Modeling the effect of credit channel of monetary transmission mechanism in Rwanda.

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Abstract

This study investigated the impact of credit channel of monetary transmission mechanism in executing monetary policies in Rwanda, during the period 2005-2015. The study employed a VAR methodology using impulse response graphs and variance decomposition to test the relative impact of the different variables tested being repo rate, money supply (M3), consumer price index (CPI), gross domestic products (GDP) and savings and investment, the data set was quarterly collected from national bank of Rwanda. And to find out whether credit channel is more effective or ineffective.

The empirical analysis found two interesting results. First, all variables was stationary at level I (0) using e-views. Second, with exception of innovation (M3), there exists significant influence of credit channel of monetary transmission shock to GDP and CPI, although weak and a strong significant influence on economic growth. The overall result reveals that R-squared is 0.83 and adjusted R-squared is 0.68 indicating that 68 percent of the variations in inflation could be explained by the combined effect of changes in all independent variables and The overall result reveals that R-squared is 0.66 and adjusted R-squared is 0.75 indicating that 75 percent of the variations in credit to private sector could be explained by the combined effect of changes in all independent variables.

Keywords: credit channels, monetary transmission, VAR

1. Introduction

Monetary transmission is the process through which monetary policy decisions affect the economy in general and the price level in particular. The transmission mechanism is characterized by long, variable and uncertain time lags. Thus it is difficult to predict the precise effect of monetary policy actions on the economy and price level. Monetary transmission is important to policy formulators, decision making and implementing authorities. The policies are used to enhance stability in key economic variables and promote social and political welfare in any country. In the USA, monetary policy is the responsibility of the Federal Reserve System. The policy goals are generally the same all over the world, with objectives of promoting stable prices, exchange rates, maximum employment and long term interest rates.Most studies have been done using Vector Autoregressive framework. Notable in the developed economies include their study on the Euro-zone and the USA, (Morsink, 2003) used a factor Augmented Autoregressive model in his study on monetary transmission in the six largest European economies. Some authors in developing economies also support the same opinion on the importance of monetary transmission.

For instance, Cheong and Boodoo (2008) used a VAR decomposition IRF and found weak pass through from inter- bank rate and Treasury bill rate to prime lending rate in Trinidad and Tobago. Kendall Patrick (2001) in his study on the Caribbean found that it was difficult to discern pattern of Tb rate in Barbados, Belize, Guyana and Jamaica.

Davoodi et al, (2013) note that transmission channels differ in East African Countries (EAC) with exchange rate and credit channel being important to Kenya, credit channel in Rwanda and interest rate in Burundi. Morales and Raei (2013) concluded generally that there was evidence for existence of interest rate and exchange rate channels in EAC. Since the 1970s, various authors have examined the consequences of relaxing the assumptions underlying the "money view". Most of them focused on the information asymmetries faced by lenders and borrowers. This research has produced the "credit view" that distinguishes different forms of financing and hence different financial assets. Consequently, whereas the "money view" generally only makes a distinction between noninterest bearing "money" and interest-bearing "securities", the credit view subdivides the "securities" further (e.g. bank loans, bonds and shares). It has become usual to describe the difference between the money view and the credit view on the basis of the transmission mechanism of monetary policy and to differentiate a "money channel" and a "credit channel". This convention is adopted here, even though it would also be possible to work on the assumption of a shock other than a monetary-policy one. What happens, then, if the central bank sells government securities on the open market, thus bringing about a reduction in the monetary

base? In the money view, this action produces a rise in the open market interest rate and causes a fall in the demand for credit and in output and employment. In the credit view, the same action additionally results in a reduction in the credit supply, so that the credit interest rate rises in relation to the open market rate.

The effects of monetary policy therefore are magnified. The credit channel illustrates a possible way in which monetary policy is able to influence the economy even if the open market interest rate barely responds. An extreme example is where the short-term interest rate controlled by the central bank is zero. In this case, the money channel is closed and monetary policy can only take effect through other channels, such as the credit channel. Aside from such extreme examples, however, most economists tend to see the credit channel as an extension of, rather than an alternative to, the money channel. However, with the deregulation of financial markets and monetary policy more oriented towards market based operations in developing countries, especially in Sub-Saharan Africa, there has been an increased interest in understanding how economies respond to monetary shocks (see for example Smal and Jager (2001) and Mahadeva and Smidhova (2000). This article is a contribution to this growing literature. It evaluates the capacity of the monetary policy in Rwanda to impact production and price. In this regard, the thesis tries to identify potential channels for the transmission of monetary policy based on the indirect instruments since 1995. The design and conduct of monetary policy critically depends on a proper assessment and understanding of the effects of policy changes and shocks on relevant macroeconomic variables and their timing. The analysis of different transmission channels helps to describe their specific characteristics, such as their relative dominance, importance, and their propagating policy effects. Before to assessing whether monetary policy shocks have an impact on output and price, we first provide a qualitative assessment with respect to the effectiveness of individual channels for the transmission of monetary policy in Rwanda.

1.2. Problem Statement

The credit channel mechanism of monetary policy describes the theory that a central bank's policy changes affect the amount of credit that banks issue to firms and consumers for purchases, which in turn affects negatively or positively the real economy. In line with other Central banks or monetary authorities across the globe, the National Bank of Rwanda have used credit channel to attain sustainable economic growth through the means of monetary policy.

There are large number of studies that assessed the effectiveness of credit channel of monetary transmission mechanism. Those studies used country specific data and revealed conflicting results, for example ,Cheng (2006)study found that monetary policy shock had little impact on real output suggesting the reason for this was structural weaknesses in the financial sector which was likely to hamper transmission of monetary policy. The endogenous variables he used were gross domestic product, consumer price index, money stock, short term interest rate and nominal effective exchange rate. However, a lot has happened in the financial sector since 2006 including increased levels of financial innovation, deregulation of financial regulatory authorities by the government to make financial sector competitive and perform well, but still in Rwanda financial sector is monopolistic which cause government to intervene.

Gichondo and Joys (2012) used Basic VAR model suggested that an increase in the money supply increased real output from the first to the third quarter and price level from the third to the ninth quarter. They then added the real interest rate to the basic model to examine the effect of the credit channel, and found that money supply still affected output, real interest rate and price level. The real interest rate did affect real output, and the effect was very significant. The effect of the credit channel was also significant, with money supply causing credit and, credit affected output.

Different authors have given mixed results, some bearing results that agree while others results that contradict each other, there is limited literature on the long run effects of credit channel effects on financial performance as the economy grows more dynamic and diversified.

Further, the authors did not consider the explicit analysis of long run behavior of the economy. All the authors used short term data. There is therefore a need to find out whether credit channel is become more effective or ineffective.

1.3. Objective of the Research

1.3.1 General Objective

The general objective of the study is to assess the effectiveness of credit channel of monetary policy of transmission mechanism on promotion of sustainable investment, and low inflation in Rwanda.

13.2 Specific objectives

1. To measure the effects of credit channel on Inflation in Rwanda.
2. To assess the importance of credit channel on private sector credit in Rwanda.
3. To determine the influence of credit channel on investment in Rwanda.

1.3.3 Justification of the Study

It is the desire of every nation' government to achieve economic stability and growth, Because of this, in line with vision 2020"s objective to have an average annual growth of 8% per annum every year, the credit channel of monetary transmission mechanism should be thoroughly studied and understood. The study therefore sought to be great contribution to the government, international financial institutions, policy formulators, private sector, the society at large and future scholars and students. In other words, the study's result was highly relevant in the formulation and implementation of an effective credit channel that will promote growth and improve the welfare of the people.

The study will be used by the government as a benchmark for comparison of past years monetary policies and review them basing on results found in the study and therefore enable them formulate and implement an interest rate considered to be optimal for economic growth and development of Rwanda. Thirdly, the study sought to serve as a contributing foundation in guiding students who wish to further their research in this topic as they will use the work as a baseline study and subsequently work on them for better results. The study will also be important to forex dealers, securities markets dealers, the government and the public as a whole, to understand the degree of responsiveness of foreign exchange, financial securities and the economy at large to interest rate changes.

1.4. Scope of the Study

The study covered the period 2005- 2015 which published by central bank of Rwanda. Focus was establishing the impact of credit channel on exchange rate price stability, financial stability and economic growth. The study uses quarterly data on key Repo rate, Exchange rate, Consumer price Index and GDP to ensure that the model is not under specified.

1.5. Limitation of the study

This study aimed to measure the effectiveness credit channel of monetary policy transmission mechanism in Rwanda,to help assess current monetary policy framework conducted by the National Bank of Rwanda. Different studies showed that empirical results are sensitive to data period covered by the study and the method employed. VAR approaches are asymptotic models and hence they need large data set of the variables under study.

Moreover, most of the studies which use quarterly data, apply interpolation technique to disaggregate annual data into quarterly data. Due to availability and reliability on quarterly data on the variables that was used in the analysis, this study dictated using quarterly data spanning from 2005Q1 to 2015Q4.

2. LITERATURE REVIEW

2.1. Introduction

This chapter reviews both the theoretical literature on monetary policy transmission channels and empirical literature that focuses both on effects of the monetary policy transmission channels and those that focus on credit channel in particular.

2.1 Theoretical review

For a successful monetary policy, the monetary authorities must have an adequate understanding of the mechanisms through which monetary policy affects the economy. The transmission mechanisms discussed in the literature are Interest rate channel , Exchange rate channel, Other Asset price effects ,Credit channel (Mishkin 1995).

The credit channel emphasizes the special role banks play in the financial system. Thus a contractionary monetary policy decreases bank reserves and bank deposits which leads to a fall in bank loans thereby reducing investment and hence output. There is another broad view of the credit channel which states that a contractionary monetary policy lowers equity prices which in turn wers the net worth of the firms. This also has an adverse

effect on lending which reduces investment spending and hence output. The origins of the 'credit channel' or 'lending channel' can be traced to Irving Fischer (1933) who in the first issue of Econometrical argued that the severity of the economic downturn of the Great Depression resulted from the poor performance of financial markets. This view was later reinforced by various economists,Tobin and Brainard (1963), Brunner and Meltzer (1936). Perhaps the best known recent formulation of the lending view is a model due to Bernanke and Blinder (1988). Their model suggests that open market sales by the Central Bank which drain reserves and hence deposits from the banking system, would limit the supply of bank loans by reducing bank's access to loanable funds.

2.1.1. **Theories of investment**

John M .Keynes and Irving Fisher, both argued that investments are made until the present value of expected future revenues, at the margin, is Equal to the opportunity cost of capital. This means that investments are made until the net present value is equal to zero. An investment is expected to generate a stream of future cash flows, C (t). Since investment, I, represents an outlay at time 0, this can be expressed as a negative cash flow, Fisher referred to the discount rate as the rate of return over costs or the internal rate of return. Keynes, on the other hand, called it the marginal efficiency of capital, (Baddeley, 2003, and Alchian, 1955).Keynes (1936) argued that investments are made until "there is no longer any class of capital assets of which the marginal efficiency exceeds the current rate of interest" (as quoted in Baddeley, 2003, p. 34). The fundamental difference between the "Keynesian view" and Fisher ("Hayekian view") lies in the perception of risk and uncertainty, and how expectations are formed. Keynes did not regard investment as an adjustment process toward equilibrium. Hayek (1941) and Fisher (1930), on the other hand, regarded investment as an optimal adjustment path towards an optimal capital stock. In the Keynesian theory investment are not! Determined by some underlying optimal capital stock.2 instead genuine or radical uncertainty takes a central position. Keynes believed that humans were "animal spirited" and that this, combined with irrational and volatile expectations, made the thought of investment as an adjustment process toward equilibrium futile.

2.1.2. **Monetary Theory of Inflation**

Monetarism refers to the followers of M. Friedman (1912-2006) who hold that "only money matters", and as such monetary policy is a more potent instrument than fiscal policy in economic stabilization. According to the monetarists, the money supply is the "dominate, though not exclusive" determinant of both the level of output and prices in the short run, and of the level of prices in the long run. The long- run level of output is not influenced by the money supply .The monetarists emphasized the role of money. Modern quantity theory led by Milton Friedman holds that "inflation is always and everywhere a monetary phenomenon that arises from a more rapid expansion in the quantity of money than in total output. Its earliest explanation was to be found in the simple quantity theory of money. The monetarists employed the familiar identity of exchange equation of Fisher.

2.1.3 Hahn's 1920 Economic Theory of Bank Credit: An "apotheosis of credit creation"

At the end of WW I Joseph Schumpeter established himself as a leading monetary theorist in the German language area with his long essay on "Money and the Social Product" (Schumpeter 1917- 18), in which he systematically elaborated central ideas on money and credit which were already contained in his Theory of Economic Development. There he had emphasized the financing of innovative investment activities by means of credit as the key function of the banking system. In Schumpeter's view the banker is not the trader but the producer of purchasing power. "[C]redit is essentially the creation of purchasing power for the purpose of transferring it to the entrepreneur, but not simply the transfer of existing purchasing power" (Schumpeter 1934: 107). In contrast to the means of exchange-function of money, credit creation shows clearly the capitalistic function of money, i.e. its importance for industrial development.

