1.97125]	[0.13984]	[-0.04795]	[0.90778]	[-0.29202]	[1.03941]	[-1.90628]
D(PPI(-6))	0.010516	-3.50E-05	-0.016623	-0.009450	-0.036308	0.037573	0.002006
	(0.01110)	(0.00052)	(0.01012)	(0.09310)	(0.03104)	(0.04779)	(0.00199)
	[0.94731]	[-0.06688]	[-1.64236]	[-0.10151]	[-1.16963]	[0.78624]	[1.00970]
D(PPI(-7))	0.001916	-0.000137	-0.001274	0.018432	0.030895	-0.067098	0.000615
	(0.01158)	(0.00055)	(0.01056)	(0.09716)	(0.03239)	(0.04987)	(0.00207)
	[0.16540]	[-0.25064]	[-0.12057]	[0.18972]	[0.95369]	[-1.34544]	[0.29654]
D(PPI(-8))	-0.008144	0.000361	-0.014027	-0.168533	-0.075270	0.029626	-0.001471
	(0.01127)	(0.00053)	(0.01027)	(0.09450)	(0.03151)	(0.04851)	(0.00202)
	[-0.72283]	[0.67962]	[-1.36534]	[-1.78344]	[-2.38889]	[0.61077]	[-0.72940]
D(RT(-1))	-0.028279	0.001117	-0.002496	-0.037555	-0.581789	0.414795	-0.004912
	(0.03076)	(0.00145)	(0.02805)	(0.25799)	(0.08602)	(0.13242)	(0.00550)
	[-0.91931]	[0.77039]	[-0.08900]	[-0.14557]	[-6.76339]	[3.13230]	[-0.89238]
D(RT(-2))	-0.039649	0.003184	0.050830	0.189251	-0.557458	0.151525	-0.006148
	(0.03633)	(0.00171)	(0.03313)	(0.30473)	(0.10161)	(0.15642)	(0.00650)
	[-1.09125]	[1.85940]	[1.53429]	[0.62104]	[-5.48648]	[0.96872]	[-0.94559]
D(RT(-3))	-0.032328	0.001214	0.001978	-0.160823	-0.439464	-0.017288	-0.005781
	(0.03857)	(0.00182)	(0.03517)	(0.32346)	(0.10785)	(0.16603)	(0.00690)
	[-0.83824]	[0.66795]	[0.05625]	[-0.49720]	[-4.07480]	[-0.10413]	[-0.83771]
D(RT(-4))	0.006340	-0.003620	-0.013498	-0.242600	-0.507054	0.079974	0.001499
	(0.03759)	(0.00177)	(0.03428)	(0.31528)	(0.10512)	(0.16183)	(0.00673)

	[0.16866]	[-2.04365]	[-0.39380]	[-0.76947]	[-4.82342]	[0.49417]	[0.22289]
D(RT(-5))	0.006786	-0.000242	0.001608	-0.046580	-0.334530	0.056126	0.000841
	(0.03705)	(0.00175)	(0.03378)	(0.31071)	(0.10360)	(0.15949)	(0.00663)
	[0.18318]	[-0.13873]	[0.04759]	[-0.14991]	[-3.22910]	[0.35192]	[0.12687]
D(RT(-6))	-0.003332	-0.000374	0.025535	0.121677	-0.220713	-0.003926	0.000377
	(0.03612)	(0.00170)	(0.03294)	(0.30295)	(0.10101)	(0.15550)	(0.00646)
	[-0.09225]	[-0.21996]	[0.77531]	[0.40164]	[-2.18503]	[-0.02525]	[0.05826]
D(RT(-7))	0.003040	-0.000709	0.008417	0.128417	-0.081839	0.247517	0.000109
	(0.03274)	(0.00154)	(0.02985)	(0.27458)	(0.09155)	(0.14094)	(0.00586)
	[0.09286]	[-0.45941]	[0.28197]	[0.46769]	[-0.89391]	[1.75619]	[0.01853]
D(RT(-8))	-0.021085	-0.002347	0.004993	0.426650	0.070992	0.060074	-0.003138
	(0.02749)	(0.00130)	(0.02506)	(0.23054)	(0.07687)	(0.11833)	(0.00492)
	[-0.76706]	[-1.81217]	[0.19920]	[1.85067]	[0.92356]	[0.50766]	[-0.63794]
D(DR(-1))	0.052274	-0.000653	0.025178	-0.006511	0.034113	0.254014	0.008770
	(0.02044)	(0.00096)	(0.01864)	(0.17141)	(0.05715)	(0.08799)	(0.00366)
	[2.55772]	[-0.67753]	[1.35107]	[-0.03798]	[0.59687]	[2.88701]	[2.39793]
D(DR(-2))	-0.020616	-0.000168	-0.028957	0.078786	-0.004591	0.148832	-0.003975
	(0.02141)	(0.00101)	(0.01952)	(0.17953)	(0.05986)	(0.09215)	(0.00383)
	[-0.96310]	[-0.16619]	[-1.48359]	[0.43884]	[-0.07670]	[1.61504]	[-1.03771]
D(DR(-3))	-0.003149	0.000894	-0.002526	0.145487	0.055045	0.072805	-0.000482
	(0.02157)	(0.00102)	(0.01967)	(0.18095)	(0.06033)	(0.09288)	(0.00386)
	[-0.14596]	[0.87961]	[-0.12842]	[0.80402]	[0.91236]	[0.78386]	[-0.12489]
D(DR(-4))	-0.031113	0.002212	-0.014903	-0.087934	-0.199007	-0.074666	-0.005620
	(0.02141)	(0.00101)	(0.01952)	(0.17954)	(0.05986)	(0.09216)	(0.00383)
	[-1.45343]	[2.19323]	[-0.76353]	[-0.48977]	[-3.32436]	[-0.81021]	[-1.46695]
D(DR(-5))	0.030503	-0.001447	-0.010578	-0.290438	-0.071648	0.002865	0.005500
	(0.02228)	(0.00105)	(0.02031)	(0.18684)	(0.06230)	(0.09591)	(0.00399)
	[1.36922]	[-1.37845]	[-0.52076]	[-1.55444]	[-1.15007]	[0.02987]	[1.37970]
D(DR(-6))	-0.020078	0.000857	-0.000471	0.071599	-0.168813	-0.051412	-0.003736
	(0.02282)	(0.00108)	(0.02081)	(0.19139)	(0.06381)	(0.09824)	(0.00408)
	[-0.87984]	[0.79737]	[-0.02263]	[0.37410]	[-2.64536]	[-0.52332]	[-0.91490]
D(DR(-7))	-0.038777	0.001210	-0.003119	-0.003502	-0.078031	-0.077137	-0.007405

	(0.02272)	(0.00107)	(0.02072)	(0.19056)	(0.06354)	(0.09781)	(0.00407)
	[-1.70669]	[1.13005]	[-0.15054]	[-0.01838]	[-1.22812]	[-0.78862]	[-1.82135]
D(DR(-8))	0.008035	-0.002401	-0.001010	-0.046319	-0.104431	0.048748	0.001578
	(0.02255)	(0.00106)	(0.02057)	(0.18916)	(0.06307)	(0.09710)	(0.00404)
	[0.35624]	[-2.25930]	[-0.04910]	[-0.24486]	[-1.65573]	[0.50205]	[0.39095]
D(LMIX(-1))	-3.135004	-0.137652	-4.884474	-28.09254	13.41270	-7.865386	-0.791975
	(3.08385)	(0.14532)	(2.81189)	(25.8642)	(8.62382)	(13.2760)	(0.55186)
	[-1.01659]	[-0.94721]	[-1.73708]	[-1.08616]	[1.55531]	[-0.59245]	[-1.43511]
D(LMIX(-2))	2.869708	0.252776	-6.408977	-41.63314	3.606420	6.689012	0.432593
	(3.18787)	(0.15022)	(2.90673)	(26.7366)	(8.91470)	(13.7238)	(0.57047)
	[0.90020]	[1.68266]	[-2.20487]	[-1.55716]	[0.40455]	[0.48740]	[0.75831]
D(LMIX(-3))	-4.502750	-0.056139	-1.283034	-17.36749	8.996665	-16.35750	-0.897765
	(3.20004)	(0.15080)	(2.91783)	(26.8387)	(8.94874)	(13.7762)	(0.57265)
	[-1.40709]	[-0.37228]	[-0.43972]	[-0.64711]	[1.00536]	[-1.18737]	[-1.56774]
D(LMIX(-4))	-0.762175	0.225054	1.422245	-30.59378	-6.893729	-13.75954	-0.128527
	(3.09833)	(0.14601)	(2.82509)	(25.9857)	(8.66432)	(13.3384)	(0.55445)
	[-0.24600]	[1.54141]	[0.50343]	[-1.17733]	[-0.79565]	[-1.03158]	[-0.23181]
D(LMIX(-5))	6.386108	-0.052941	-5.263649	-31.79239	11.98071	-9.860644	0.892098
	(3.04263)	(0.14338)	(2.77430)	(25.5185)	(8.50856)	(13.0986)	(0.54448)
	[2.09888]	[-0.36924]	[-1.89729]	[-1.24586]	[1.40808]	[-0.75280]	[1.63844]
D(LMIX(-6))	-3.796642	0.071602	-7.071338	-37.75874	16.03064	-5.410720	-0.726724
	(3.08496)	(0.14537)	(2.81290)	(25.8735)	(8.62693)	(13.2808)	(0.55205)
	[-1.23069]	[0.49253]	[-2.51390]	[-1.45936]	[1.85821]	[-0.40741]	[-1.31640]
D(LMIX(-7))	-3.051331	0.027570	-12.06891	-63.03295	-4.366639	-23.26864	-0.767621
	(3.19593)	(0.15060)	(2.91408)	(26.8042)	(8.93725)	(13.7585)	(0.57191)
	[-0.95475]	[0.18306]	[-4.14158]	[-2.35160]	[-0.48859]	[-1.69122]	[-1.34220]
D(LMIX(-8))	-3.923199	-0.007466	-0.387583	-8.274957	2.247490	-2.075107	-1.005614
	(3.27321)	(0.15425)	(2.98454)	(27.4523)	(9.15335)	(14.0912)	(0.58574)
	[-1.19858]	[-0.04840]	[-0.12986]	[-0.30143]	[0.24554]	[-0.14726]	[-1.71682]
C	0.016827	0.002237	-0.057683	0.051663	0.011071	-0.241506	0.001120
	(0.02134)	(0.00101)	(0.01946)	(0.17900)	(0.05968)	(0.09188)	(0.00382)
	[0.78842]	[2.22443]	[-2.96416]	[0.28862]	[0.18550]	[-2.62850]	[0.29316]
R-squared	0.415746	0.750560	0.749277	0.382331	0.527305	0.414860	0.415121

Adj. R-squared	0.162117	0.642276	0.640437	0.114196	0.322104	0.160845	0.161220
Sum sq. resids	1.678420	0.003727	1.395434	118.0625	13.12542	31.10641	0.053748
S.E. equation	0.114066	0.005375	0.104006	0.956668	0.318979	0.491055	0.020412
F-statistic	1.639188	6.931396	6.884160	1.425890	2.569701	1.633212	1.634972
Log likelihood	173.9115	742.1376	191.0838	-221.6511	-17.36137	-97.60762	493.9521
Akaike AIC	-1.257113	-7.367071	-1.441761	2.996248	0.799585	1.662448	-4.698409
Schwarz SC	-0.268578	-6.378536	-0.453226	3.984783	1.788120	2.650983	-3.709874
Mean dependent	0.002578	0.004330	-0.025368	0.535971	0.005430	-0.051075	-0.000241
S.D. dependent	0.124613	0.008987	0.173449	1.016465	0.387418	0.536055	0.022288

Determinant resid covariance (dof adj.)	7.36E-16
Determinant resid covariance	5.68E-17
Log likelihood	1631.344
Akaike information criterion	-13.25101
Schwarz criterion	-6.331259

APPENDIX 4

LAG LENGTH SELECTION CRITERIA AND VAR RESULTS-HOUSEHOLDS

Lag length selection criteria

VAR Lag Order Selection Criteria

Endogenous variables: D(LCREDIT) D(LCONS) D(LINC) D(PR)

Exogenous variables: C

Date: 01/25/12 Time: 13:41

Sample: 1995M01 2011M03

Included observations: 180

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2173.649	NA	3.99e-16	-24.10722	-24.03626	-24.07845
1	2264.732	177.1052	1.73e-16	-24.94147	-24.58669	-24.79762
2	2277.298	23.87552	1.80e-16	-24.90331	-24.26472	-24.64439
3	2361.834	156.8617	8.40e-17	-25.66483	-24.74242*	-25.29083
4	2395.136	60.31326	6.94e-17	-25.85707	-24.65084	-25.36800*
5	2406.534	20.13542	7.32e-17	-25.80593	-24.31588	-25.20178
6	2442.941	62.70217	5.85e-17	-26.03268	-24.25882	-25.31346
7	2464.975	36.96790	5.50e-17	-26.09972	-24.04204	-25.26542
8	2477.553	20.54403	5.74e-17	-26.06170	-23.72020	-25.11232
9	2498.628	33.48495	5.46e-17	-26.11808	-23.49276	-25.05363
10	2518.768	31.10510	5.26e-17	-26.16408	-23.25495	-24.98455
11	2532.239	20.20662	5.47e-17	-26.13599	-22.94303	-24.84138
12	2570.487	55.67254	4.33e-17	-26.38319	-22.90641	-24.97351
13	2591.748	30.00106*	4.15e-17*	-26.44164*	-22.68105	-24.91688
14	2604.870	17.93343	4.36e-17	-26.40966	-22.36525	-24.76983

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

LM test for serial correlation in with a lag length of 3

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Sample: 1995M01 2011M03
Included observations: 191

Lags	LM-Stat	Prob
1	60.19555	0.0000
2	21.07398	0.1757
3	107.7444	0.0000
4	39.12040	0.0010
5	25.12952	0.0676
6	28.13785	0.0304
7	30.15850	0.0172
8	28.35068	0.0287
9	27.04229	0.0410
10	14.56924	0.5564
11	7.883526	0.9523
12	32.92492	0.0076

Probs from chi-square with 16 df.

The LM test shows autocorrelation at lags 1,3,4,5, 6,7,8,9 and 12 with 4 of these lags significant at the 1% level of significance.

LM test for serial correlation with a lag length of 4

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Sample: 1995M01 2011M03
Included observations: 190

Lags	LM-Stat	Prob
1	21.47480	0.1610
2	25.02487	0.0694
3	84.40835	0.0000
4	28.95875	0.0242
5	19.61454	0.2381

6	66.19237	0.0000
7	14.88115	0.5334
8	20.96959	0.1797
9	29.34693	0.0217
10	9.088687	0.9097
11	6.217941	0.9856
12	30.99129	0.0135

Probs from chi-square with 16 df.

Results show that there is serial correlation at lags 2, 3,4,6,9 and 12 with 2 lags being significant at the 1 % level of significance.

LM test for serial correlation with a lag length of 13

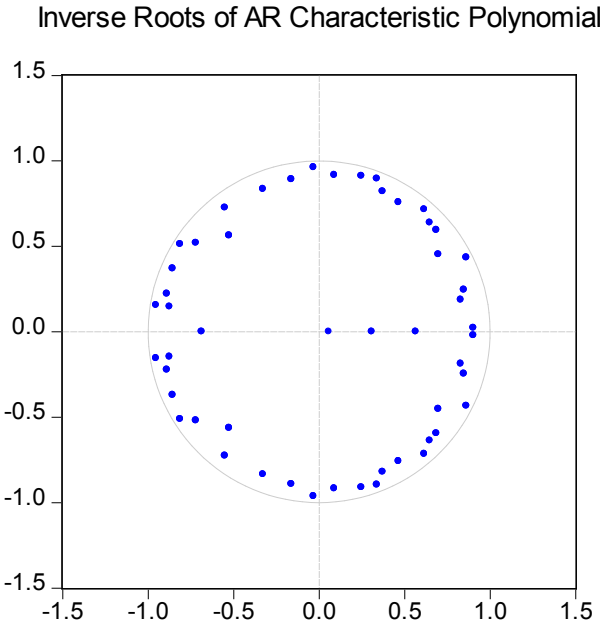
VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Sample: 1995M01 2011M03
Included observations: 181

Lags	LM-Stat	Prob
1	20.09366	0.2160
2	18.63928	0.2878
3	35.57439	0.0033
4	16.69061	0.4059
5	14.00390	0.5984
6	24.86114	0.0723
7	13.98000	0.6002
8	20.19567	0.2115
9	37.40838	0.0018
10	14.19199	0.5844
11	22.03475	0.1421
12	11.52232	0.7762

Probs from chi-square with 16 df.

Results indicate that there is autocorrelation at lags 3, 6 and 9 with 2 of these lags being significant at the 1% level of significance. This is the chosen lag length.

AR unit roots graph at lag length of 13



No unit roots lie outside the unit circle.

Household VAR estimation results

Vector Autoregression Estimates
Date: 01/25/12 Time: 14:04
Sample (adjusted): 1996M03 2011M03
Included observations: 181 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(LCREDIT)	D(LCONS)	D(LINC)	D(PR)
D(LCREDIT(-1))	0.133045	-0.011471	-0.065155	6.215206
	(0.08606)	(0.02529)	(0.08106)	(15.1138)
	[1.54594]	[-0.45348]	[-0.80381]	[0.41123]
D(LCREDIT(-2))	-0.016638	0.006406	0.014862	9.606522
	(0.08222)	(0.02417)	(0.07745)	(14.4402)
	[-0.20235]	[0.26509]	[0.19191]	[0.66526]
D(LCREDIT(-3))	0.193283	0.016595	0.101258	14.64882
	(0.08125)	(0.02388)	(0.07653)	(14.2692)