In chapter 8 "Money, Credit and Cycles" of 22 See Hauck (2009: 19). 23 Caspari (2004: 467). Neumark (in Schefold 2004, p.92). 7 Part IV of his History of Economic Analysis Schumpeter (1954) deals intensively with the important developments that occurred between 1870 and 1914 in the banking systems of all advanced economies. However, Schumpeter for whom money plays the role of a servant for proceedings in the real economy and basically constitutes a method to dispose of goods or factors of production, saw the true role of banks in capitalist evolution only insufficiently reflected in the literature on banking and finance in the pre-WW I period which "was as much of a separate compartment within the literature on money and credit as the latter

was a separate compartment within the literature on general economics" (Schumpeter 1954: 1110-1). Schumpeter who exposes the great difficulties economists had to grasp that bank loans do create deposits and have a central role to play in the financing of investment, independently of previous savings, and acknowledges Wicksell"s achievements "to recognize certain aspects of „credit creation", in particular the phenomenon of Forced Saving", in his analysis of the effects upon prices, emphasizes that "it was not until 1924 that the theoretical job was done completely in a book by Hahn" (Ibid: 1115-6).25 However, with regard to the definitive impact of Hahn"s book Schumpeter in retrospect came to the conclusion: "One reason why this book left so many economists unconvinced was ... the fact that the theory of bank credit there presented was wedded to certain highly optimistic views about the possibility of achieving permanent prosperity, which prejudiced some economists against its essential achievement" (Ibid, n. 10).

 The first and second edition of Hahn"s Economic Theory of Bank Credit consists of three parts: Credit and Banks (pp. 6-105), Credit and Goods world (pp. 106-159), and International Credit (pp. 160-171). The short third part is eliminated in the third edition. The lengthy first part shows the intimate connection between theory and practice which penetrated Hahn"s work lifelong and did not change with his pronounced mutation from a "pre-Keynesian" to an anti-Keynesian. In sometimes illuminating, sometimes rather technical and occasionally rather boring explanations the author wants to make clear the role of credit in the modern economy to his contemporaries. Hahn is respectful of the classical economists whose monetary theory was adequate for their time, but ardently declares the "uselessness" of the quantity theory for the modern economy, in which cash money plays only "a very unimportant, sometimes a completely vanishing role"

. This reasoning is as important for Hahn"s further argumentation as is his view that the active business of banks dominates the passive side. It is impossible to consider the means which are at the disposal of 25 It should read 1920 since the second edition of Hahn"s book is a completely unchanged version of the first edition. 26 Strangely, Schumpeter in the note to the text refers to the third and completely revised edition of Hahn"s book (1930) in which the vision of a permanent prosperity does not conclude the author"s considerations of the effects of credit creation any longer.

See Hahn (1920/24: 16-8). Ibid: 32. 8 banks for the granting of credit as an independently available stock, because these means are generated only by credit creation. According to Hahn the activity of banks consists in functioning as guarantors, i.e. to procure trust for debtors. Money and credit markets therefore are nothing else than markets on which credit in the literal sense of trust is traded.

 Hahn gives his Economic Theory of Bank Credit the leitmotiv from the British economist Henry Dunning Macleod (1821-1902) "A Bank is therefore not an office for „borrowing" and „lending" money, but it is a Manufactory of Credit (Macleod II/2, 1891: 594). Following not only Macleod but also Wicksell and Schumpeter31, Hahn denies the traditional idea of the role of the banks to function only as the mediator of credit between savers and investors. Different to Macleod, in whose writings money creation by private banks sides with that of the central bank, in Hahn the money creation capacity of the private banking sector takes the key role. "It is a basic view of this work that the passive business of banks is not the presupposition but only the result of credit creation" (Hahn 1920/24: 55). Even in the third and completely revised edition of Economic Theory of Bank Credit the author emphasizes that "[i]t is a main purpose of this work to underline the relative independence of credit expansion from preceding and simultaneous savings and to point to the enormous theoretical and practical importance of an amount of credit expansion which transcends the sum of savings made simultaneously" (Hahn 1930: 41). In part II of his book Hahn (1920/24) first discusses the "prevailing view on the relation between credit and the amount of capital goods" which he criticizes for the neglect of connecting business cycles with capital theory (119). For Hahn an expansion of credit means nothing else than an increase of demand for goods leading to an expansion of production since, as Hahn implicitly assumes to be the case, unemployed resources are available. Hahn emphasizes, as later Keynes, the deflationary consequences of voluntary savings and the positive effects of an expansionary credit policy for innovations and employment. Thus Hahn begins his discussion of the influences of credit 29 See Hahn (1920/24: 51-2) and Haberler (1927: 813) who criticizes Hahn that the banks are not mediating trust but purchasing power which allows debtors to acquire goods in the amount of the credited sum. 30 See Hahn (1920/24: 52, n. 61). The leitmotiv is kept in the German translation on the cover page in the third edition (Hahn 1930).

Schumpeter (1954: 1115: n. 7) considered Macleod as "an economist of many merits who somehow failed to achieve recognition, or even to be taken quite seriously, owing to his inability to put his many good ideas in a professionally acceptable form". In a typically contradictory Schumpeterian style he goes on to argue that

Macleod "laid the foundations of the modern theory of the subject … , though what he really succeeded in doing was to discredit this theory for quite a time". For a modern assessment of Macleod''s credit theory of money see Skaggs (1997). 9 on capital, the core and most revolutionary part of Economic Theory of Bank Credit with the dictum: "Capital formation is not the result of saving but of the granting of credit." With this fundamental proposition of his Economic Theory of Bank Credit Hahn turned upside down the traditional view that credit represented a store of savings deposited with the banks by the public. According to his revolutionary view the formation of deposits is not the cause but the effect of the granting of credit by the banks. Despite all emphasis on the positive consequences of credit extension via capital formation in the long run, Hahn primarily understood his approach as a monetary theory of the business cycle in which stress is laid on the credit theory of production. All relevant statements on the production and distribution of goods "are deduced from the sentence that bank credit exerts the importance of a stimulus to conjuncture" (Hahn 1920/24: 156). According to Hahn credit constitutes the conditio sine qua non of the production of commodities and all capital formation in a modern economy. His most outstanding early critic Ladislaus von Bortkiewicz has aptly summarized Hahn''s main thesis in the statement: "Am Anfang war die Schuld." (In the beginning was the Debt.) According to Hahn the view of the representatives of the quantity theory that the extension of money and credit does not increase real income is not only inaccurate but wrong. "Credit takes the goods out of nothing, where they would have remained without credit extension" (Hahn 1920/24: 141). Hahn''s conclusion that the extension of credit leads to an expansion of production rests on two assumptions34: 1. Modern mass production with its economies of scale requires only a small increase of labour input for a doubling of production output.

There is an enormous reserve of an underemployed labour force. Both components together have raised enormously the "elasticity" of production. The extension of credit activates these formerly unemployed resources which causes an increase of real wages. The change in distribution causes an increase in production. Hahn concludes that distribution, although following production, therefore, like consumption, logically precedes production.35 The early Hahn, who sides with the critics of Say''s law, also invokes the effective demand analysis of Malthus with the emphasis on income distribution as an anticipation of his own ideas.36 However, the parallels are not very strong, except a certain emphasis on underconsumption and income distribution. The increase in wages only holds for the upswing of the economy. In the long run, however, a modern economy is characterized by the tendency towards an excess supply of labour due to the 32 Hahn (1920/24: 120). This dictum which is printed in italics in the first and second edition of the book, is not made anymore in this explicit form in the third edition. 33 v. Bortkiewicz (1921-22: 87). See Hahn (1920/24: 135-7). 35 See Hahn (1920/24: 138). Ibid: 147, n. 13. 10 two factors of a labour-saving technical progress and population growth which results in a downward pressure on real wages. This tendency towards a displacement and lying idleness of workers could be counteracted by an extension of credit which exerts the function of an offsetting force leading to capital formation and generating new employment opportunities. Credit extension thus is an "eminent social factor" (Ibid: 140). But how long can the boom last? Is there any limit for credit extension to raise production and consumption and thereby the wealth of nations? Hahn, who held the view that cyclical fluctuations are nothing else than alternating credit inflations and deflations, gave as a first answer to this theoretically as well as practically important question that the expansion could persist as long as additional credit drew the last remaining reserves of labour power into production.37 However, experience shows that this does not happen in economic reality, and instead of pushing production and consumption to the theoretical limit a general glut occurs before this point is reached. Hahn identifies the reason for the deficient matching of production by consumption in an increase of savings which make "circulating deposits metamorphose into savings accounts" (Ibid: 147).

The result is a shortage of effective demand causing a fall in prices, wages, production and employment. Hahn not only refers to Malthus and Sismondi but also to Hobson''s analysis of oversaving. Could the termination of the boom because of these negative consequences of additional savings be prevented? In his analysis of the influence of credit on the formation of savings38, Hahn points out that no savings could exist without prior granting of credit. The more credit is extended the more savings could be generated. "An extension of credit does not only involve an absolute increase of savings pro rata of the granted credit, but also that the formation of these additional savings goes much quicker and more intensive than the formation of savings which takes place without a prior credit expansion" (Ibid: 153). Credit expansion does not only increase but also accelerates the formation of savings.39 Interestingly, Hahn also argues against the dominant theory, as represented in Cassel''s explanations of the nature and necessity of interest, constructing an inverse relationship between the amount of savings and the interest rate. As an observer of practical developments one must come to the conclusion that no factor has a lower influence on savings than the interest rate.

In an analysis of the laws of savings formation instead one should investigate the influence of fluctuations in income on savings. However, in his pre-Keynesian analysis Hahn refers to increases and decreases of

See ibid: 145-6. 38 See ibid: 152-5. 39 Hahn‟s reference to the consequences of the enormous expansion of credit on savings formation during WW I is not conclusive since the war situation is also characterized by a shortage, i.e. a rationing of consumption goods. 40 See Hahn (1920/24: 154, n. 147). 11 individuals and does not go as far as making the overall savings function dependent on income in the whole economy. According to Hahn the upswing is primarily caused by an expansion of credit which again has its main reason in the interest rate policy of the banks. The phenomenon of a glut which is rooted in the oversaving discussed before, with its negative consequences on the profitability of firms, causes the banks to restrict the granting of credit in the crisis. The resulting increases of interest rates should not be interpreted as a shortage of capital, as it is so often the case, but as a shortage of credit and trust. Here the government, as a special privileged debtor, in Hahn‟s story41, comes into play. Although the state also has to pay interest for its loans, it can transfer the payment to the tax payers and therefore does not have to take the burden of interest payments into account in a way a private person has to calculate. The state (or the central bank by continuously lowering the interest rate), therefore could prevent the termination of the boom. Hahn concludes his analysis with the statement: "In theory, at least the assumption of the possibility of a „perpetual boom‟ does not belong to the realm of Utopia" (Ibid: 159). No wonder that this enthusiasm in Hahn‟s original argument, against the historical background of an enormous increase of public debt in WW I and the hyperinflationary processes in Germany and Austria thereafter, has caused just so ardent opponents who criticized Hahn‟s Economic Theory of Bank Credit as an "apotheosis of credit creation"42 . IV. Modifications: Credit (1923) and the 3rd edition of Economic Theory of Bank Credit (1930) As we have seen in the preceding section, Hahn belonged to the exponents of the old credit view who based their analysis on the benchmark of a cash-saving credit economy in which the limits of credit are not drawn clearly.43 Banks could determine the amount of credit granted in an autonomous and irresponsible way. Hahn‟s argument that capital formation in a pure credit economy differs fundamentally from capital formation in a cash economy has been a target of critique by many contemporaries.44 One of the most noteworthy critics was Hans Neisser who was recognized by Keynes as one of the leading neo-Wicksellians in the German language area. Keynes found "Dr. Neisser‟s general attitude to monetary problems particularly sympathetic" and hoped "that he may feel the same about 41 See ibid: 151-2. 42 Ellis (1934: 329). 43 For a detailed survey comparing old and new credit views see Trautwein (2000). 44 See Lampe (1926: 134-5), Haberler (1927:814), Mannstaedt (1927: 13-5), Neisser (1928: 70-1), and Ellis (1934: 329). 12 my work" (Keynes 1930: 178). Although he regarded Hahn‟s distinction between primary banks creating credit, "the issuing bank of the modern economy" (Hahn 1920/24: 58), and secondary banks where the deposits appear quite fruitful, Neisser nevertheless criticized Hahn for denying the difference between the granting of credit by money creation and the granting of credit from saving deposits.45 It would never be decisive whether a deposit had been generated by paying in cash or by the granting of credit but solely whether the deposit could be used for payments, i.e. exerting the function of money. It must be clear that additional credit could be created only by those banks which keep cheque accounts, and therefore are the carrier of cashless payments, i.e. exactly those deposit banks which can increase the amount of money in the economy by lending out again the cash flowing to them, by simultaneously keeping the cheque deposits. A similar but even harsher critique had been raised by Bortkiewicz and Haberler. Bortkiewicz found fault with Hahn‟s classification of two types of banks which was only the result of ignoring the possibility that a bank could operate alternately on the active and the passive side.

2.2. Forms of the credit channel

2.2.1. Balance sheet channel effects

The source of the credit channel is widely seen in financial market frictions caused by information asymmetries between lenders and borrowers. The borrower generally knows himself and his situation better than the lender. He is better able to judge the chances of his investment project being successful, and to some extent also influences these chances by his own behaviour. This asymmetry gives rise to a premium for all forms of external financing. Expressed in rather more technical terms, the lender-borrower relationship is determined by a principal-agent problem, whereby the lender is the principal and the borrower the agent. This gives rise to the usual problems of "adverse selection" and "moral hazard", which drive a wedge between the cost of external and internal funds. Financing an investment project from external funds is more expensive than financing it from retained profits.