	[2.37882]	[0.69492]	[1.32315]	[1.02660]
D(LCREDIT(-4))	-0.019188	0.024603	-0.010447	-11.40330
	(0.08327)	(0.02447)	(0.07843)	(14.6234)
	[-0.23044]	[1.00529]	[-0.13320]	[-0.77980]
D(LCREDIT(-5))	0.166523	-0.024631	0.003410	-34.23313
	(0.08166)	(0.02400)	(0.07691)	(14.3407)
	[2.03925]	[-1.02627]	[0.04434]	[-2.38713]
D(LCREDIT(-6))	0.106039	0.054284	-0.081026	3.461561
	(0.08354)	(0.02455)	(0.07868)	(14.6710)
	[1.26932]	[2.21083]	[-1.02978]	[0.23595]
D(LCREDIT(-7))	0.073227	-0.037920	0.098801	-4.252642
	(0.08639)	(0.02539)	(0.08137)	(15.1719)
	[0.84762]	[-1.49341]	[1.21422]	[-0.28030]
D(LCREDIT(-8))	0.143365	0.018188	-0.021090	10.27873
	(0.08705)	(0.02559)	(0.08199)	(15.2883)
	[1.64685]	[0.71085]	[-0.25721]	[0.67233]
D(LCREDIT(-9))	0.240801	0.028220	0.174312	11.46305
	(0.08676)	(0.02550)	(0.08171)	(15.2362)
	[2.77555]	[1.10669]	[2.13318]	[0.75235]
D(LCREDIT(-10))	-0.038788	0.005447	-0.062294	11.96445
	(0.09044)	(0.02658)	(0.08518)	(15.8830)
	[-0.42888]	[0.20491]	[-0.73129]	[0.75329]
D(LCREDIT(-11))	0.029584	-0.020416	0.047855	2.262202
	(0.08646)	(0.02541)	(0.08144)	(15.1846)
	[0.34215]	[-0.80336]	[0.58763]	[0.14898]
D(LCREDIT(-12))	-0.087836	-0.028463	-0.101444	-1.241650
	(0.08418)	(0.02474)	(0.07928)	(14.7831)
	[-1.04347]	[-1.15042]	[-1.27949]	[-0.08399]
D(LCREDIT(-13))	-0.107164	0.030092	0.028031	0.186644

	(0.08169)	(0.02401)	(0.07694)	(14.3459)
	[-1.31186]	[1.25332]	[0.36433]	[0.01301]
D(LCONS(-1))	0.075549	1.034509	0.144477	56.39837
	(0.30382)	(0.08930)	(0.28616)	(53.3560)
	[0.24866]	[11.5851]	[0.50488]	[1.05702]
D(LCONS(-2))	-0.419004	0.108175	0.140476	-89.81285
	(0.41402)	(0.12169)	(0.38995)	(72.7088)
	[-1.01205]	[0.88897]	[0.36024]	[-1.23524]
D(LCONS(-3))	0.615118	-1.329453	0.677388	86.56695
	(0.41622)	(0.12233)	(0.39203)	(73.0965)
	[1.47785]	[-10.8673]	[1.72790]	[1.18428]
D(LCONS(-4))	0.470389	1.278454	-0.150795	30.17890
	(0.58275)	(0.17128)	(0.54887)	(102.341)
	[0.80719]	[7.46421]	[-0.27474]	[0.29489]
D(LCONS(-5))	-0.362904	0.037143	0.017744	-197.6032
	(0.63576)	(0.18686)	(0.59881)	(111.651)
	[-0.57082]	[0.19877]	[0.02963]	[-1.76982]
D(LCONS(-6))	-0.441528	-1.109581	-0.107341	148.1632
	(0.64792)	(0.19043)	(0.61026)	(113.787)
	[-0.68145]	[-5.82660]	[-0.17589]	[1.30212]
D(LCONS(-7))	1.167594	0.941467	0.281979	-26.72895
	(0.69155)	(0.20326)	(0.65135)	(121.448)
	[1.68838]	[4.63193]	[0.43292]	[-0.22009]
D(LCONS(-8))	-0.436724	0.036620	0.125498	-28.30416
	(0.62825)	(0.18465)	(0.59173)	(110.332)
	[-0.69514]	[0.19832]	[0.21209]	[-0.25654]
D(LCONS(-9))	-1.017715	-0.680616	-0.421519	146.8943
	(0.63929)	(0.18790)	(0.60213)	(112.271)
	[-1.59194]	[-3.62227]	[-0.70005]	[1.30839]

D(LCONS(-10))	1.389633	0.473419	0.235754	-70.48053
	(0.58850)	(0.17297)	(0.55429)	(103.352)
	[2.36129]	[2.73700]	[0.42532]	[-0.68195]
D(LCONS(-11))	-0.099312	0.042659	0.275446	-26.92763
	(0.44251)	(0.13006)	(0.41678)	(77.7120)
	[-0.22443]	[0.32800]	[0.66089]	[-0.34651]
D(LCONS(-12))	-1.830543	-0.262504	0.193732	21.00669
	(0.43418)	(0.12761)	(0.40894)	(76.2497)
	[-4.21610]	[-2.05705]	[0.47374]	[0.27550]
D(LCONS(-13))	0.584564	0.097508	-0.432489	-1.693299
	(0.34932)	(0.10267)	(0.32902)	(61.3476)
	[1.67341]	[0.94970]	[-1.31449]	[-0.02760]
D(LINC(-1))	0.111793	-0.023663	0.680038	11.55891
	(0.09056)	(0.02662)	(0.08530)	(15.9044)
	[1.23444]	[-0.88899]	[7.97250]	[0.72678]
D(LINC(-2))	0.022050	0.025178	0.058613	16.27016
	(0.09714)	(0.02855)	(0.09149)	(17.0590)
	[0.22700]	[0.88189]	[0.64065]	[0.95376]
D(LINC(-3))	-0.306863	0.040521	-1.346803	-22.85496
	(0.10055)	(0.02955)	(0.09470)	(17.6575)
	[-3.05198]	[1.37117]	[-14.2217]	[-1.29434]
D(LINC(-4))	0.187673	-0.081980	0.848072	36.97707
	(0.16034)	(0.04713)	(0.15102)	(28.1586)
	[1.17047]	[-1.73957]	[5.61563]	[1.31317]
D(LINC(-5))	-0.004447	0.021069	0.054088	5.073578
	(0.15779)	(0.04638)	(0.14861)	(27.7100)
	[-0.02818]	[0.45430]	[0.36395]	[0.18310]
D(LINC(-6))	-0.162983	0.052852	-1.286726	-20.66717
	(0.16830)	(0.04947)	(0.15852)	(29.5571)
	[-0.96839]	[1.06844]	[-8.11713]	[-0.69923]

D(LINC(-7))	0.140905	-0.067467	0.810199	31.09322
	(0.19430)	(0.05711)	(0.18300)	(34.1221)
	[0.72520]	[-1.18142]	[4.42725]	[0.91123]
D(LINC(-8))	-0.028732	-0.004486	0.011608	-9.273192
	(0.16029)	(0.04711)	(0.15097)	(28.1500)
	[-0.17925]	[-0.09521]	[0.07689]	[-0.32942]
D(LINC(-9))	0.071023	0.042930	-1.001444	-10.58275
	(0.16726)	(0.04916)	(0.15754)	(29.3742)
	[0.42462]	[0.87327]	[-6.35681]	[-0.36027]
D(LINC(-10))	0.111314	-0.036375	0.633384	16.76905
	(0.16673)	(0.04900)	(0.15703)	(29.2799)
	[0.66765]	[-0.74230]	[4.03343]	[0.57272]
D(LINC(-11))	-0.059449	-0.004600	-0.015662	-9.626781
	(0.09894)	(0.02908)	(0.09319)	(17.3758)
	[-0.60086]	[-0.15817]	[-0.16806]	[-0.55403]
D(LINC(-12))	0.137611	0.006638	-0.548426	0.317439
	(0.09982)	(0.02934)	(0.09402)	(17.5309)
	[1.37853]	[0.22625]	[-5.83298]	[0.01811]
D(LINC(-13))	0.035270	0.004896	0.349764	10.68735
	(0.09101)	(0.02675)	(0.08572)	(15.9823)
	[0.38756]	[0.18304]	[4.08050]	[0.66870]
D(PR(-1))	0.000558	0.000203	-0.000112	0.209191
	(0.00051)	(0.00015)	(0.00048)	(0.08916)
	[1.09951]	[1.35979]	[-0.23327]	[2.34627]
D(PR(-2))	-0.000281	-0.000201	-0.000357	0.340092
	(0.00052)	(0.00015)	(0.00049)	(0.09086)
	[-0.54289]	[-1.31962]	[-0.73164]	[3.74283]
D(PR(-3))	-0.000154	-0.000322	-1.75E-05	-0.007935
	(0.00055)	(0.00016)	(0.00052)	(0.09702)