M ↑→ price level ↑→ adverse selection ↓ &moral hazard ↓→ lending ↑ invest ↑ → economic growth ↑

The difference reflects the premium for external financing. The premium depends primarily on the borrower's financial situation. The lower the borrower's net worth, the less security he can offer the lender and the higher the premium on the external funding. Moreover, the lower his cash flow, the smaller the proportion of the investment he is able to finance with internal funds and the higher again the premium on the external funding. These interactions are of particular relevance to the central bank if monetary policy is able to influence the net worth and the cash flow. Advocates of the credit channel argue that it is able to do both.

A restrictive monetary policy reduces the value of collateral sable assets and thereby reduces the borrower's net worth. At the same time, it weakens aggregate demand, the decline being reflected in lower cash flow. This completes the "balance sheet channel". A tightening of monetary policy leads to a deterioration of the borrowers' balance sheets. Information costs rise and the premium demanded for external financing grows. The increase in credit interest exceeds the rise in the default-risk-free rate associated with the monetary policy tightening. Consequently, the effects on credit and the real economy are amplified. It should be borne in mind that the credit channel, as we have described it here, does not imply any credit rationing. Its effect is exerted purely through interest rates. Of course there is also the possibility that the lenders may react to the information problems by rationing credit instead of raising credit interest, especially if they fear that the higher interest rates will increasingly attract only the poor credit risks (adverse selection). In other words, the credit channel can exist either with or without credit rationing. 2 "Adverse selection" refers to the incentive to look for outside funds for financing risky investment projects, while "moral hazard" refers to the incentive for those with externally financed investments to enter into major risks and not repay their loans. Adverse selection thus relates to the situation prior to the signing of a credit agreement, and moral hazard to the post-signing situation. (Mishkin, 1996).

2.2.2. Bank lending channel effect

Banks have not played a specific role so far. It actually would be true to say that the balance sheet channel could even exist in a world without banks. The idea of the balance sheet channel is based on the balance sheet of the borrower, i.e. generally a firm or a household. If the balance sheet deteriorates, the premium for external financing rises. Whether or not the credit comes from a bank does not matter. However, banks also have to finance their activities. The arguments regarding the balance sheet channel thus also apply to the banks.

M ↑→ Bank deposit ↑→ bank loan ↑→ investment ↑→ economic growth ↑

If a bank's balance sheet worsens following a tightening of monetary policy, it generally becomes more difficult for the bank to procure sufficient external resources to continue its lending activities as before. If the bank is unable or unwilling to adjust its balance sheet purely by reducing its portfolio of securities, it will have to cut back its lending activities. In this way, the money channel and balance sheet channel of monetary policy may be augmented by a "bank lending channel". It is important to note that the reduction in the banks' supply of credit will only affect the economy if at least some of the borrowers are unable to resort to other sources of funding. In practice, this condition is unquestionably met. Only large companies have the option of procuring funds from the capital market. For small firms and households, banks are generally the only source of external financing (viet, 2013).

2.3 How the credit channel works

The credit channel view posits that monetary policy adjustments that affect the short-term interest rate are amplified by endogenous changes in the external finance premium. The external finance premium is a wedge reflecting the difference in the cost of capital internally available to firms (i.e. retaining earnings) versus firms' cost of raising capital externally via equity and debt markets. External financing is more expensive than internal financing and the external finance premium will exist so long as external financing is not fully collateralized. Fully collateralized financing implies that even under the worst-case scenario the expected payoff of the project is at least sufficient to guarantee full loan repayment. In other words, full collateralization means that the firm who borrows for the project has enough internal funds relative to the size of the project that the lenders assume no risk. Contractionary monetary policy is thought to increase the size of the external finance premium, and subsequently, through the credit channel, reduce credit availability in the economy.

The external finance premium exists because of frictions such as imperfect information or costly contract enforcement in financial markets. The frictions prohibit efficient allocation of resources and result in dead-weight cost. For example, lenders may incur costs, also known as agency costs, to overcome the moral

hazard problem that arises when evaluating the credit worthiness of borrowers. Moral hazard in this context refers to the notion that borrowers who need access to credit may be those who are least likely to be able to repay their debts (Al-Jasser, 2008).

2.4. Monetary policy and credit channel

Empirical studies have found evidence that increases in the central bank policy rate have a negative impact on bank lending. Examples of such papers using macroeconomic data include Halvorsen and Jacobsen (2009) and Hammerlsland and Traee (2010) which study both the UK and the Norwegian economies. Similarly, at the micro (bank) level, Tabak et al (2010) find that bank lending is reduced in response to an increase in the central bank policy rate in Brazil. While such an effect is consistent with the existence of credit channel influences on credit supply, these studies do not prove that credit channel effects are present since they do not identify whether the amount of credit changes because of a shift in credit supply or a change in credit demand. Several papers have tried to solve this identification problem.

Ciccarelli et al (2010) use the confidential euro area Bank Lending Survey and the publicly-available US Senior Loan Officer Survey to disentangle the effects of loan supply from loan demand. They find loan supply to be more sensitive to monetary policy shocks than loan demand. Black and Rosen (2009) use bank-level data on extensions of business credit to examine how monetary policy affects aggregate loan supply. They examine the distribution of loans across firms of different sizes, the maturity structure of loan originations and the supply of loans from small and large banks. They find monetary policy affects aggregate loan supply by causing variation in the maturities of new originations, with the impact being at least as strong for large banks as for small banks. Jiménez et al (2010) use disaggregated data for analysing the bank lending The policy implications of transmission channels between the financial system and the real economy 5 channel and conclude that the provision of loans is significantly affected by tighter monetary policy. Havro and Vale (2011) as well as Jimborean and Mésonnier (2010) provide further evidence using Norwegian and French data, respectively. The empirical findings highlighted above suggest that at least part of the effect on bank lending from tighter monetary policy is supply driven, ie there is a bank lending channel for monetary policy.

2.5. Financial market conditions and the credit channel

Financial market conditions appear to affect the strength of the credit channel. More specifically, a decrease in market liquidity weakens the credit channel of monetary policy and results in slower GDP growth for any given level of the policy rate. Even in the presence of very low interest rates, when market liquidity conditions are poor, credit availability is subdued as banks tighten lending standards, especially for uncollateralized borrowers. Recent theoretical models have considered the optimal policy responses to adverse financial shocks; such models suggest that aggressive easing of monetary policy is appropriate and that higher capitalized banking systems can attenuate this liquidity effect. In a financial crisis, bank behaviour can offset monetary policy motivation (Mésonnier 2010).

2.6. The importance of the bank lending channels in the financial transmission

The evidence of the importance of bank capital positions for sustaining bank loan growth is mixed but the data supports the importance of household balance sheets as a factor limiting credit. Some studies find that well capitalized banks are more likely to grant credit and are less likely to limit credit. However, other studies find banks that are holding less capital are more willing to lend. On the borrower side of the equation, research shows that balance sheet conditions are the dominant credit channel affecting households. Households with weak balance sheets and credit performance are less likely to obtain credit from a bank. Bank capital conditions can affect the strength of the credit channel. Foglia et al (2010) use bank loan- and firm-level data to separate bank lending effects from borrower balance sheet effects in order to quantify how loan supply constraints affected real investment spending following the collapse of Lehman Brothers in 2008.

2.7. Channels of Monetary Transmission Mechanism

2.7.1. The Interest Rate Channel

According to Mishkin (2006), expansionary monetary policy (increasing money supply - M) causes the real interest rate (ir) to fall, which means that the cost of capital is lowered. The fall in real interest rate induces businesses to increase spending on investments spending and consumers to increase their housing and durable expenditures, which are also considered investment. This increase in investment spending (I) leads in turn to an

increase in aggregate demand and a rise in output (Y). This process is illustrated in the following schematic:
M ↑⇒ ri ↓⇒ I ↑⇒ Y ↑

2.7.2. The Exchange Rate Channel

According to Mishkin (2006), an increase in money supply (M) causes the domestic real interest rate (ir) to fall. Therefore, assets which are denominated in domestic currency are less attractive than assets denominated in foreign currency, resulting in a depreciation of domestic currency (E). The depreciation of the domestic currency makes domestic goods relatively cheaper than foreign goods, thereby causing net export (NX) and output to rise. This is demonstrated in the following schematic: M ↑⇒ ri↓⇒ E ↓⇒ NX ↑⇒ Y ↑

2.7.4. The Credit Channel

This channel mainly involves with the agency problems arising from asymmetric information and costly enforcement of contracts in the financial market. The credit channel operates via two main channels, that are the bank lending channel and the balance-sheet channel (Mishkin, 1995).
A decrease in money supply leads to a decrease in bank deposits, which further decreases the volume of money that banks have to loan out. This, in turn, decreases investment and, ultimately, aggregate demand. This channel allows monetary policy to operate without interest rate, meaning that decreasing interest rates may not be sufficient to increase investment. However, it is worth noting that, with financial innovation, the significance of this channel has been doubted (Mishkin, 1995). The schematic for the bank lending channel is as follows:
M ↓⇒ bank loans ↓⇒ bank deposits ↓⇒ I ↓⇒ Y↓
The balance-sheet channel operates through the net worth of firms, with the effects of adverse selection and moral hazard. A decrease in the firm's net worth means that lenders can rely on lower collateral for their loans, which raises the problem of adverse selection and reduce lending for investment spending. Lower net worth also results in the problem of moral hazard because business owners have a lower equity stake in the firm and, therefore, have incentive to take part in risky projects. As a result, lending and investment spending decreases (Mishkin, 1995).
The ways monetary policy affect firms' balance-sheets are as follows:
M ↓⇒ lending↓⇒ adverse selection & moral hazard ↑⇒ Pe ↓⇒ I ↓⇒ Y ↓.

A tightened monetary policy leads to a decrease in the prices of equities (Pe), raising the problems of adverse selection and moral hazard. As a result, lending for investment spending decreases.
M ↓⇒ cashflow adverse selection & moral hazard ↑⇒ ↓⇒ lending↑⇒ i ↓⇒ I ↓⇒ Y ↓.

Contractionary monetary policy increases the interest rate, which in turn increases the problems of adverse selection and moral hazard. Similar to a tightened monetary policy, when a contractionary policy is implemented, lending and investment spending decrease.

2.8. Instruments of Monetary Policy in Rwanda

During last decade, the Central bank used, a weekly auction for absorbing or injecting liquidity. From May 2008 to date, NBR replaced weekly auction and deposit facility (overnight) by repos operations.
a. Open market operations
The Central bank accepts surplus liquidity from banks and in return transfers eligible securities to them as collateral. The two parties agree to reverse the transaction at a future point in time, when the Central bank as borrower repays the principal of the loan plus interest and the creditor bank returns the collateral to the Central bank. The duration of these operations can vary between 1 to 14 days. Repos with shorter maturities are executed from time to time depending on the forecasts of banking sector liquidity. Owing to the systemic liquidity surplus in the Rwanda banking sector, repo tenders are currently used exclusively for absorbing liquidity.
The bids are ranked using the Duchy auction procedure, i.e. those with the lowest interest rate are satisfied as having priority and those with successively higher rates are accepted until the total predicted liquidity surplus for the day is exhausted. If the volume ordered by the banks exceeds the predicted surplus, the Central bank either completely refuses the bids at the highest rate or reduces them pro rata. Repo tenders are usually announced on Friday after the Monetary Policy Committee's meeting and on another working day banks can bid for 1-day repo at around 2:00 PM. Banks may submit their orders - i.e. the amounts of money and the interest rates at which they want to enter into transactions with the Central bank- within a prescribed time. The minimum acceptable volume is RWF 50 million. Bids exceeding the minimum must be expressed as multiples of RWF 50 million.

Mishkin (2006),
b. Reserve requirement:
Cash reserve requirement can affect Banks's free reserve in short run and supply of broad money. The cash reserve is one of the instruments available to NBR for controlling base money.
c. Discount window facility:
 Central bank usually limit access to their funds by commercial banks, by using a penalty rate and /or through the prescribed amount.
• The supplementary monetary instrument is foreign exchange operations (sales) mainly to smooth unexpected liquidity fluctuations in the market.
Treasury bills and Treasury Bonds market dominate the money market in Rwanda. Treasury bills can be mobilized for government financing or for monetary purposes for absorbing excess liquidity for long duration.

2.8. Review of the empirical literature

Recent studies discussed transmission mechanisms of monetary policy in various countries. To stress the importance of the structure and the nature of the various economies (differences and diversity of the financial markets, the role of the banking sector, the history of inflation...) in the process of monetary transmission, studies are classified according to principal groups of countries. It arises from the empirical literature on the transmission mechanisms of monetary policy that in the developed countries, the interest and exchange rates channels are most important; the effectiveness of the credit channel varies from one country to another.
Coudert and Mojon (1995) analyzed empirically by modeling VAR, the transmission mechanisms in 4 countries of the euro zone: Germany, France, Italy and the United Kingdom. Their model comprises the following variables: long interest rate, money supply, credit, exchange rate, price and production over the period 1976-1993. Simulations of shock of monetary policy show that a change in interest rate has varied effects from one country to another. The recessive effect is observed in France, in Italy and in the United Kingdom, it is not very significant in Germany.
Angeloni et al. (2002) analyzed twelve countries of the Euro zone (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain). The results of this study, based on VAR model confirm that the rise of the short-term interest rate temporarily reduces the production. The prices follow slowly with a rise of inflation the first year and a fall over the following years. The interest and exchange rates channels are present in almost all the countries; the role of the credit channel varies from one country to another.
Morsink and Bayoumi (2001) used VAR models with quarterly, seasonally-adjusted data from 1980Q1 to 1998Q3, using two lags to analyze the effect of monetary shock on the economy. In their basic model, they used economic activity, prices, interest rates, and broad money. They found that both interest rate and broad money significantly affect output. Then, after examining the basic model, they extended the VAR to examine different channels of the monetary transmission mechanism and concluded that both monetary policy and banks' balance sheets are important sources of shocks to output, that banks play a crucial role in transmitting monetary shocks to economic activity, and that business investment is especially sensitive to monetary shocks. In their analysis, Disyatat and Vongsinsirikul (2003) also used the VAR approach with quarterly, seasonally-adjusted data from 1993Q1 to 2001Q4 with two lags to analyze the monetary transmission mechanism in Thailand. Their basic model included real output, price level, and the fourteen-day repurchase rate, which they assumed to be the measure of monetary policy. They found that tightening monetary policy led to a decrease in output, which bottomed out after around 4–5 quarters and dissipated after approximately eleven quarters. The aggregate price level initially responded very little, but ultimately started to decline after about a year. Investment appeared to be the most sensitive component of gross domestic product (GDP) to monetary policy shocks. Their findings were consistent with those of other countries and with what monetary theory suggests. In the case of Jordan, the results were different. Poddar, Sab, and Khatrachyan (2006) found no evidence of monetary policy affecting output. However, Jordan's monetary policy, which is measured by the spread between the three-month CD rate and the US Federal Funds rate, was effective in influencing foreign reserves. Other channels, like equity prices and exchange rate, were not significant channels for transmitting monetary policy to economic activity.
Loayza (2002) presents an empirical study starting from a VAR model on Australia, Canada and the United Kingdom. The study confirms that the interest and exchange rates channels are effective in all these countries. Morsink (2000), by an analysis of quarterly macroeconomic data of Japan has following results: 67% of the direct impact of the shocks of the interest rate on the aggregate demand pass by the bank credit and 67% of change of the aggregate demand come from the private investment. The monetary shocks and the fluctuations of the bank balance sheet influence the real economy; the balance sheet channel dominating the other monetary channels. As mentioned in the following studies, the situation of the emerging countries is different from that of the developed countries.

Hericourt and Matei (2005) propose an empirical evaluation of the transmission mechanisms of the monetary policy in 8 central and eastern European countries (Czech Republic, Hungary, Poland, Slovak Republic, Estonia, Lithuania, Latvia and Slovenia) based on VAR models. The study made over the period (1995-2004) for the countries having maintained a fixed exchange rate regime shows the significant impact of the monetary aggregates on the real economy. The countries with a flexible exchange regime during the same period have heterogeneous behavior profiles. In Czech Republic, the interest and exchange rates channels are particularly active. On the other hand the quantitative channel (variation of the monetary aggregate M2) and the credit channel appear ineffective to impact the real economy.

Hung (2007) presents an empirical analysis of the monetary transmission mechanisms for Vietnam. The results show that the shock on the interest rate affects production, GDP decreases from the 1st quarter until the 3rd quarter. A positive shock on M2 decreases the interest rate and increases GDP. The domestic credit is also sensitive to this shock and the real effective exchange rate is appreciated. The author concluded that the real effective exchange rate and M2 are the two important sources of the shocks on the GDP.

The African economies, specifically sub-Saharan Africa have their characteristics, as the few studies stipulate. Cheng (2006) studied the impact of a shock of the monetary policy on production and prices for Kenya. Its research shows that a monetary shock has a very significant impact on production (GDP) and inflation. The shock of the interest rate has short-term effects on the nominal exchange rate and prices. These effects on production are not significant.

The evidence from Kenya is derived from a VAR analysis and simulations carried out on the Bank's macroeconomic model. The results show that monetary policy in Kenya significantly influences inflation through the interest rate, exchange rate and credit channels. Monetary policy transmission through the reserve money (operating target) to money supply (intermediate target) is not entirely efficient because the policy signal released as a shock to reserve money is Several authors analyzed the monetary transmission mechanisms in the emerging countries of Asia, in particular Brazil, Chile, Colombia, Korea, Mexico, Peru and Vietnam. These studies use VAR model and conclude with the fact that the interest and exchange rates channels were most important in these countries.

Lost in the sense that change in reserve money is not fully reflected in the corresponding change in the intermediate target. Monetary policy transmission mechanism lag in Kenya is 13 to 19 months when monetary policy is measured in terms of REPO interest rate shock. If reserve money is used, instead, the transmission lag is longer, 23 to 36 months (Maturu, 2007).

Mutoti (2006) examines the transmission of monetary policy in Zambian post-liberalized economy. Using a cointegrated structural VAR model, it is suggested that the impact of money supply shocks on Zambia's output is little and temporary. Output volatility is mainly associated with the aggregate supply and IS shocks, the latter is more pronounced in the short run. Money supply shocks also hardly explain Zambia's consumer price inflation. He adopted a well-known macroeconomic model for a small open economy under flexible exchange rates, the Mundell-Fleming-Durnbush model (widely used in empirical analyses). The results show that in Zambia and in the short run, consumer price and by implication CPI inflation is mainly on account of aggregate supply, money demand and exchange rate shocks. At longer horizons, it is mainly underlined by aggregate supply shocks and modestly by foreign price shocks. Also the results indicate that in Zambia monetary policy is mainly transmitted through interest rate and exchange channels. Monetary policy transmission mechanism lag in Zambia is 12 to 24 months.

The credit channel emphasizes the special role banks play in the financial system. Thus a contractionary monetary policy decreases bank reserves and bank deposits which leads to a fall in bank loans thereby reducing investment and hence output. There is another broad view of the credit channel which states that a contractionary monetary policy lowers equity prices which in turn lowers the net worth of the firms.

Lower net worth of business firms also increases the moral hazard problem because as the owners have a lower equity stake, it gives them more incentive to engage in risky projects. This also has an adverse effect on lending which reduces investment spending and hence output.

The origins of the 'credit channel' or 'lending channel' can be traced to Irving Fischer(1933) who in the first issue of Econometrics argued that the severity of the economic downturn of the Great Depression resulted from the poor performance of financial markets.

This view was later reinforced by various economists viz, Tobin and Brainard (1963), Brunner and Meltzer(1936). Perhaps the best known recent formulation of the lending view is a model due to Bernanke and Blinder (1988). Their model suggests that open market sales by the Central Bank which drain reserves and hence deposits from the banking system, would limit the supply of bank loans by reducing bank's access to loanable funds. This will create a shortage of credit in the economy affecting real activity.

The credit view was empirically tested by many economists. Among the earliest was the work by King (1986) who tested the correlation between bank loans and some measure of economic activity. This is a useful first step. However because it makes no effort to address issues of indigeneity, it provides little evidence concerning the

nature of the transmission mechanism. Bank loans are in turn affected by economic activity. Thus correlations between bank lending and economic activity may capture the effects of output on lending rather than the other way round.

An influential study on this area is Bernanke's (1983) examination of the Great Depression in the United States.. According to him the depression had caused banking crises in 1930-33 which had disrupted the credit allocation process. In his words 'Fear of runs led to large withdrawals of deposits, precautionary increases in reserve deposit ratios and an increased desire by banks for very liquid and rediscount able assets. These factors plus the actual failures forced a contraction of the banking system's role in the intermediation of credit'. Bernanke and James (1991) extends this work to study the cause of depression in other countries.

Evidence from structural vector autoregressions (VARs) also supports the notion that shocks to loan supply have significant real effects. Bernanke (1986) formulates a standard VAR analysis using two alternative credit variables viz, the log of total commercial bank loans in nominal terms and the log of the sum of loans made by commercial banks, mutual savings banks and others. The other variables used are log of real GNP(Y), the GNP deflator (P), real defense spending (G), the monetary base (B) and M1 (M).

Findings by Davoodi et al (2013) suggest that channel of monetary transmission mechanism differ across EAC with exchange rate and credit channel being important in Kenya, credit in Rwanda and interest rate in Burundi. More so, a loose policy stance increases prices significantly in Kenya and Uganda and output in Burundi, Kenya and Rwanda. Also, monetary policy measured by shock to policy rate has long lags to prices and output of all countries while policy measured by shock to reserve money, has short lags in Uganda but long lags in Burundi and Rwanda. They applied the use of a Bayesian VAR model which has affected way of dealing with problem of over-parameterization by using previously acquired information.

Morales and Raei (2013), in their study on the evolving role of interest rate and exchange rate channels in monetary policy transmission in EAC countries, generally concluded that there was evidence for the existence of interest rate and exchange rate channels of transmission of monetary policy in the EAC. Move over, for countries with imperfect financial markets the exchange rate channel proves a strong vehicle. They noted that deposit rates are more responsive to changes in discount rate in across all EAC countries in the short run. More so for leading rate, the contemporaneous pass through of both discount and Treasury bill rate is significant only for Kenya and Tanzania.

Ludi and Ground (2006) used the VAR approach to investigate the Bank lending channel in South Africa. Citing its ability to incorporate endogenity and the fact that it is pervasive in nature, because everything affects everything else. Results suggest that loans in South Africa are governed by consumer demand and not by bank supply which tends to disapprove the fact that bank lending channel has effectively worked as a tool of monetary policy in South Africa. They suggest further research since with presence of demand driven loans in essence nullifies the bank lending channel.

Kendall Patrick (2001) examined determinants of interest rates in the Caribbean he used the VAR estimation model and impulse response function (IRF) in his analysis. The author emphasized on the timing and effects of monetary policies on the economy. The researcher used five variable VAR i.e. the lending rate, deposit rate, discount rate Tb rate and found that the R2 was greater than 0.7 after running the regression. In addition he found that it was difficult to discern response pattern of Tb rates in Barbados, Belize, Guyana and Jamaica but response was strongest and most consistent in Bahamas and Trinidad.

Cheong & Boodoo, (2008) in their paper on the monetary transmission mechanism: A closer look at the interest rate channel in Trinidad and Tobago used IRF and the variance decomposition of the VAR model. The authors used the analysis to provide an idea of the strength of interest rate transmission and also the time it takes on interest rate policy on target variables. The aim of the study was to determine the relative importance of the Repo rate in explanation of market interest rates, the importance of interest rates on credit and finally, the importance of credit in the explanation of movements in inflation and income. Consistent with the IRF, the variance decomposition suggest that there was weak pass through from interbank rate and Tb rate to prime lending rate and that there was no strong relationship and pass through effects among the variables, particularly between short term interest rates and lending rates. But the positive aspect was that while the relationship may not have been strong, they never the less existed. The results also shows that the model also suggest high liquidity in financial systems was one of the reasons for incomplete Repo pass through.

Michal Andrle et al, (2013) in their study Forecasting and monetary policy analysis in low income countries, with a focus on Kenya, they developed a semi structural new Keynesian open-economy model, by use of existing Forecasting and Policy Analysis (FPAS) frame works which embody the fairly general view that aggregate demand and monetary policy matter for output dynamics in the short run. At their core, they consist of a forward looking IS equation, a hybrid Philips curve with two separate Philips curve, one for food and the other for nonfood, a monetary policy rule and an uncovered interest parity equation. They used in sample and out of sample forecasting where the results suggest that imported food price shocks accounted for some inflation dynamics in 2008 and that an accommodative monetary policy played an important role. They noted that the out

of sample performance together with its in sample properties and more generally its ability to provide a plausible interpretation of recent events in Kenya validates the use of the models in policy analysis in low income countries.

2.10 Research Critiques

Most of the available studies have investigated the effects of interest rate channel of monetary transmission mechanism. However the current study unlike the prior studies focuses credit channel analysis using long term data variable to enable capture the long term analysis and effects on the economy and also seek to clarify as suggested by kigabo (2008) that development of infrastructure inform of financial innovation would translate in to a more effective credit channel in Rwanda. There has been mixed results since Pascal (2011) and Adha, suggest that financial innovation weakens the effectiveness of monetary policies while output in the case of interest policy shock changes insignificantly, it changes significantly in the case of financial innovation. On that vein therefore, the study seeks to analyze the credit channel and its long term effects on price movement, investment and relationship with financial sector performance.From literature, different authors have given mixed results, some bearing results that agree while others results that contradict each other, there is limited literature on the long run effects of credit channel effects on financial performance as the economy grows more dynamic and diversified.

3. RESEACH DESIGN AND METHODOLOGY

3.1. Introduction

Research design is the structure and plan of investigation undertaken to obtain answers to research questions. According to (Robson, 2002) the overall scheme or program of research is the plan. (Cooper & Schindler, 2003) there are many definitions of research design but no one definition impacts the fool range of important aspects but should be noted that however, all definitions provides answers for questions such as ; what kind of sampling used ? What techniques was used to gather data? How time and cost constraints was be dealt with? According to (Leedy, 1989) the study design should include an outline of what the researcher did from writing hypothesis and their operational implications to the final analysis of the data.

3.2 Research Design

 The research design adopted in this study was the investigative econometric research design as it is meant to investigate and analyses the relationship between two or more variables, namely, credit to private sector investment and consumer price index inflation**.** This research study is both quantitative and qualitative. It is qualitative because it investigates how credit channel of monetary transmission mechanism influence monetary policy goals in Rwanda and the challenges they encounter in the attempt to apply it. It is also quantitative because it analyzed data statistically and frequencies used. In data collection researcher used secondary data collected from BNR. Concerning methods of data analysis, I was used econometric approach tabulation, coding and comparison. Tabulation was used whereby I put data into tables. Before putting them into tables, data entry was done through Excel. In Excel, the frequencies and percentages must be computed. This was allowed me to do qualitative presentation and analysis.