	[-0.27842]	[-1.98454]	[-0.03355]	[-0.08179]
D(PR(-4))	0.000406	0.000440	2.68E-06	-0.204189
	(0.00055)	(0.00016)	(0.00052)	(0.09691)
	[0.73573]	[2.71111]	[0.00516]	[-2.10690]
D(PR(-5))	0.000125	-7.75E-05	-0.000294	-0.061380
	(0.00058)	(0.00017)	(0.00055)	(0.10186)
	[0.21553]	[-0.45461]	[-0.53869]	[-0.60257]
D(PR(-6))	-0.001135	-0.000231	0.000139	0.274575
	(0.00055)	(0.00016)	(0.00052)	(0.09725)
	[-2.04869]	[-1.41906]	[0.26697]	[2.82329]
D(PR(-7))	1.13E-05	4.75E-06	-0.000295	-0.058446
	(0.00058)	(0.00017)	(0.00054)	(0.10104)
	[0.01972]	[0.02808]	[-0.54460]	[-0.57847]
D(PR(-8))	-8.43E-05	0.000107	-0.000210	-0.254521
	(0.00055)	(0.00016)	(0.00051)	(0.09575)
	[-0.15463]	[0.67021]	[-0.40901]	[-2.65817]
D(PR(-9))	5.14E-05	0.000134	-0.000248	-0.039317
	(0.00056)	(0.00017)	(0.00053)	(0.09871)
	[0.09150]	[0.80828]	[-0.46862]	[-0.39829]
D(PR(-10))	0.000464	-0.000252	-0.000272	0.150619
	(0.00055)	(0.00016)	(0.00051)	(0.09600)
	[0.84885]	[-1.56655]	[-0.52833]	[1.56903]
D(PR(-11))	-5.40E-05	-4.16E-05	0.000139	0.042001
	(0.00054)	(0.00016)	(0.00051)	(0.09447)
	[-0.10036]	[-0.26309]	[0.27389]	[0.44461]
D(PR(-12))	-8.50E-05	0.000228	0.000166	-0.177173
	(0.00051)	(0.00015)	(0.00048)	(0.08987)
	[-0.16613]	[1.51845]	[0.34424]	[-1.97153]
D(PR(-13))	0.000382	-0.000259	-0.000515	-0.010724

	(0.00049)	(0.00014)	(0.00046)	(0.08616)
	[0.77788]	[-1.79292]	[-1.11343]	[-0.12446]
C	0.000939	0.001058	0.001974	-0.499420
	(0.00146)	(0.00043)	(0.00138)	(0.25663)
	[0.64246]	[2.46405]	[1.43442]	[-1.94609]
R-squared	0.565886	0.763540	0.842827	0.397059
Adj. R-squared	0.389527	0.667477	0.778975	0.152114
Sum sq. resids	0.001158	0.000100	0.001028	35.72509
S.E. equation	0.003008	0.000884	0.002833	0.528301
F-statistic	3.208722	7.948397	13.19979	1.621014
Log likelihood	825.4855	1047.114	836.3253	-109.9786
Akaike AIC	-8.535752	-10.98468	-8.655529	1.800869
Schwarz SC	-7.599175	-10.04811	-7.718952	2.737445
Mean dependent	0.004188	0.003742	0.003573	-0.052486
S.D. dependent	0.003850	0.001533	0.006027	0.573737

Determinant resid covariance (dof adj.)	1.46E-17
Determinant resid covariance	3.66E-18
Log likelihood	2606.171
Akaike information criterion	-26.45493
Schwarz criterion	-22.70862

APPENDIX 5

VAR ESTIMATES WHEN INCLUDING DUM1 (NATIONAL CREDIT ACT)

The results for the National Credit Act dummy variable (DUM1) show that the dummy variable is not statistically significant when LTL is taken as the dependent variable. The R-squared did not increase significantly (from about 0.5658 to about 0.5661) and the adjusted R-squared decreased, although not significantly (from about 0.39 to about 0.385 respectively). The F-statistic decreased to about 3.127 from about 3.209.

The information criterion for the model as a whole showed mixed results. The Schwarz criterion increased to about -22.66 from about -22.71 and the Akaike criterion decreased to about -26.47 from about -26.45. Thus it is concluded, mainly from the lack of the statistical significance of the dummy variable (except when LINC is taken as the dependent variable), the drop in the F-statistic when LTL is taken as the dependent variable and the increase in the Schwarz criterion that the dummy variable for the National Credit Act does not add predictive power and is not included in the final VAR model.

Estimates

Vector Autoregression Estimates
Date: 01/25/12 Time: 14:07
Sample (adjusted): 1996M03 2011M03
Included observations: 181 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(LCREDIT)	D(LCONS)	D(LINC)	D(PR)
D(LCREDIT(-1))	0.131333	-0.014199	-0.079548	6.921837
	(0.08659)	(0.02523)	(0.07961)	(15.1868)
	[1.51665]	[-0.56270]	[-0.99926]	[0.45578]
D(LCREDIT(-2))	-0.017936	0.004338	0.003949	10.14234
	(0.08266)	(0.02409)	(0.07599)	(14.4962)
	[-0.21699]	[0.18011]	[0.05197]	[0.69965]
D(LCREDIT(-3))	0.192188	0.014851	0.092055	15.10068
	(0.08164)	(0.02379)	(0.07505)	(14.3183)

	[2.35403]	[0.62426]	[1.22652]	[1.05464]
D(LCREDIT(-4))	-0.020022	0.023274	-0.017461	-11.05895
	(0.08363)	(0.02437)	(0.07688)	(14.6660)
	[-0.23943]	[0.95511]	[-0.22712]	[-0.75405]
D(LCREDIT(-5))	0.166032	-0.025414	-0.000719	-34.03040
	(0.08197)	(0.02389)	(0.07536)	(14.3765)
	[2.02542]	[-1.06393]	[-0.00954]	[-2.36708]
D(LCREDIT(-6))	0.106006	0.054231	-0.081303	3.475138
	(0.08384)	(0.02443)	(0.07708)	(14.7042)
	[1.26434]	[2.21976]	[-1.05483]	[0.23634]
D(LCREDIT(-7))	0.072798	-0.038604	0.095193	-4.075522
	(0.08672)	(0.02527)	(0.07972)	(15.2086)
	[0.83947]	[-1.52771]	[1.19408]	[-0.26797]
D(LCREDIT(-8))	0.143052	0.017688	-0.023726	10.40816
	(0.08738)	(0.02546)	(0.08033)	(15.3241)
	[1.63717]	[0.69472]	[-0.29537]	[0.67920]
D(LCREDIT(-9))	0.241344	0.029085	0.178875	11.23901
	(0.08709)	(0.02538)	(0.08007)	(15.2746)
	[2.77105]	[1.14603]	[2.23409]	[0.73580]
D(LCREDIT(-10))	-0.036629	0.008888	-0.044139	11.07306
	(0.09110)	(0.02655)	(0.08375)	(15.9777)
	[-0.40205]	[0.33481]	[-0.52702]	[0.69303]
D(LCREDIT(-11))	0.032112	-0.016386	0.069115	1.218378
	(0.08726)	(0.02543)	(0.08022)	(15.3033)
	[0.36801]	[-0.64445]	[0.86161]	[0.07962]
D(LCREDIT(-12))	-0.085527	-0.024781	-0.082020	-2.195302
	(0.08490)	(0.02474)	(0.07804)	(14.8888)
	[-1.00744]	[-1.00175]	[-1.05094]	[-0.14745]
D(LCREDIT(-13))	-0.104995	0.033548	0.046268	-0.708744

	(0.08236)	(0.02400)	(0.07571)	(14.4441)
	[-1.27484]	[1.39791]	[0.61110]	[-0.04907]
D(LCONS(-1))	0.067025	1.020924	0.072803	59.91738
	(0.30648)	(0.08930)	(0.28174)	(53.7494)
	[0.21870]	[11.4319]	[0.25840]	[1.11475]
D(LCONS(-2))	-0.418718	0.108631	0.142882	-89.93096
	(0.41552)	(0.12108)	(0.38199)	(72.8733)
	[-1.00770]	[0.89718]	[0.37405]	[-1.23407]
D(LCONS(-3))	0.618763	-1.323643	0.708041	85.06196
	(0.41794)	(0.12179)	(0.38422)	(73.2982)
	[1.48050]	[-10.8686]	[1.84282]	[1.16049]
D(LCONS(-4))	0.468110	1.274822	-0.169957	31.11972
	(0.58492)	(0.17044)	(0.53772)	(102.582)
	[0.80030]	[7.47954]	[-0.31607]	[0.30336]
D(LCONS(-5))	-0.362142	0.038358	0.024156	-197.9180
	(0.63808)	(0.18593)	(0.58658)	(111.905)
	[-0.56755]	[0.20631]	[0.04118]	[-1.76863]
D(LCONS(-6))	-0.434651	-1.098621	-0.049515	145.3241
	(0.65075)	(0.18962)	(0.59823)	(114.127)
	[-0.66793]	[-5.79371]	[-0.08277]	[1.27335]
D(LCONS(-7))	1.161143	0.931183	0.227725	-24.06523
	(0.69445)	(0.20236)	(0.63841)	(121.791)
	[1.67204]	[4.60169]	[0.35671]	[-0.19759]
D(LCONS(-8))	-0.434348	0.040407	0.145478	-29.28513
	(0.63059)	(0.18375)	(0.57970)	(110.592)
	[-0.68880]	[0.21990]	[0.25095]	[-0.26480]
D(LCONS(-9))	-1.011054	-0.670000	-0.365513	144.1446
	(0.64206)	(0.18709)	(0.59025)	(112.604)
	[-1.57469]	[-3.58112]	[-0.61925]	[1.28010]