3.3 Data Collection

The study was used secondary data. The time series data of inflation, GDP, key Repo rate and exchange rate, volume of deposit, volume of credit to private sector broad money was collected from BNR these included quarterly data spanning the period from 2005Q1 to 2015Q4"

3.4. Model Specification

 The research covered the period of 2005-2015. The data are taken from National Bank of Rwanda (NBR) Library .Given that the study is aimed at establishing relationships between variables, we employed the multiple regression and correlation analysis expressed functionally as follows:

INVEST = f (M3, Lnr, Tbr, RR, Ree, Tdep, Rgdp, RIR) ………………………………… (1)

CPI = f (M3, Lnr, Tbr, Rr, Ree, Tdep, Rgdp, RIR) ….………………………………. (2)

CPS   = f (M3, Lnr, Tbr, Rr, Ree, Tdep, Rgdp, RIR) ….…………………………….. (3)

Econometrically, the regression models can be specified as:

$$Invest = \beta_0 + \beta_1 M3 + \beta_2 Lnr + \beta_3 Rr + \beta_4 Ree + \beta_5 Tdep + \beta_6 Tbr + \beta_7 Rgdp + \beta_8 RIR + \varepsilon_t \dots \quad (4)$$

$$CPI = \beta_0 + \beta_1 M3 + \beta_2 Lnr + \beta_3 Rr + \beta_4 Ree + \beta_5 Tdep + \beta_6 Tbr + \beta_7 Rgdp + \beta_8 RIR + \varepsilon_t \dots\dots \quad (5)$$

$$CPS = \beta_0 + \beta_1 M3 + \beta_2 Lnr + \beta_3 Rr + \beta_4 Ree + \beta_5 Tdep + \beta_6 Tbr + \beta_7 Rgdp + \beta_8 RIR + \varepsilon_t \dots \dots (6)$$

Where:

INVEST =Gross investment

CPS= credit private sector

LNR= Lending rate

RR= Repo rate

REE= Real effective exchange

TDEP= Total bank deposit

RGDP= real gross domestic products

RIR= Real interbank rate

CPI=consumer price index inflation

M3= Broad money

TBR= Treasury bill rate

$\varepsilon_t =$ Is the error terms respective?

$\beta 1 \dots \beta 8$ = coefficients to be estimated

$\beta 0$ = Intercepts

3.5. Estimation Technique

All these variables were assumed to be non-stationary in levels. See Kigabo (2008), Gichondo
And Kimenyi (2012) among others. This study, therefore, used Augmented Dickey Fuller (ADF) and Philip-
Perron tests for unit root of stationarity. Moreover, this study used vector autoregressive model to assess the
linear interdependencies among the variables under study. It used error correction model to measure the speed of
adjustment for any shock. Finally, it employed Granger causality test to show the causal effect between the
variables under study.

3.5.1. Unit Root Test

One of the assumptions for existence of co integration is that all variables of the model equation be integrated to
the same order. In other words, all the series are expected to exhibit a deterministic trend behavior. Two popular
set of unit root test were utilized to test the order of integration of the variables – Philip Peron (PP) and
Augmented Dickey Fuller test (ADF) tests with their results as presented in table 1 below.

3.5.2. Co integration analysis

The co integration test establishes the existence or otherwise of a long run relationship among series of the
variables included in the model equation. The confirmation of at least one or more co integrated equations is an
indication that all the variables will tend to be co integrated at in the long run though they could be a mix of level
and non-stationary trended data series currently present in the model. The co integration is the pre-condition
which is normally conducted to determine the long run equilibrium state of the data prior to the application of
vector error correction method. This is informed by the argument that the co integration test is based on the
assumption that there is an existence of linear trends in the series. In other words the model allows the drifting of
the non-stationary relations associated with its equation. Following the result of the co integration we can
conclude that there exists at least one co integrating vector or otherwise.

3.5.3. Vector Error Correction

The identification of a co integrating relationship among the variables wherefore is an indication for an existence
of an error correction representation of the model estimation. The presence of an error correction term further
suggest that the variation in the endogenous variable are explained by the equilibrium disturbances in the long
run co integrating equation. These changes are confirmed from the error terms and the variations from other
exogenous variables in the model. The error correction term(s) basically captures the rate of adjustment process
towards the long run equilibrium state. Although the Johansen co integration procedure indicates presence or
absence of co integrating equations, it does not does not reflect the direction of causality. This is normally
included in the estimated vector error correction result.

The error correction terms represents the short run adjustment process to the long-run equilibrium state. The
higher the error correction terms the better the speed of adjustment within a specific period. The magnitude of
the error correction terms ranges between zero (0) and one (1) expressed in percentage and should be negatively
signed with statistically significant T-value for an acceptable adjustment process to be achieved. The error

correction terms arising from the cointegrating vectors are derived from the study using the Johansen multivariate co integration procedure. The lagged levels of the error correction terms incorporated among the pre-determined variables of the error correction model analysis as part of the exogenous determinants. The introduction of error correction model obtained from the co integrating equation as the lagged error correction terms captures the lost long run information as a result of the differenced trend stationary series of the estimated model. The advantage of this approach relates not only to the confirmation of the existence of a co integrating relationship or otherwise among the variables derived from the Johansen procedure. It further identifies the nature and direction of the adjustment effect. This also informs the significance of the vector error correction methodology particularly in econometric analysis of multivariate system dynamic relationships.

3.5.4. The granger causality test

Granger (1969) proposed a time-series data based approach in order to determine causality. He applies this concept to economic time series to determine whether one time series causes in the sense of precedes another. In the Granger-sense a variable x is a cause of another variable y if it is useful in forecasting y, i.e x is able to increase the accuracy of the prediction of y with respect to a forecast, considering only past values of y. In a VAR framework Granger-causality is tested using the multivariate model that is extended in order to test for the simultaneity of all included variables. For this study, the model for testing causality was as follows:

$$yt = \sum_{k=0}^{n} aiy_{t-i} + \sum_{i=1}^{k} \beta_{ixt} + \varepsilon_t$$

With yt representing a variable considered as dependent variable while $xt-1$ representing lagged values for all remained, independent, variables. The existence of causality is determined by the significance of the βis coefficients of the lagged values of variables taken as independent variables.

4. PRESENTATION, ANALYSIS AND INTERPRETATION OF FINDINGS

4.1. Introduction

This chapter is concerned with empirical analyses with the data of all credit channel transmission mechanism in Rwanda. The data are quarterly data from 2005 to 2015, and the source comes from financial statistics databases of Rwanda. The variables include bank loans, total deposit, broad money, real GDP, treasury bill rate, real effective exchange, interbank rate or overnight rate all variable are chosen to represent credit channel and all variables are in log form. We also present the findings of the stationarity and diagnostic tests. First, the section describes the findings of the cointegration analysis and the error correction modelling. Finally, impulse response functions are presented. Impulse response function shows the dynamic response of the variable to an error term in the structural equation. Next, forecast error variance (FEV) decomposition demonstrates the variability degree of the particular variable evoked by its own shock and by the shocks to other variables.

Table 1: Descriptive Statistics

Source: researcher's estimation from e-views **7**

Statistic	INVEST	CPS	CPI	M3	LNR	REE	RGDP	RIR	RR	TBR	TDEP
Mean	5.2438	486.15	6.9154	6.3649	16.631	82.481	6.7834	0.4295	5.8438	7.8704	6.2157
Median	5.3471	374.60	6.0350	6.3331	16.750	80.100	6.7814	1.5000	5.9900	7.5500	6.1744
Maxim	5.9584	1148.1	22.190	7.3012	17.500	98.800	7.175	6.9000	9.1300	12.300	7.2000
Minimu	3.7625	133.10	0.1900	5.3371	15.400	72.900	6.3602	-14.800	1.9700	4.0000	5.1498
Std. De	0.5732	286.43	4.9579	0.5738	0.6095	6.6065	0.2397	4.8026	1.9801	2.0778	0.6055
Skewne	-1.286	0.7328	1.2505	-0.0936	-0.3010	0.6159	-0.1604	-1.3013	-0.2310	0.3127	-0.0774
Kurtosi	4.0998	2.4122	4.5055	1.9118	2.0231	2.3990	1.8791	4.7367	2.4077	2.4223	1.9156
Jarque-Bera	14.361	4.5717	15.623	2.2351	2.4143	3.4447	2.4921	17.949	1.0345	1.3288	2.1995
Probabt	0.0007	0.1016	0.0004	0.3270	0.2990	0.1786	0.2876	0.0001	0.5961	0.5145	0.3329
Sum	230.72	21390	304.28	280.05	731.80	3629.2	298.47	18.900	257.13	346.30	273.49
Sum Sq. Dev.	14.129	352784	1056.9	14.162	15.975	1876.8	2.4708	991.83	168.59	185.65	15.766
Observations	44	44	44	44	44	44	44	44	44	44	44

Table 1 shows the descriptive statistics of the variables. The results indicate that the mean values are for ratio of total deposit (TDEP) 6.21; for ratio of Investment (INVEST) 5.24 and for ratio of credit to private sector (CPS) 486.15. The mean value for broad money (M3) is 6.36, for consumer price index inflation (CPI) is 6.91 and for return lending rate (LNR) the value is 16.63, for real effective exchange (REE)mean value is 82.48,real gross domestic product(RGDP) mean is 6.78 and real interbank rate (RIR) mean value is0.42 for repo rate(RR)mean value is5.84 and for treasury bills rate(TBR)mean value is 7.87   .The Jarque-Bera statistics indicate that all the variables except RIR are normally distributed at the 5% level of significance.

4.2. Unit Root Tests

Augmented Dickey-Fuller (ADF) tests and Phillips-Perron (PP) tests are applied to examine the null of the unit root in each variable.since all variables are time series, we examine the null of the unit root in each variable. Table 1 reports the test results for level and the first difference of data. By the results in table 1, the nonstationary null hypothesis of the unit roots cannot be rejected. However, all variables' first differences appear to be stationary with the rejection of the unit-root hypotheses. Therefore, all data series in our sample are integrated of order one

Table 2: Unit Root Tests

| variables | ADF test | | | PP TEST | | |
	Level	1st difference	I(D)	Level	1st difference	I(D)
CPI	-0.014441	-0.657679	I	-0.017140	-0.657679	I
RGDP	-0.025238	-2.614170	I	-0.017190	-1.091165	I
INVEST	-0.088553	-1.242286	I	-0.088553	-0.931003	I
M3	-0.011862	-1.257438	I	-0.011696	-1.377692	I
TBR	-0.196157	-0.649355	I	-0.136764	-0.649355	I
RR	-0.102938	-0.830046	I	-0.102938	-0.830046	I
REE	-0.110646	-0.760240	I	-0.128154	-0.760240	I
LNR	-0.108114	-1.879390	I	-0.166765	-1.225815	I
RIR	0.116717	-0.247018	I	-0.195506	-0.554034	I
CPS	-0.386775	0.049300	I	0.049300	-0.386775	I
TDEP	-0.008171	-0.755434	I	-0.008171	-0.755434	I

Source: Author's estimation

Table 2: above presents the summary results of the ADF unit root tests. The results show that the null hypotheses of a unit root test for first difference series for all the variables can be rejected at all the critical values indicating that the level series which is largely time-dependent and non-stationary can be made stationary at the first difference and maximum lag of two. Thus, the reduced form model follows an integrating order of 1(1) process and is therefore a stationary process. It also reveals that the test of stationarity in the residuals from the level series regression is significant at all lags. Furthermore, this indicates that the regression is no more spurious but real. That is to say, all the variables are individually stationary and stable. Having established the stationarity of the individual variables, it is also important to establish the stationarity of the linear combinations of the variables as to whether there could be a long-run or equilibrium relationship between the dependent variables and the independent variables (that is, whether they are co-integrated). We, therefore, tested for co-integration to establish long-run stationary or stable relationship using the Johansen Co-integration test.

4.3 Co integration test

The co integration relationship among the variables employed the VAR model of eight variables (M3, LNR, TBR, RR, REE, RGDP, RIR and TDEP) specification for the first differenced variables with constant term in linear deterministic trend in the data. This implies that though there is an existence of none stationary relationship among the variables at levels, a linear combination of the series would allow the relationship to drift, producing a co integrated (long-run) relationship. The procedure utilized the Johansen (1988, Johansen and Juselius, 1990) reduced rank approach to determine the number of co integrating equations as shown in table 2.

Table 3: The Johnsen's Co-Integration Test Based on Trace and MaximalEigen Value investment

Hypothesized	Trace statistics	0.05 critical value	P. value	maximum Eigen statistics	0.05 critical value	p. value
None*	320.6257	197.3709	0.0000	84.87727	58.43354	0.0000
At most1*	235.7484	159.5297	0.0000	63.61565	52.36261	0.0024
At most 2*	172.1328	125.6154	0.0000	53.61136	46.23142	0.0069
At most 3	118.5214	95.75366	0.0006	45.55580	40.07757	0.0110
At most 4	72.96560	69.81889	0.0274	26.91279	33.87687	0.2680
At most5	46.05281	47.85613	0.0731	20.77264	27.58434	0.2902
At most 6	25.28017	29.79707	0.1517	16.18398	21.13162	0.2143
At most 7	9.096189	15.49471	0.3566	8.960694	14.26460	0.2894
At most 8	0.135494	3.841466	0.7128	0.135494	3.841466	0.7128

Source: Author's estimation, (*) denotes rejection of the hypothesis at the 0.05 level

Table 3 shows the summary results of the Johansen Co-integration test employed to test for the long run co-integration relationship between investment and independent variables representing credit channel, namely: broad money (M3), lending rate(LNR), Treasury Bill rate (TBR),repo rate (RR), real effective exchange (REE), real gross domestic product(RGDP),real interbank rate (RIR)and, total deposit(TDEP), have three co-integrating equations each for both the trace tests and the maximum-eigenvalue test with one to two lag intervals taken at 5 percent significant level.

Table 4: long run Dynamics: Normalized cointegration coefficient Investment

INVEST	M3	LNR	TBR	RR	REE	RGDP	RIR	Tdep
1.000000	-29.12577	-6.001793	0.06756	-0.076818	0.080924	91.0773	-0.1074	0.067562
S.Error	4.77354	0.92371	0.23149	0.25350	0.03820	7.61346	0.0548	0.231490
T-stat	-6.10150	-6.4948	0.29184	-0.3030	2.11842	11.962	1.9598	0.29185

Source: researcher's estimation from e-views 7

The result of the normalized co integrating vectors as shown in table 4 indicates a significant long run relationship between investment (invest) and independent variables representing credit channel, namely: broad money (M3), lending rate(LNR), Treasury Bill rate (TBR),repo rate (RR), real effective exchange (REE), real gross domestic product (RGDP),real interbank rate (RIR)and, total deposit(TDEP).

Table 5: The Johnsen's Co-Integration Test Based on Trace and Maximal Eigen Value inflation

Hypothesized	Trace statistics	0.05 critical value	P. value	maximum Eigen statistics	0.05 critical value	p. value
None *	370.4300	197.3709	0.0000	98.21532	58.43354	0.0000
At most 1 *	272.2147	159.5297	0.0000	76.88446	52.36261	0.0000
At most 2 *	195.3302	125.6154	0.0000	62.00659	46.23142	0.0005
At most 3 *	133.3237	95.75366	0.0000	46.86065	40.07757	0.0074
At most 4	86.46300	69.81889	0.0013	42.81587	33.87687	0.0033
At most 5	43.64713	47.85613	0.1176	20.59170	27.58434	0.3016
At most 6	23.05543	29.79707	0.2433	14.64090	21.13162	0.3149
At most 7	8.414527	15.49471	0.4222	7.331274	14.26460	0.4507
At most 8	1.083253	3.841466	0.2980	1.083253	3.841466	0.2980

Source: Author's estimation, (*) denotes rejection of the hypothesis at the 0.05 level

Table 5 shows the summary results of the Johansen Co-integration test employed to test for the long run co-integration relationship between inflation and independent variables representing credit channel, namely: broad money (M3), lending rate(LNR), Treasury Bill rate (TBR),repo rate (RR), real effective exchange (REE), real gross domestic product(RGDP),real interbank rate (RIR)and, total deposit(TDEP), have four co-integrating equations each for both the trace tests and the maximum-eigenvalue test with one to two lag intervals taken at 5 percent significant level.

Table 6: long run Dynamics: Normalized cointegration coefficient Inflation

CPI	M3	LNR	TBR	RR	REE	RGDP	RIR	TDEP
1.000000	308.8909	42.94636	-0.81504	1.342199	-1.150608	-1164.4	-0.9621	85.98379
S.E	40.4430	7.35944	1.72635	1.91825	0.31479	79.1663	0.42375	32.9375
T-stat	7.63768	5.83554	-0.4721	0.6996	-3.6551	-14.70	-2.270	2.61

Source: researcher's estimation from e-views 7

The result of the normalized co integrating vectors as shown in table 6 indicates a significant long run relationship between inflation (CPI) and independent variables representing credit channel, namely: broad money (M3), lending rate(LNR), Treasury Bill rate (TBR),repo rate (RR), real effective exchange (REE), real gross domestic product(RGDP),real interbank rate (RIR)and, total deposit(TDEP).

Table 7: The Johnsen's Co-Integration Test Based on Trace and MaximalEigen Value credit to private sector

Hypothesized	Trace statistics	0.05 critical value	P. value	maximum Eigen statistics	0.05 critical value	p. value
None *	360.3359	197.3709	0.0000	90.17276	58.43354	0.0000
At most 1 *	270.1632	159.5297	0.0000	76.90677	52.36261	0.0000
At most 2 *	193.2564	125.6154	0.0000	58.88161	46.23142	0.0014
At most 3 *	134.3748	95.75366	0.0000	58.36300	40.07757	0.0002
At most 4 *	76.01180	69.81889	0.0147	33.81029	33.87687	0.0509
At most 5	42.20151	47.85613	0.1532	22.97871	27.58434	0.1744
At most 6	19.22280	29.79707	0.4770	11.83095	21.13162	0.5644
At most 7	7.391848	15.49471	0.5325	7.389215	14.26460	0.4442
At most 8	0.002633	3.841466	0.9566	0.002633	3.841466	0.9566

Source: Author's estimation (*) denotes rejection of the hypothesis at the 0.05 level

Table 6 shows the summary results of the Johansen Co-integration test employed to test for the long run co-integration relationship between credit to private sector and independent variables representing credit channel, namely: broad money (M3), lending rate(LNR), Treasury Bill rate (TBR),repo rate (RR), real effective exchange (REE), real gross domestic product(RGDP),real interbank rate (RIR)and, total deposit(TDEP), have five co-integrating equations each for both the trace tests and the maximum-eigenvalue test with one to two lag intervals taken at 5 percent significant level.

Table 8: Long run Dynamics: Normalized cointegration coefficient total credit to private sector

CPS	M3	LNR	TBR	RR	REE	RGDP	RIR	TDEP
1.000000	1234.800	323.7449	-48.3732	12.70472	-13.20209	-5071.4	19.8625	318.5586
S.E	406.380	68.7993	20.5975	19.5230	2.97190	568.850	4.26776	397.432
T-stat	3.038	4.705	-2.3484	0.650	-4.4422	-8.915	4.66	0.801

Source: researcher's estimation from e-views

The result of the normalized co integrating vectors as shown in table 8 indicates a significant long run relationship between credit to private sector (CPS) and independent variables representing credit channel, namely: broad money (M3), lending rate (LNR), Treasury Bill rate (TBR), repo rate (RR), real effective exchange (REE), real gross domestic product (RGDP), real interbank rate (RIR) and, total deposit (TDEP).

Hypothesis 1

Credit channel does not have any significant impact on investment in Rwanda. Tables 9 shows the results of the parsimonious error correction for the impact on investment (INVEST) of the independent variables representing credit channel, namely: broad money (M3), lending rate(LNR), Treasury Bill rate (TBR),repo rate (RR), real effective exchange (REE), real gross domestic product(RGDP),real interbank rate (RIR)and, total deposit each lagged four periods.

Table 9: Short-run dynamics: Vector error correction model coefficients on investment

Dependent Variable: D(INVEST)
Method: Least Squares
Date: 06/05/16 Time: 14:18
Sample (adjusted): 2005Q4 2015Q4
Included observations: 41 after adjustments

Regressor	Coefficien	Std. Error	t-Statistic	Prob.
CEM	-0.004486	0.015961	-0.281083	0.7814
D(M3(-1))	2.919792	4.076864	0.716186	0.4818
D(LNR(-1))	0.084827	0.115584	0.733897	0.4711
D(TBR(-1))	-0.019235	0.039003	-0.493170	0.6270
D(RR(-1))	0.047682	0.051006	0.934830	0.3605
D(REE(-1))	-0.017618	0.017707	-0.994970	0.3311
D(RGDP(-1))	0.374665	1.164406	0.321765	0.7508
D(RIR(-1))	0.010150	0.012739	0.796812	0.4345
D(TDEP(-1))	-2.544518	3.914972	-0.649945	0.5228

R-squared	0.407501			
Adjusted R-squared	0.128569			
F-statistic	0.760164	Durbin-Watson stat	1.976752	
Prob(F-statistic)	0.724075			

Source: researcher's estimation from e-views

The Parsimonious Error Correction results in Table 9 on the impact of credit channel investment show that R-squared is 0.40 while adjusted R-squared is 0.12 indicating that 40 percent of changes in investment are

attributable to the combined effect of the ratio of broad money (M3), the ratio of lending rate (LNR),Treasury bill rate(TBR),repo rate (RR),real effective exchange (REE),real gross domestic product (RDGP),real interbank rate(RIR) and the total deposit(CPS). Also, from the table, we see that The Parsimonious Error Correction results in Table 9 on the impact of credit channel on investment reveal that none of the independent variables is statistically significant in the current period.

F-statistic is 0.76 with a probability value of 0.72 indicating that the combined effect of all independents variables have non-significant impact on investment. Consequently, we accept the null hypothesis in short run but rejected in long run.

And furthermore, the Error Correction Co-efficient of -0.004486is appropriately signed, being negative and also insignificant at 5% level of significance. The co-efficient shows that the speed of adjustment of the model is approximately 12.8 percent quarterly due to a deviation from equilibrium.

Hypothesis 2:

Credit channel does not have any significant impact on inflation in Rwanda. Tables 10 shows the results of the parsimonious error correction for the impact on inflation (CPI) of the independent variables representing credit channel, namely: broad money (M3), lending rate(LNR), Treasury Bill rate (TBR),repo rate (RR), real effective exchange (REE), real gross domestic product(RGDP),real interbank rate (RIR)and, total deposit, each lagged two periods.

Table 10: Short-run dynamics: Vector error correction model coefficients on inflation

Dependent Varia ble: D(CPI)
Method: Least Squares
Date: 06/05/16   Time: 14:04
Sample (adjusted): 2005Q4 2015Q4
Included observations: 41 after adjustments

Regressor	Coefficien	Std. Error	t-Statistic	Prob.
CEM	-0.750923	0.122892	3.669264	0.0014
D(M3(-1))	-16.34101	42.69093	-0.382775	0.0057
D(LNR(-1))	1.106165	0.412185	2.683663	0.0139
D(TBR(-1))	0.902021	0.617112	1.461682	0.1586
D(RR(-1))	0.284763	0.177215	1.606876	0.0230
D(REE(-1))	3.366807	1.292685	2.604507	0.0166
D(RGDP(-1))	-1.686176	0.597718	-2.821023	0.0102
D(RIR(-1))	30.43772	10.32270	2.948619	0.0077
D(TDEP(-1))	7.632877	40.99130	0.186207	0.8541

R-squared	0.836071			
Adjusted R-squared	0.687754			
F-statistic	5.637065	Durbin-Watson stat		2.978956
Prob(F-statistic)	0.000124			

Source: researcher's estimation from e-views

The Parsimonious Error Correction results in Table 10 on the impact of credit channel of monetary transmission used by central bank on inflation reveal that all the eight independent variables, namely: broad money (M3), lending rate (LNR), Treasury Bill rate (TBR), repo rate (RR), real effective exchange (REE), real gross domestic product (RGDP), real interbank rate (RIR) and, total deposit, have a significant impact on inflation. The overall result reveals that R-squared is 0.83 and adjusted R-squared is 0.68 indicating that 68 percent of the variations in inflation could be explained by the combined effect of changes in all independent variables.

Hypothesis 3:

Credit channel does not have any significant impact on credit to private sector in Rwanda. Tables 11 shows the results of the parsimonious error correction for the impact on credit to private sector   (CPI) of the independent variables representing credit channel, namely: broad money (M3), lending rate (LNR), Treasury Bill rate (TBR), repo rate (RR), real effective exchange (REE), real gross domestic product (RGDP), real interbank rate (RIR) and, total deposit (TEDP), each lagged four periods.

Table 11: Short-run dynamics: Vector error correction model coefficients on credit to private sector

Dependent Variable: D(CPS)
Method: Least Squares
Date: 06/05/16   Time: 14:36
Sample (adjusted): 2005Q4 2015Q4
Included observations: 41 after adjustments

Regress or	Coefficien	Std. Error	t-Statistic	Prob.
CEM	-0.753569	0.035070	1.242335	0.0278
D(M(-1))	-308.0670	454.8331	-0.677319	0.0556
D(LNR(-1))	25.80857	15.87428	1.625811	0.0189
D(TBR(-1))	-3.303031	4.332200	-0.762437	0.0543
D(RR(-1))	14.82574	5.720794	2.591552	0.0170
D(REE(-1))	1.333210	2.128449	0.626376	0.0378
D(RGDP(-1))	13.14543	115.4143	0.113898	0.0104
D(RIR(-1))	-0.527261	1.446951	-0.364395	0.0192
D(TDEP(-1))	247.1024	457.8563	0.539694	0.0451
R-squared	0.662967			
Adjusted R-squared	0.758033			
F-statistic	2.174132	Durbin-Watson stat		2.239146
Prob(F-statistic)	0.043590			

Source: researcher's estimation from e-views

The Parsimonious Error Correction results in Table 11 on the impact of credit channel of monetary transmission used by central bank on credit to private sector reveal that all the eight independent variables, namely: broad money (M3), lending rate (LNR), Treasury Bill rate (TBR), repo rate (RR), real effective exchange (REE), real gross domestic product (RGDP), real interbank rate (RIR) and, total deposit, have a significant impact on credit to private sector. The overall result reveals that R-squared is 0.66 and adjusted R-squared is 0.75 indicating that 75 percent of the variations in credit to private sector could be explained by the combined effect of changes in all independent variables.