D(LCONS(-10))	1.380505	0.458871	0.159002	-66.71222
	(0.59156)	(0.17238)	(0.54382)	(103.747)
	[2.33366]	[2.66202]	[0.29238]	[-0.64303]
D(LCONS(-11))	-0.093852	0.051361	0.321357	-29.18175
	(0.44455)	(0.12954)	(0.40868)	(77.9647)
	[-0.21112]	[0.39649]	[0.78634]	[-0.37429]
D(LCONS(-12))	-1.824267	-0.252501	0.246501	18.41583
	(0.43635)	(0.12715)	(0.40113)	(76.5257)
	[-4.18079]	[-1.98589]	[0.61451]	[0.24065]
D(LCONS(-13))	0.580327	0.090755	-0.468114	0.055822
	(0.35093)	(0.10226)	(0.32261)	(61.5449)
	[1.65370]	[0.88752]	[-1.45104]	[0.00091]
D(LINC(-1))	0.106535	-0.032043	0.635824	13.72972
	(0.09286)	(0.02706)	(0.08537)	(16.2857)
	[1.14727]	[-1.18421]	[7.44815]	[0.84305]
D(LINC(-2))	0.022065	0.025203	0.058743	16.26378
	(0.09749)	(0.02841)	(0.08962)	(17.0976)
	[0.22633]	[0.88717]	[0.65545]	[0.95123]
D(LINC(-3))	-0.307273	0.039867	-1.350253	-22.68559
	(0.10092)	(0.02941)	(0.09278)	(17.6994)
	[-3.04469]	[1.35566]	[-14.5538]	[-1.28172]
D(LINC(-4))	0.179422	-0.095130	0.778692	40.38347
	(0.16367)	(0.04769)	(0.15046)	(28.7037)
	[1.09626]	[-1.99470]	[5.17542]	[1.40691]
D(LINC(-5))	-0.004309	0.021289	0.055250	5.016526
	(0.15836)	(0.04614)	(0.14558)	(27.7728)
	[-0.02721]	[0.46135]	[0.37952]	[0.18063]
D(LINC(-6))	-0.164357	0.050662	-1.298282	-20.09981
	(0.16899)	(0.04924)	(0.15535)	(29.6367)
	[-0.97260]	[1.02884]	[-8.35713]	[-0.67821]

D(LINC(-7))	0.131908	-0.081807	0.734546	34.80764
	(0.19770)	(0.05761)	(0.18175)	(34.6724)
	[0.66721]	[-1.42005]	[4.04160]	[1.00390]
D(LINC(-8))	-0.029235	-0.005288	0.007376	-9.065397
	(0.16088)	(0.04688)	(0.14790)	(28.2154)
	[-0.18172]	[-0.11280]	[0.04987]	[-0.32129]
D(LINC(-9))	0.069361	0.040281	-1.015423	-9.896416
	(0.16798)	(0.04895)	(0.15442)	(29.4594)
	[0.41292]	[0.82294]	[-6.57568]	[-0.33593]
D(LINC(-10))	0.103439	-0.048927	0.567163	20.02034
	(0.16974)	(0.04946)	(0.15604)	(29.7685)
	[0.60940]	[-0.98921]	[3.63471]	[0.67254]
D(LINC(-11))	-0.060126	-0.005679	-0.021355	-9.347279
	(0.09933)	(0.02894)	(0.09131)	(17.4204)
	[-0.60532]	[-0.19620]	[-0.23386]	[-0.53657]
D(LINC(-12))	0.136467	0.004815	-0.558042	0.789564
	(0.10027)	(0.02922)	(0.09218)	(17.5855)
	[1.36097]	[0.16481]	[-6.05382]	[0.04490]
D(LINC(-13))	0.030115	-0.003321	0.306410	12.81590
	(0.09322)	(0.02716)	(0.08570)	(16.3490)
	[0.32304]	[-0.12227]	[3.57544]	[0.78389]
D(PR(-1))	0.000564	0.000213	-6.00E-05	0.206661
	(0.00051)	(0.00015)	(0.00047)	(0.08944)
	[1.10651]	[1.43103]	[-0.12800]	[2.31048]
D(PR(-2))	-0.000275	-0.000191	-0.000305	0.337568
	(0.00052)	(0.00015)	(0.00048)	(0.09115)
	[-0.52867]	[-1.26071]	[-0.63865]	[3.70332]
D(PR(-3))	-0.000157	-0.000327	-4.46E-05	-0.006603
	(0.00055)	(0.00016)	(0.00051)	(0.09726)

	[-0.28318]	[-2.02587]	[-0.08748]	[-0.06789]
D(PR(-4))	0.000402	0.000433	-3.02E-05	-0.202573
	(0.00055)	(0.00016)	(0.00051)	(0.09717)
	[0.72577]	[2.68515]	[-0.05937]	[-2.08483]
D(PR(-5))	0.000130	-6.90E-05	-0.000249	-0.063583
	(0.00058)	(0.00017)	(0.00054)	(0.10215)
	[0.22379]	[-0.40654]	[-0.46583]	[-0.62245]
D(PR(-6))	-0.001128	-0.000220	0.000198	0.271700
	(0.00056)	(0.00016)	(0.00051)	(0.09757)
	[-2.02667]	[-1.35623]	[0.38675]	[2.78456]
D(PR(-7))	8.96E-06	9.45E-07	-0.000315	-0.057461
	(0.00058)	(0.00017)	(0.00053)	(0.10128)
	[0.01552]	[0.00562]	[-0.59369]	[-0.56737]
D(PR(-8))	-8.90E-05	9.99E-05	-0.000250	-0.252573
	(0.00055)	(0.00016)	(0.00050)	(0.09601)
	[-0.16262]	[0.62610]	[-0.49616]	[-2.63060]
D(PR(-9))	5.01E-05	0.000131	-0.000260	-0.038750
	(0.00056)	(0.00016)	(0.00052)	(0.09894)
	[0.08873]	[0.79897]	[-0.50066]	[-0.39164]
D(PR(-10))	0.000460	-0.000258	-0.000305	0.152244
	(0.00055)	(0.00016)	(0.00050)	(0.09624)
	[0.83832]	[-1.61310]	[-0.60477]	[1.58185]
D(PR(-11))	-5.83E-05	-4.85E-05	0.000103	0.043781
	(0.00054)	(0.00016)	(0.00050)	(0.09472)
	[-0.10793]	[-0.30796]	[0.20648]	[0.46221]
D(PR(-12))	-9.21E-05	0.000217	0.000106	-0.174227
	(0.00051)	(0.00015)	(0.00047)	(0.09018)
	[-0.17920]	[1.44822]	[0.22402]	[-1.93192]
D(PR(-13))	0.000380	-0.000262	-0.000532	-0.009865

	(0.00049)	(0.00014)	(0.00045)	(0.08637)
	[0.77075]	[-1.82480]	[-1.17515]	[-0.11422]
C	0.001106	0.001325	0.003381	-0.568502
	(0.00159)	(0.00046)	(0.00146)	(0.27826)
	[0.69717]	[2.86591]	[2.31820]	[-2.04307]
DUM1	-0.000163	-0.000260	-0.001374	0.067467
	(0.00059)	(0.00017)	(0.00054)	(0.10369)
	[-0.27640]	[-1.51186]	[-2.52825]	[0.65067]
R-squared	0.566147	0.767720	0.850359	0.399062
Adj. R-squared	0.385090	0.670784	0.787910	0.148277
Sum sq. resids	0.001158	9.83E-05	0.000978	35.60639
S.E. equation	0.003019	0.000880	0.002776	0.529495
F-statistic	3.126906	7.919887	13.61690	1.591252
Log likelihood	825.5400	1048.728	840.7694	-109.6774
Akaike AIC	-8.525304	-10.99147	-8.693584	1.808590
Schwarz SC	-7.571056	-10.03722	-7.739337	2.762838
Mean dependent	0.004188	0.003742	0.003573	-0.052486
S.D. dependent	0.003850	0.001533	0.006027	0.573737

Determinant resid covariance (dof adj.)	1.42E-17
Determinant resid covariance	3.44E-18
Log likelihood	2611.850
Akaike information criterion	-26.47348
Schwarz criterion	-22.65649

APPENDIX 6
VAR ESTIMATES WHEN INCLUDING DUM2 AND LINC*DUM2

The second dummy variable (DUM2) is used to capture the period of the increasing rate of credit demand between December 1999 and December 2007, where credit seems to increase at an increasing rate. It is thought that expectations of future income may be formed at an increasing rate during this period and that is one of the reasons behind the increasing rate of credit demand over the period December 1999 and December 2007 and thus the use of a slope and intercept dummy variable for income may increase the predictive power of future income when modelling its relationship with credit. The results indicate that neither the intercept dummy (DUM2) nor slope dummy (LINC*DUM2) coefficients are statistically significant for any of the variables within the VAR.

When the LTL variable is taken as the dependent variable the R-squared and adjusted R-squared statistics increase slightly (from about 0.566 to about 0.589 and about 0.39 to about 0.413 respectively). The F-statistic increases slightly from about 3.209 to about 3.346. The number of statistically significant coefficients of the LINC variable is 1 (the same was also seen in the basic VAR not including dummy variables), which indicates that the LINC variable does not succeed in better explaining the relationship of expected future earnings and credit demand when allowing for a change in the slope and intercept of the LINC variable. The information criteria for the model as a whole showed the Schwarz criterion increased from about -22.709 to around -22.564 and the Akaike criterion also increased from about -26,455 to about -26,452.

It is concluded, mainly from the lack of the statistical significance of both the slope and intercept dummy variables, and the increase in the Schwarz and Akaike information criterion that DUM2 and LINC*DUM2 are excluded from the final VAR model.

Estimates

Vector Autoregression Estimates
Date: 01/25/12 Time: 14:08
Sample (adjusted): 1996M03 2011M03

Included observations: 181 after adjustments

Standard errors in ( ) & t-statistics in [ ]

	D(LCREDIT)	D(LCONS)	D(LINC)	D(PR)
D(LCREDIT(-1))	0.084353	-0.014563	-0.089349	9.661240
	(0.08648)	(0.02610)	(0.08285)	(15.5490)
	[0.97536]	[-0.55801]	[-1.07844]	[0.62134]
D(LCREDIT(-2))	-0.050832	0.004299	0.001124	11.90863
	(0.08164)	(0.02464)	(0.07821)	(14.6780)
	[-0.62265]	[0.17451]	[0.01437]	[0.81132]
D(LCREDIT(-3))	0.156722	0.014508	0.094977	16.80540
	(0.08105)	(0.02446)	(0.07764)	(14.5715)
	[1.93374]	[0.59321]	[1.22327]	[1.15331]
D(LCREDIT(-4))	-0.045440	0.023219	-0.009160	-10.06493
	(0.08272)	(0.02496)	(0.07924)	(14.8719)
	[-0.54934]	[0.93020]	[-0.11560]	[-0.67677]
D(LCREDIT(-5))	0.140144	-0.026047	0.003426	-32.84197
	(0.08106)	(0.02446)	(0.07766)	(14.5743)
	[1.72884]	[-1.06482]	[0.04412]	[-2.25341]
D(LCREDIT(-6))	0.085503	0.053289	-0.075530	4.345705
	(0.08296)	(0.02503)	(0.07947)	(14.9148)
	[1.03071]	[2.12874]	[-0.95040]	[0.29137]
D(LCREDIT(-7))	0.060369	-0.038470	0.105940	-3.833094
	(0.08539)	(0.02577)	(0.08181)	(15.3533)
	[0.70694]	[-1.49286]	[1.29499]	[-0.24966]
D(LCREDIT(-8))	0.130494	0.017672	-0.012191	10.63519
	(0.08621)	(0.02602)	(0.08259)	(15.5004)
	[1.51363]	[0.67929]	[-0.14761]	[0.68612]
D(LCREDIT(-9))	0.240242	0.028525	0.191301	10.87661
	(0.08621)	(0.02602)	(0.08259)	(15.5007)
	[2.78657]	[1.09642]	[2.31619]	[0.70169]

D(LCREDIT(-10))	-0.031028	0.006330	-0.038671	10.69865
	(0.09033)	(0.02726)	(0.08653)	(16.2400)
	[-0.34351]	[0.23222]	[-0.44690]	[0.65878]
D(LCREDIT(-11))	0.038146	-0.019568	0.067550	1.096474
	(0.08591)	(0.02592)	(0.08230)	(15.4451)
	[0.44405]	[-0.75482]	[0.82081]	[0.07099]
D(LCREDIT(-12))	-0.079925	-0.027770	-0.087892	-2.150354
	(0.08305)	(0.02506)	(0.07956)	(14.9309)
	[-0.96242]	[-1.10814]	[-1.10477]	[-0.14402]
D(LCREDIT(-13))	-0.103239	0.030626	0.044457	-0.615926
	(0.08104)	(0.02445)	(0.07763)	(14.5696)
	[-1.27399]	[1.25241]	[0.57266]	[-0.04227]
D(LCONS(-1))	-0.003503	1.029735	0.117674	61.54070
	(0.29937)	(0.09034)	(0.28680)	(53.8250)
	[-0.01170]	[11.3983]	[0.41030]	[1.14335]
D(LCONS(-2))	-0.390087	0.109748	0.141539	-91.37698
	(0.40617)	(0.12257)	(0.38911)	(73.0266)
	[-0.96040]	[0.89540]	[0.36375]	[-1.25128]
D(LCONS(-3))	0.626897	-1.328752	0.680854	85.81986
	(0.40814)	(0.12316)	(0.39100)	(73.3809)
	[1.53597]	[-10.7885]	[1.74132]	[1.16951]
D(LCONS(-4))	0.436452	1.276200	-0.172679	32.76271
	(0.57159)	(0.17249)	(0.54758)	(102.767)
	[0.76358]	[7.39883]	[-0.31535]	[0.31880]
D(LCONS(-5))	-0.311936	0.040514	0.049880	-201.4573
	(0.62377)	(0.18823)	(0.59757)	(112.149)
	[-0.50008]	[0.21524]	[0.08347]	[-1.79634]
D(LCONS(-6))	-0.379202	-1.105610	-0.075713	143.7284
	(0.63577)	(0.19185)	(0.60906)	(114.306)

	[-0.59645]	[-5.76277]	[-0.12431]	[1.25740]
D(LCONS(-7))	1.144197	0.938865	0.213792	-23.02250
	(0.67987)	(0.20516)	(0.65131)	(122.235)
	[1.68296]	[4.57621]	[0.32825]	[-0.18835]
D(LCONS(-8))	-0.401934	0.039369	0.170134	-31.75783
	(0.61670)	(0.18610)	(0.59080)	(110.878)
	[-0.65175]	[0.21155]	[0.28797]	[-0.28642]
D(LCONS(-9))	-0.960674	-0.677079	-0.397481	143.0135
	(0.62721)	(0.18927)	(0.60086)	(112.767)
	[-1.53166]	[-3.57730]	[-0.66152]	[1.26822]
D(LCONS(-10))	1.370631	0.470493	0.139198	-65.97752
	(0.58168)	(0.17553)	(0.55725)	(104.582)
	[2.35632]	[2.68038]	[0.24980]	[-0.63087]
D(LCONS(-11))	-0.079980	0.044659	0.324208	-29.71539
	(0.43527)	(0.13135)	(0.41699)	(78.2588)
	[-0.18375]	[0.34000]	[0.77750]	[-0.37971]
D(LCONS(-12))	-1.796085	-0.260613	0.195797	19.11391
	(0.42601)	(0.12855)	(0.40811)	(76.5926)
	[-4.21610]	[-2.02726]	[0.47976]	[0.24955]
D(LCONS(-13))	0.543726	0.093337	-0.532724	4.095102
	(0.34982)	(0.10557)	(0.33513)	(62.8956)
	[1.55429]	[0.88416]	[-1.58961]	[0.06511]
D(LINC(-1))	0.091689	-0.025074	0.663237	13.22872
	(0.08945)	(0.02699)	(0.08569)	(16.0817)
	[1.02507]	[-0.92894]	[7.74003]	[0.82259]
D(LINC(-2))	0.009858	0.024527	0.058791	16.90693
	(0.09543)	(0.02880)	(0.09142)	(17.1576)
	[0.10330]	[0.85170]	[0.64308]	[0.98539]
D(LINC(-3))	-0.313719	0.040110	-1.348930	-22.41615

	(0.09862)	(0.02976)	(0.09448)	(17.7313)
	[-3.18105]	[1.34777]	[-14.2777]	[-1.26422]
D(LINC(-4))	0.135218	-0.085517	0.811565	41.06800
	(0.15906)	(0.04800)	(0.15238)	(28.5977)
	[0.85011]	[-1.78164]	[5.32598]	[1.43606]
D(LINC(-5))	-0.015217	0.020462	0.052658	5.693634
	(0.15478)	(0.04671)	(0.14828)	(27.8281)
	[-0.09832]	[0.43809]	[0.35513]	[0.20460]
D(LINC(-6))	-0.181357	0.051739	-1.293138	-19.46532
	(0.16517)	(0.04984)	(0.15823)	(29.6961)
	[-1.09801]	[1.03805]	[-8.17247]	[-0.65548]
D(LINC(-7))	0.078328	-0.071527	0.774765	35.67927
	(0.19222)	(0.05800)	(0.18414)	(34.5588)
	[0.40750]	[-1.23313]	[4.20744]	[1.03242]
D(LINC(-8))	-0.033702	-0.004821	0.008148	-8.885551
	(0.15719)	(0.04743)	(0.15058)	(28.2608)
	[-0.21441]	[-0.10164]	[0.05411]	[-0.31441]
D(LINC(-9))	0.050192	0.041686	-1.007794	-9.253517
	(0.16419)	(0.04955)	(0.15730)	(29.5206)
	[0.30569]	[0.84134]	[-6.40699]	[-0.31346]
D(LINC(-10))	0.059852	-0.039627	0.608617	20.38196
	(0.16468)	(0.04969)	(0.15776)	(29.6079)
	[0.36345]	[-0.79742]	[3.85784]	[0.68840]
D(LINC(-11))	-0.058245	-0.004565	-0.017178	-9.635367
	(0.09703)	(0.02928)	(0.09295)	(17.4449)
	[-0.60029]	[-0.15591]	[-0.18480]	[-0.55233]
D(LINC(-12))	0.127196	0.006023	-0.551266	0.969864
	(0.09796)	(0.02956)	(0.09385)	(17.6126)
	[1.29844]	[0.20374]	[-5.87415]	[0.05507]