Table 12: Pairwise Granger Causality Tests results of investment

Pairwise Granger Causality Tests
Date: 06/05/16   Time: 19:18
Sample: 2005Q1 2015Q4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
M3 does not Granger Cause INVEST	42	3.45850	0.0420
LNR does not Granger Cause INVEST	42	2.93692	0.0655
RR does not Granger Cause INVEST	42	0.00160	0.9984
TBR does not Granger Cause INVEST	42	0.35116	0.7062
REE does not Granger Cause INVEST	42	0.41891	0.6608
RGDP does not Granger Cause INVEST	42	2.86562	0.0697
RIR does not Granger Cause INVEST	42	1.74927	0.1880
TDEP does not Granger Cause INVEST	42	3.28658	0.0485

Source: Author's estimation from E-views7

The Granger causality test results in Table 12 reveals the direction of causality between the various variables representing credit channel ((M3), lending rate(LNR), Treasury Bill rate (TBR),repo rate (RR), real effective exchange (REE), real gross domestic product(RGDP),real interbank rate (RIR)and, total deposit(TEDP),) and investment . The results above indicate that there is a unidirectional granger causality relationship running from M3 to INVEST and also from TEDP, to INEVST respectively.

Table 13: Pairwise Granger Causality Tests on inflation

Pairwise Granger Causality Tests
Date: 06/05/16   Time: 19:45
Sample: 2005Q1 2015Q4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
M3 does not Granger Cause CPI	42	2.01552	0.1476
LNR does not Granger Cause CPI	42	6.41446	0.0041
RR does not Granger Cause CPI	42	0.86108	0.4310
TBR does not Granger Cause CPI	42	0.74780	0.4804
REE does not Granger Cause CPI	42	1.47686	0.2415
RGDP does not Granger Cause CPI	42	2.74492	0.0773
RIR does not Granger Cause CPI	42	0.61710	0.5450
TDEP does not Granger Cause CPI	42	2.02919	0.1458

Source: Author's estimation from E-views7

The Granger causality test results in Table 13 reveals the direction of causality between the various variables representing credit channel ((M3), lending rate(LNR), Treasury Bill rate (TBR),repo rate (RR), real effective exchange (REE), real gross domestic product(RGDP),real interbank rate (RIR)and, total deposit(TEDP),) and inflation . The results above indicate that there is a unidirectional granger causality relationship running from LNR to CPI.

Table 14: Pairwise Granger Causality Tests results of credit to private sector

Pairwise Granger Causality Tests
Sample: 2005Q1 2015Q4
Lags: 2
Date: 06/05/16   Time: 19:45

Null Hypothesis:	Obs	F-Statistic	Prob.
M3 does not Granger Cause CPS	42	2.48483	0.0971
LNR does not Granger Cause CPS	42	0.05268	0.9488
RR does not Granger Cause CPS	42	0.84301	0.4385
TBR does not Granger Cause CPS	42	2.09805	0.1371
REE does not Granger Cause CPS	42	0.80722	0.4538
RIR does not Granger Cause CPS	42	0.76462	0.4727
RGDP does not Granger Cause CPS	42	0.37902	0.6872
TDEP does not Granger Cause CPS	42	2.40032	0.1047

Source: Author's estimation from E-views7

The Granger causality test results in Table 13 reveals the direction of causality between the various variables representing credit channel ((M3), lending rate(LNR), Treasury Bill rate (TBR),repo rate (RR), real effective exchange (REE), real gross domestic product(RGDP),real interbank rate (RIR)and, total deposit(TEDP),) and credit to private sector . The results above indicate that there is a unidirectional granger causality relationship running from M3 to CPS.

Figure 1: Impulse response function between investment and explanatory variables
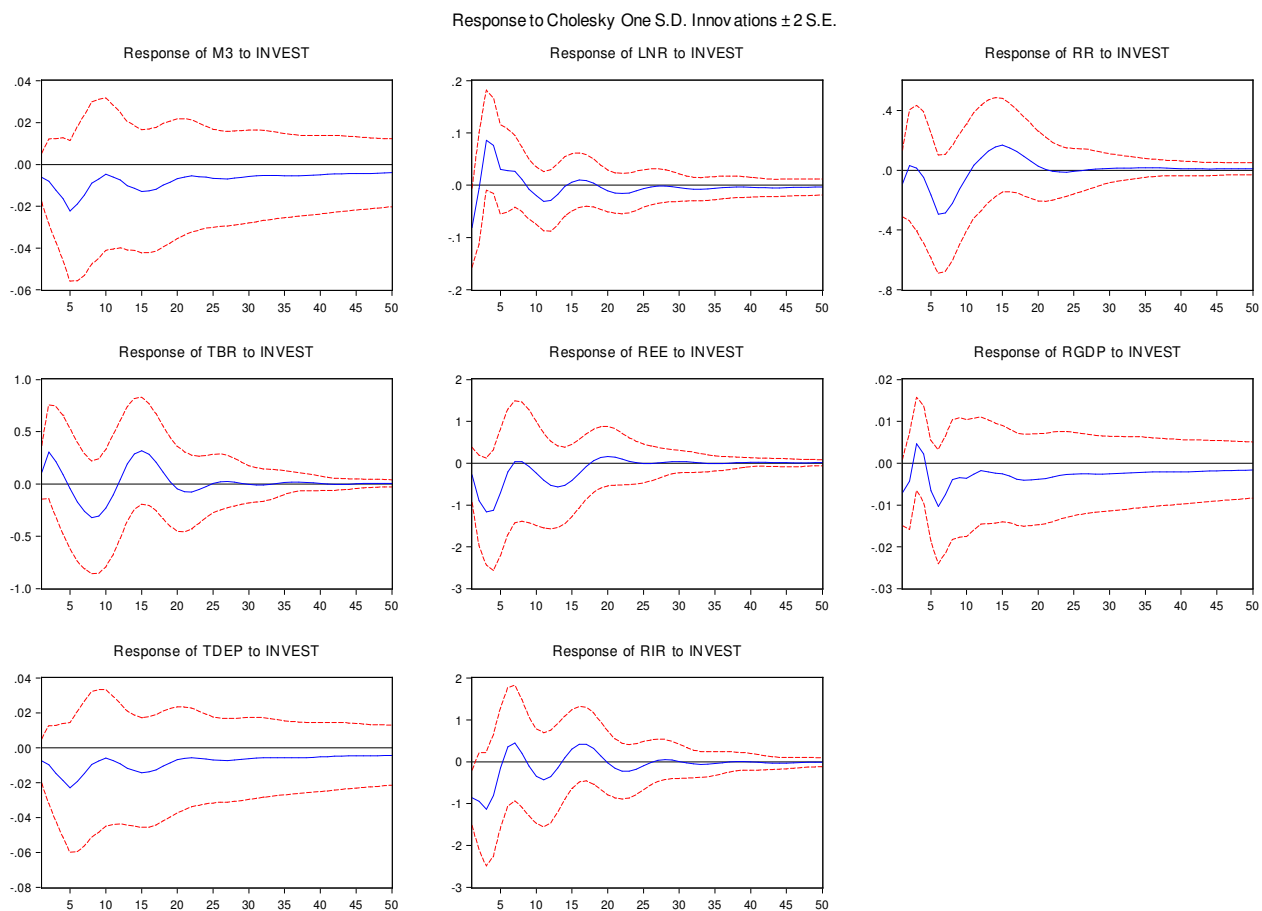

Figure above presents the responses of key economic variables to investment shocks. As expected, although, the impact on these variables are negligible and not statistically significant in short run.. Further, shocks to the investment do not affect all independent variables in short run significantly. In summary, positive independent variables shocks representing credit channel do not generate a significant effect with regard to investment in short run, but in long run.

Figure 2: Impulse response function between inflation and selected variables
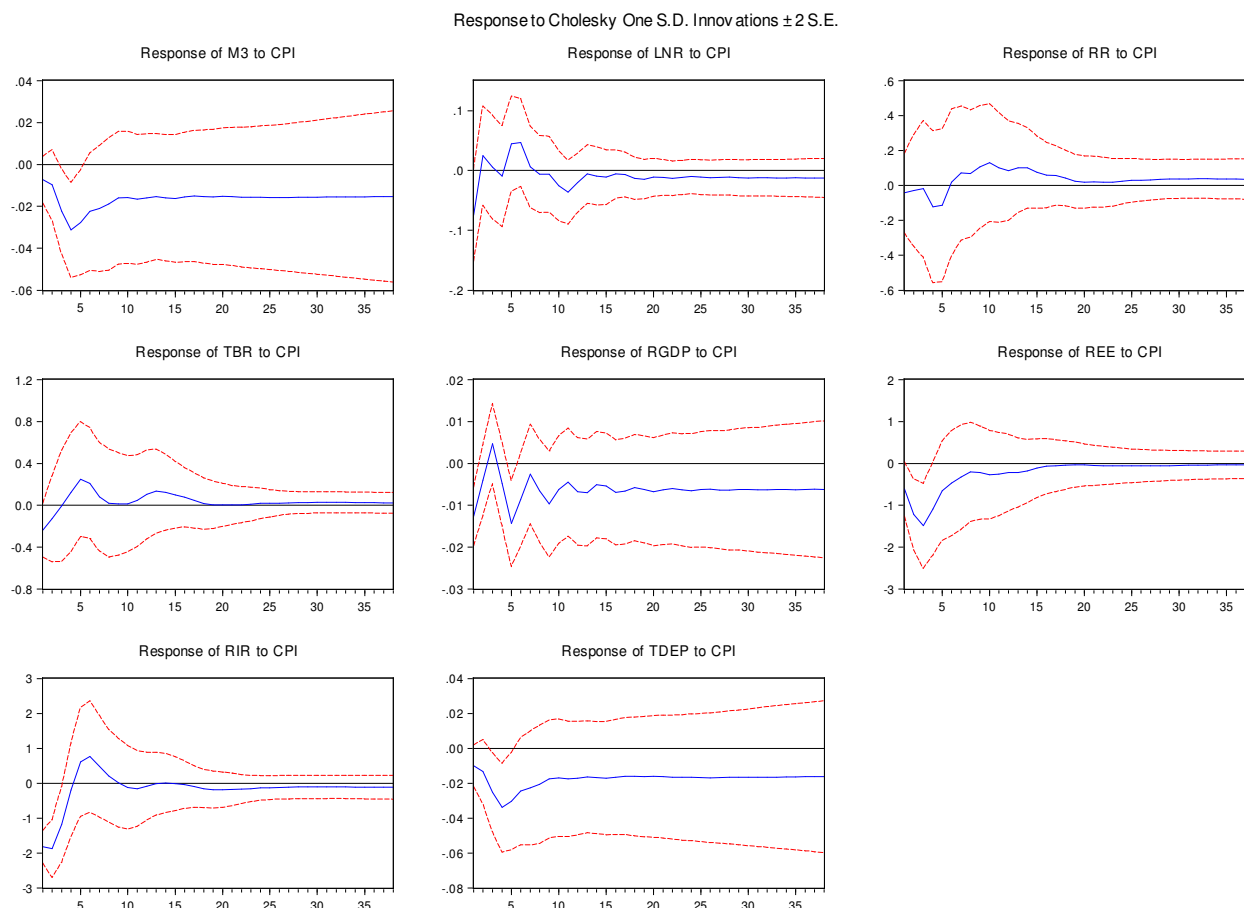

Response to Cholesky One S.D. Innovations ± 2 S.E.

Figure above shows the estimated impulse responses of each economic variable to negative price shocks. The positive money shock on price produced the expected results, as the price increase rather than declined. However, the response of output is short-lived, declining for only a few months and then returning to pre-shock values. Neither the total deposit nor the REE responded significantly to price. In summary, positive independent variables shocks representing credit channel generated a significant effect with regard to inflation in long run.