D(LINC(-13))	0.008736	0.003180	0.334985	12.62305
	(0.08988)	(0.02712)	(0.08610)	(16.1594)
	[0.09720]	[0.11723]	[3.89051]	[0.78116]
D(PR(-1))	0.000618	0.000207	-8.51E-05	0.205092
	(0.00050)	(0.00015)	(0.00048)	(0.08959)
	[1.23968]	[1.37405]	[-0.17835]	[2.28917]
D(PR(-2))	-0.000185	-0.000195	-0.000343	0.334574
	(0.00051)	(0.00015)	(0.00049)	(0.09149)
	[-0.36446]	[-1.27171]	[-0.70402]	[3.65678]
D(PR(-3))	-0.000138	-0.000321	-4.97E-06	-0.009224
	(0.00054)	(0.00016)	(0.00052)	(0.09740)
	[-0.25467]	[-1.96437]	[-0.00958]	[-0.09470]
D(PR(-4))	0.000418	0.000441	3.26E-05	-0.205920
	(0.00054)	(0.00016)	(0.00052)	(0.09736)
	[0.77239]	[2.69859]	[0.06285]	[-2.11503]
D(PR(-5))	0.000209	-7.17E-05	-0.000228	-0.068204
	(0.00057)	(0.00017)	(0.00055)	(0.10254)
	[0.36601]	[-0.41658]	[-0.41718]	[-0.66513]
D(PR(-6))	-0.001085	-0.000228	0.000164	0.271071
	(0.00054)	(0.00016)	(0.00052)	(0.09769)
	[-1.99654]	[-1.38949]	[0.31419]	[2.77488]
D(PR(-7))	-3.41E-05	1.68E-06	-0.000327	-0.054901
	(0.00056)	(0.00017)	(0.00054)	(0.10149)
	[-0.06035]	[0.00988]	[-0.60432]	[-0.54094]
D(PR(-8))	-9.29E-05	0.000107	-0.000203	-0.254323
	(0.00053)	(0.00016)	(0.00051)	(0.09613)
	[-0.17377]	[0.66364]	[-0.39631]	[-2.64559]
D(PR(-9))	7.80E-05	0.000136	-0.000204	-0.042335
	(0.00055)	(0.00017)	(0.00053)	(0.09924)
	[0.14134]	[0.81555]	[-0.38493]	[-0.42660]

D(PR(-10))	0.000474	-0.000251	-0.000268	0.149947
	(0.00054)	(0.00016)	(0.00051)	(0.09637)
	[0.88383]	[-1.55230]	[-0.52121]	[1.55603]
D(PR(-11))	-9.57E-05	-4.32E-05	0.000173	0.042951
	(0.00053)	(0.00016)	(0.00051)	(0.09515)
	[-0.18083]	[-0.27022]	[0.34179]	[0.45139]
D(PR(-12))	-6.19E-05	0.000231	0.000234	-0.180848
	(0.00050)	(0.00015)	(0.00048)	(0.09064)
	[-0.12278]	[1.51811]	[0.48376]	[-1.99523]
D(PR(-13))	0.000514	-0.000249	-0.000392	-0.022143
	(0.00049)	(0.00015)	(0.00047)	(0.08763)
	[1.05401]	[-1.69321]	[-0.83892]	[-0.25270]
C	0.001671	0.001105	0.002373	-0.552501
	(0.00146)	(0.00044)	(0.00140)	(0.26297)
	[1.14252]	[2.50466]	[1.69343]	[-2.10103]
DUM2	-0.021131	-0.000733	0.020363	0.376605
	(0.02425)	(0.00732)	(0.02323)	(4.35940)
	[-0.87151]	[-0.10017]	[0.87664]	[0.08639]
LINC*DUM2	0.004248	0.000155	-0.003704	-0.089851
	(0.00458)	(0.00138)	(0.00438)	(0.82264)
	[0.92849]	[0.11229]	[-0.84500]	[-0.10922]
R-squared	0.589153	0.764097	0.846114	0.401925
Adj. R-squared	0.413076	0.662995	0.780163	0.145607
Sum sq. resids	0.001096	9.98E-05	0.001006	35.43676
S.E. equation	0.002950	0.000890	0.002826	0.530325
F-statistic	3.345993	7.557721	12.82939	1.568073
Log likelihood	830.4708	1047.327	838.2380	-109.2453
Akaike AIC	-8.568739	-10.96494	-8.654563	1.814865
Schwarz SC	-7.596820	-9.993023	-7.682644	2.786784
Mean dependent	0.004188	0.003742	0.003573	-0.052486
S.D. dependent	0.003850	0.001533	0.006027	0.573737

Determinant resid covariance (dof adj.)	1.43E-17
Determinant resid covariance	3.36E-18
Log likelihood	2613.921
Akaike information criterion	-26.45216
Schwarz criterion	-22.56449

APPENDIX 7 – FIRM GRANGER-CAUSALITY TEST RESULTS

Firm block exogeneity Wald test and Granger causality tests

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 01/19/12 Time: 13:56
Sample: 1995M01 2011M03
Included observations: 186

Dependent variable: D(LTL)

Excluded	Chi-sq	Df	Prob.
D(LWB)	5.947960	8	0.6531
D(S)	4.512514	8	0.8082
D(PPI)	5.723173	8	0.6782
D(RT)	3.883333	8	0.8675
D(DR)	14.52011	8	0.0692
D(LMIX)	12.92518	8	0.1144
All	57.63259	48	0.1608

Dependent variable: D(LWB)

Excluded	Chi-sq	Df	Prob.
D(LTL)	9.159060	8	0.3291
D(S)	2.092768	8	0.9780
D(PPI)	2.345514	8	0.9685
D(RT)	17.83438	8	0.0225
D(DR)	16.62098	8	0.0343
D(LMIX)	9.406662	8	0.3092
All	52.46058	48	0.3052

Dependent variable: D(S)

Excluded	Chi-sq	df	Prob.
D(LTL)	29.45825	8	0.0003

D(LWB)	12.84131	8	0.1174
D(PPI)	13.42493	8	0.0980
D(RT)	5.331706	8	0.7216
D(DR)	5.870095	8	0.6618
D(LMIX)	29.48619	8	0.0003
All	84.34230	48	0.0009

Dependent variable: D(PPI)

Excluded	Chi-sq	df	Prob.
D(LTL)	11.14187	8	0.1938
D(LWB)	7.462586	8	0.4876
D(S)	8.022726	8	0.4313
D(RT)	6.779875	8	0.5606
D(DR)	3.515937	8	0.8979
D(LMIX)	10.88817	8	0.2081
All	39.93346	48	0.7897

Dependent variable: D(RT)

Excluded	Chi-sq	df	Prob.
D(LTL)	9.075099	8	0.3360
D(LWB)	7.639438	8	0.4695
D(S)	13.08530	8	0.1089
D(PPI)	9.012719	8	0.3412
D(DR)	39.12434	8	0.0000
D(LMIX)	9.704466	8	0.2864
All	96.11324	48	0.0000

Dependent variable: D(DR)

Excluded	Chi-sq	df	Prob.
D(LTL)	7.539587	8	0.4797
D(LWB)	7.110714	8	0.5247
D(S)	3.369610	8	0.9091
D(PPI)	6.032580	8	0.6436

D(RT)	18.58126	8	0.0173
D(LMIX)	7.197311	8	0.5155
All	53.37017	48	0.2755

Dependent variable: D(LMIX)

Excluded	Chi-sq	df	Prob.
D(LTL)	12.49059	8	0.1306
D(LWB)	5.617179	8	0.6900
D(S)	4.730909	8	0.7859
D(PPI)	5.782416	8	0.6716
D(RT)	3.415110	8	0.9057
D(DR)	14.64514	8	0.0664
All	58.99442	48	0.1328

APPENDIX 8

HOUSEHOLD GRANGER CAUSALITY TEST RESULTS

Household block exogeneity Wald and Granger causality test results

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 01/25/12 Time: 17:59
Sample: 1995M01 2011M03
Included observations: 181

Dependent variable: D(LCREDIT)

Excluded	Chi-sq	df	Prob.
D(LCONS)	50.49846	13	0.0000
D(LINC)	28.69280	13	0.0072
D(PR)	8.784235	13	0.7890
All	77.26037	39	0.0003

Dependent variable: D(LCONS)

Excluded	Chi-sq	df	Prob.
D(LCREDIT)	16.34071	13	0.2312
D(LINC)	7.966908	13	0.8457
D(PR)	18.02979	13	0.1564
All	44.03528	39	0.2669

Dependent variable: D(LINC)

Excluded	Chi-sq	df	Prob.
D(LCREDIT)	10.00189	13	0.6938
D(LCONS)	32.05411	13	0.0024
D(PR)	4.815112	13	0.9790

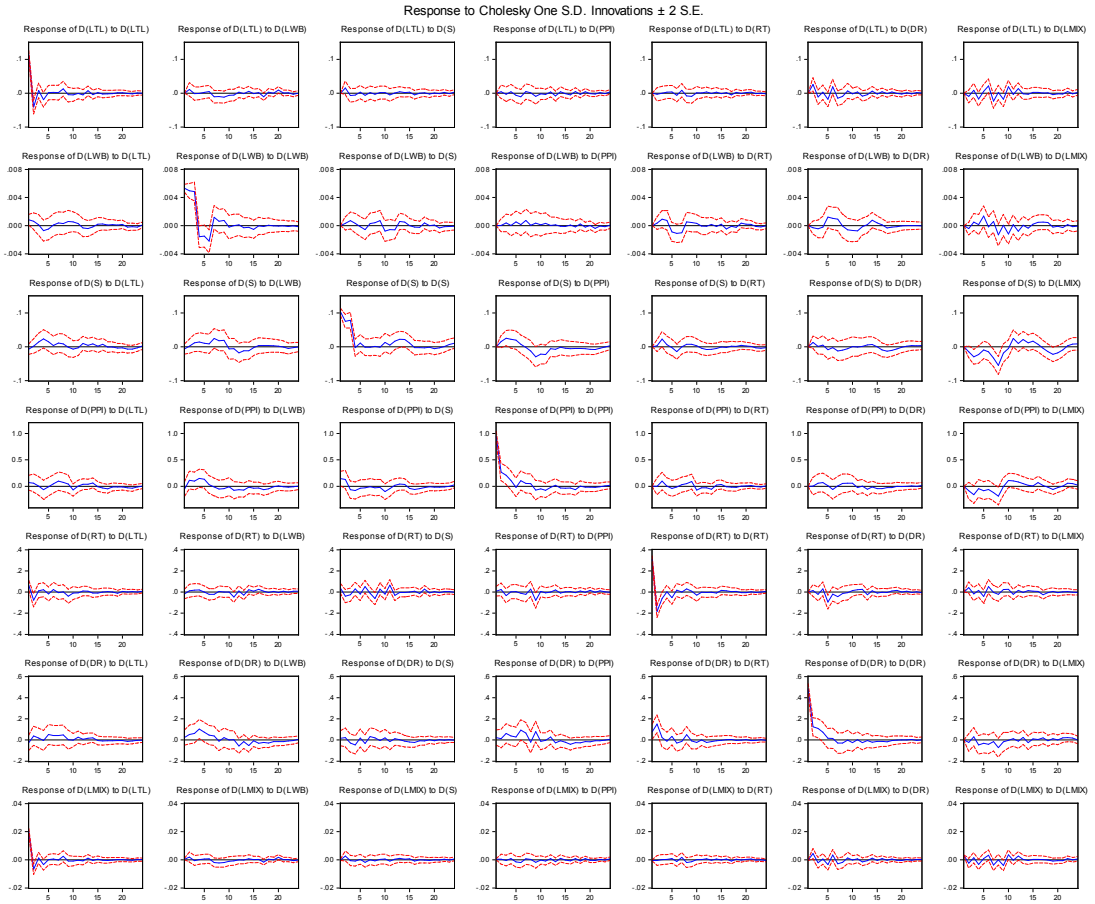
All	66.59451	39	0.0038

Dependent variable: D(PR)

Excluded	Chi-sq	df	Prob.
D(LCREDIT)	11.49300	13	0.5696
D(LCONS)	15.01111	13	0.3067
D(LINC)	7.522106	13	0.8733
All	32.65931	39	0.7531

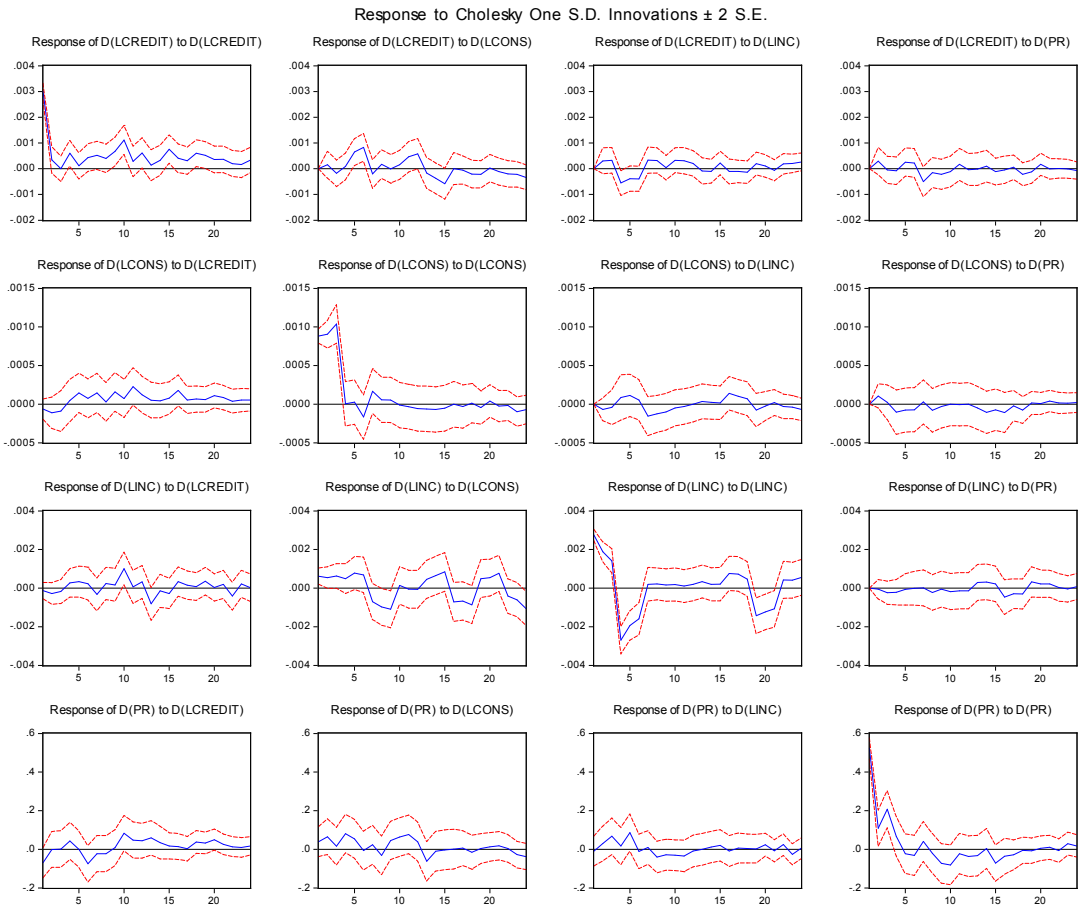
APPENDIX 9

FIRM IMPULSE RESPONSE FUNCTIONS



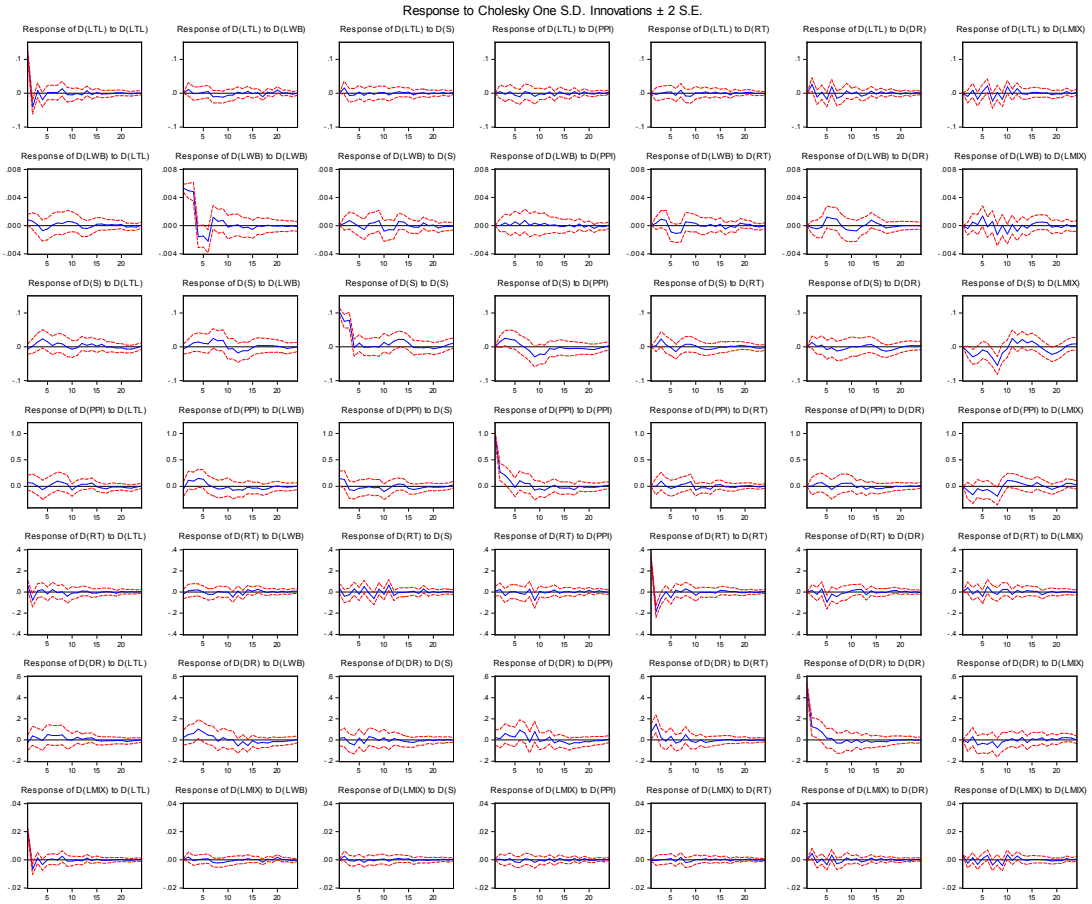
APPENDIX 10

HOUSEHOLD IMPULSE RESPONSE FUNCTIONS



APPENDIX 11

FIRM VARIANCE DECOMPOSITION RESULTS



APPENDIX 12

HOUSEHOLD VARIANCE DECOMPOSITION RESULTS