Figure 3: Impulse response function between credit to private sector and selected variables

Response to Cholesky One S.D. Innovations ± 2 S.E.
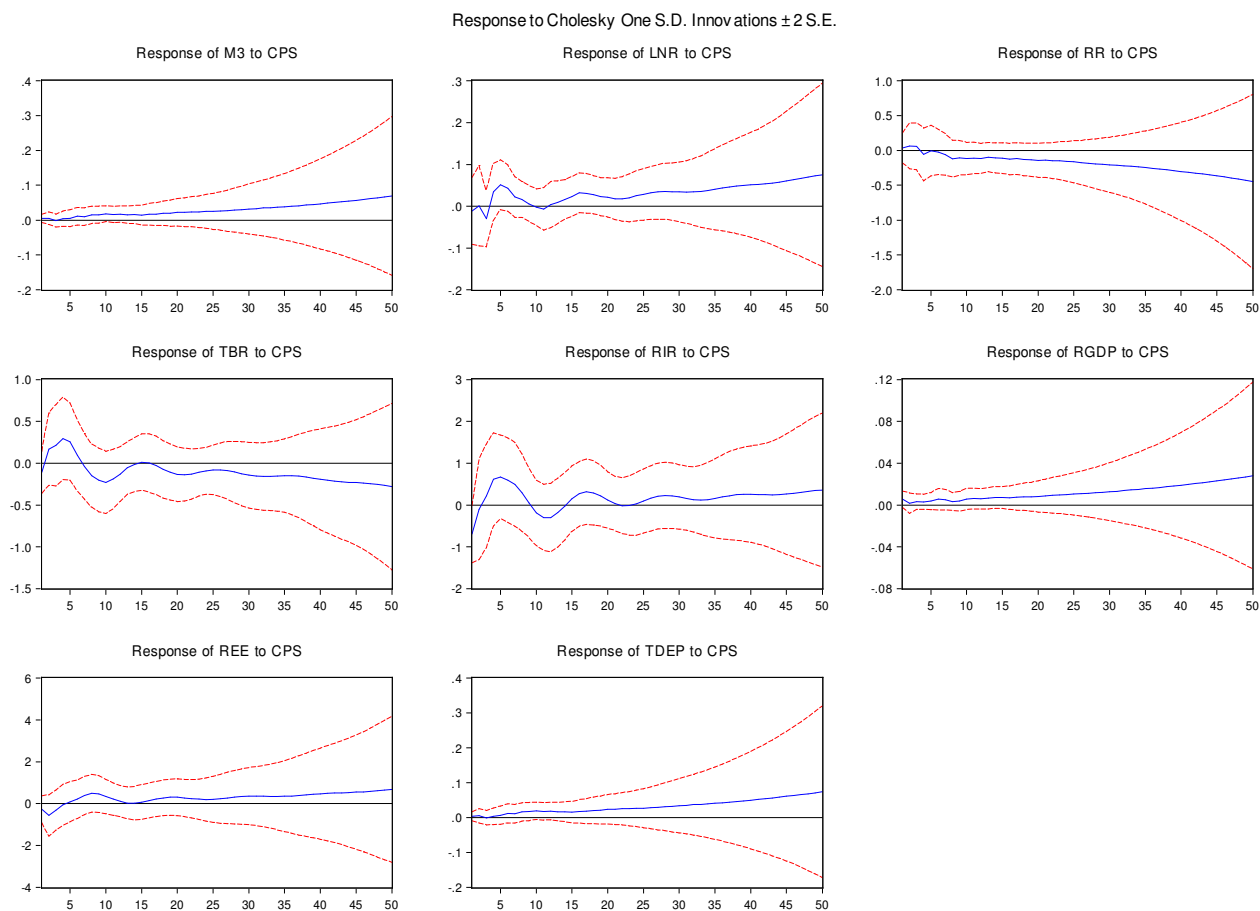
Figure above shows the estimated impulse responses of each economic variable to credit to private sector. The positive money shock on price produced the expected results, as the credit to private sector increase rather than declined. However, the response of output is short-lived, increasing for long time and then returning to pre-shock values. In summary, positive independent variables shocks representing credit channel generated a significant effect with regard to inflation in long run.

Table 15: variance decomposition of investment

Period	S.E.	INVEST	M3	LNR	RR	REE	TDEP	TBR	RGDP	RIR
1	0.117	100.0	0.00	0.00	0.000	0.00	0.00	0.00	0.000	0.00
2	0.144	88.9	0.40	2.94	0.414	3.73	0.95	0.76	0.070	1.72
3	0.158	79.56	2.51	2.45	1.720	5.74	2.01	2.85	1.405	1.73
4	0.163	77.65	3.67	2.79	1.750	5.56	2.18	2.87	1.416	2.08
5	0.166	75.41	4.33	2.75	1.890	5.48	2.36	2.77	1.597	3.39
6	0.170	71.62	5.785	3.088	2.158	5.27	2.555	2.63	1.573	5.296
7	0.173	69.95	6.670	3.268	2.231	5.13	3.153	2.61	1.547	5.425
8	0.174	68.78	6.949	3.305	2.198	5.07	3.838	2.87	1.565	5.406
9	0.176	67.07	6.994	3.605	2.157	5.00	4.835	3.14	1.619	5.292
10	0.178	66.44	7.267	3.904	2.128	4.95	5.215	3.28	1.594	5.208
11	0.179	65.85	7.498	4.001	2.134	4.91	5.453	3.29	1.593	5.244
12	0.179	65.38	7.775	4.053	2.236	4.88	5.570	3.29	1.587	5.204
13	0.180	64.71	8.133	4.273	2.308	4.83	5.724	3.26	1.578	5.166
14	0.182	63.87	8.696	4.539	2.385	4.78	5.756	3.21	1.555	5.192
15	0.183	63.03	9.169	4.801	2.505	4.71	5.853	3.17	1.534	5.202
16	0.185	62.09	9.577	5.087	2.667	4.65	5.966	3.12	1.534	5.297
17	0.186	61.15	9.908	5.459	2.762	4.60	6.160	3.07	1.527	5.340
18	0.188	60.40	10.23	5.723	2.827	4.58	6.301	3.06	1.514	5.350
19	0.188	59.81	10.48	5.875	2.864	4.61	6.469	3.06	1.503	5.312
20	0.189	59.33	10.71	5.957	2.875	4.63	6.597	3.09	1.497	5.280
21	0.190	58.91	10.96	6.008	2.862	4.66	6.719	3.12	1.488	5.245
22	0.190	58.55	11.26	6.021	2.846	4.68	6.796	3.14	1.479	5.215
23	0.191	58.19	11.56	6.022	2.828	4.70	6.884	3.14	1.471	5.185
24	0.192	57.81	11.89	6.027	2.808	4.71	6.966	3.14	1.464	5.168

Source: Author's estimation from E-VIEWS7

Table 16: Variance decomposition of CPI

Per	S.E.	CPI	M3	LNR	REE	RGDP	RIR	RR	TBR	TDEP
1	1.520	100.0	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000
2	2.442	92.116	6.410	3.7766	0.155	0.344	0.213	1.710	0.777	0.904
3	3.110	74.802	5.909	2.3326	0.096	2.302	5.970	3.109	4.384	1.092
4	4.273	40.620	13.53	4.3179	0.860	4.093	16.29	4.072	15.13	1.072
5	5.316	26.755	15.53	4.8331	1.290	4.325	21.90	3.748	20.52	1.085
6	5.821	23.416	15.73	4.5639	1.303	4.264	23.84	3.244	22.36	1.269
7	5.937	23.065	15.49	4.4608	1.269	4.238	24.31	3.126	22.46	1.564
8	5.960	23.023	15.45	4.4283	1.285	4.206	24.25	3.239	22.30	1.813
9	5.995	22.756	15.628	4.3871	1.3184	4.1772	23.977	3.5395	22.335	1.8805
10	6.029	22.539	15.754	4.3415	1.3357	4.1380	23.775	3.9125	22.337	1.8658
11	6.058	22.422	15.755	4.4011	1.3279	4.0980	23.818	4.1415	22.177	1.8583
12	6.093	22.249	15.636	4.6121	1.3188	4.0590	24.112	4.1975	21.934	1.8792
13	6.138	21.970	15.423	4.9029	1.3561	4.0337	24.499	4.1578	21.735	1.9201
14	6.183	21.686	15.212	5.1612	1.4342	4.0344	24.789	4.0978	21.630	1.9541
15	6.217	21.483	15.077	5.3167	1.5279	4.0421	24.923	4.0582	21.592	1.9772
16	6.239	21.371	15.042	5.3640	1.6121	4.0469	24.952	4.0426	21.579	1.9885
17	6.254	21.328	15.071	5.3596	1.6788	4.0514	24.920	4.0380	21.557	1.9945
18	6.266	21.336	15.132	5.3425	1.7203	4.0544	24.861	4.0378	21.518	1.9950
19	6.278	21.368	15.193	5.3245	1.7477	4.0551	24.800	4.0417	21.474	1.9932
20	6.289	21.402	15.235	5.3080	1.7678	4.0574	24.756	4.0459	21.435	1.9897
21	6.300	21.429	15.247	5.2963	1.7849	4.0646	24.738	4.0478	21.405	1.9857
22	6.313	21.442	15.238	5.2935	1.7978	4.0750	24.748	4.0465	21.377	1.9802
23	6.326	21.436	15.213	5.3013	1.8092	4.0859	24.784	4.0419	21.352	1.9739
24	6.339	21.414	15.178	5.3169	1.8193	4.0974	24.846	4.0326	21.327	1.9667

Source: Author's estimation from E-VIEWS7

Table 17: Variance decomposition of CPS

Source: Author's estimation from E-VIEWS7

Period	S.E.	CPS	M3	LNR	REE	RGDP	RIR	RR	TBR	TDEP
1	13.465	100.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	20.198	83.877	3.1630	0.2504	0.1183	0.2765	0.7042	10.269	0.004	1.1732
3	26.938	73.844	8.0900	1.0106	0.8688	0.5166	0.8365	9.7479	0.3807	2.0423
4	34.444	58.406	15.765	3.0867	1.1508	2.4183	2.0978	7.2622	1.0991	2.3200
5	43.615	44.777	22.271	7.0428	1.1690	3.4037	3.1210	4.9351	1.5173	2.6880
6	53.461	35.167	26.656	10.171	1.3304	4.0396	3.9193	3.4323	1.9986	2.7397
7	63.227	28.955	28.125	12.759	1.6486	5.2141	4.5999	2.4964	2.1964	3.0074
8	72.552	25.019	28.279	15.069	1.7621	6.2907	5.3930	1.9476	2.2433	3.2266
9	80.781	23.215	27.797	16.804	1.7501	6.7085	5.9078	1.7112	2.1535	3.6087
10	87.769	22.756	27.133	17.639	1.7188	6.8724	6.2567	1.7162	2.0531	3.9622
11	94.096	23.030	26.204	17.983	1.6897	7.0060	6.4600	1.8876	1.9326	4.3638
12	100.20	23.572	25.379	18.070	1.6098	7.0118	6.6122	2.1915	1.8434	4.6559
13	106.31	24.253	24.748	17.980	1.5219	6.8664	6.6358	2.5267	1.7749	4.9079
14	112.56	24.756	24.434	17.761	1.4580	6.7345	6.6350	2.7736	1.7529	5.0437
15	119.29	24.926	24.329	17.597	1.4264	6.6858	6.6361	2.8829	1.7574	5.1313
16	126.65	24.722	24.460	17.554	1.4049	6.6790	6.6813	2.8826	1.7945	5.1367
17	134.56	24.328	24.668	17.624	1.4068	6.6912	6.7230	2.8094	1.8282	5.1349
18	142.84	23.842	24.868	17.752	1.4306	6.7593	6.7934	2.7056	1.8564	5.1150
19	151.38	23.403	24.939	17.942	1.4622	6.8594	6.8710	2.6099	1.8604	5.1261
20	160.01	23.090	24.919	18.137	1.4790	6.9373	6.9556	2.5527	1.8528	5.1475
21	168.61	22.963	24.799	18.288	1.4872	6.9782	7.0119	2.5406	1.8303	5.2018
22	177.20	22.970	24.637	18.368	1.4863	7.0010	7.0564	2.5669	1.8073	5.2573
23	185.90	23.067	24.452	18.402	1.4775	7.0035	7.0801	2.6176	1.7844	5.3204
24	194.83	23.186	24.308	18.397	1.4615	6.9850	7.0944	2.6765	1.7709	5.3662

The results of the variance decomposition in table 18 over the horizon of 24 quarters, suggests that in the short run, shock to investment account for 100% variations of fluctuations in investment (own shock) and 0% from other variables in that quarter. After 2 quarters the all variables also significantly contributed to the fluctuations in investment. Their contribution has been increasing as the horizon increase. Meanwhile, the fluctuations in investment are mainly attributed to itself but M3 and LNR taking a notable share in the fluctuations as from the beginning of the horizon. The results of the variance decomposition in table 19 over the horizon of 24 quarters, suggests that in the short run, shock to consumer price index inflation account for 100% variations of fluctuations in inflation (own shock) and 0% from other variables in that quarter. After 2 quarters the all variables also significantly contributed to the fluctuations in CPI. Their contribution has been increasing as the horizon increase. Meanwhile, the fluctuations in CPI are mainly attributed to itself but M3, TBR and RIR taking a notable share in the fluctuations as from the beginning of the horizon extend. The result from table20 shows

that the forecast error variance decomposition in CPS are largely due to itself in the first quarter but after 2 quarters the variables M3,LNR,RR and RGDP contributed significantly to the fluctuations in CPS as the horizon extend.

5.1 Introduction

 This chapter consists of the conclusions, the summary of the major findings and policy recommendations.

5.2 Summary of findings

The study was designed to the modeling the effectiveness credit channel of monetary transmission mechanism in Rwanda. The findings from variance decomposition depicts that there is a long run relationship between the real Effective Exchange (REE) and real GDP although real interbank rate lending rate, repo rate, total deposit treasury bill rate , M3 and CPI investment and private sector credit still there exists a pass through effect from a shock in the credit channel. From the study, investment has the weakest response to broad money shock but generally, findings suggest that the credit channel was effective in the long run analysis.

5.3 Conclusions

The general objective of the study was to give measurement the effectiveness of the credit channel of monetary transmission mechanism in Rwanda. This objective was translated in to three specific objectives. The first specific objective was to determine the dynamic effect of credit channel on the consumer price index in Rwanda. The findings suggests 37.3% variations in fluctuations in REE in the second quarter are a attributed to a standard deviation shock in inflation, which maintains almost the same rate in the long run depicting 46.6% with the CPI suggesting that the impact is fingered after the ninth quarter. The second specific objective was to establish the relative importance of the credit channel on credit to private sector whereby the study suggests that 88.9%% variations in fluctuations of CPS are as result of shock to itself and 10.2% as a result of shock from the repo rate. In the long run (10th quarter) 10.2% variations in fluctuation were as a result of one standard deviation repo rate shock. The shock is positively felt in the first quarter after which it neutralizes Findings based on the third specific objective suggest that, credit to private sector variable peroxide by M3 was in the first quarter 87.3%. According to VAR, it had a significant influence of positive nature in second quarter. It was also observed that credit channel explains 26.4% variation in fluctuations in total deposit and 17.6 % fluctuations in GDP in the first quarter while in the 10th quarter; it explains 69.8% variations in fluctuations in CPS.

These results especially on Gdp to a smaller extent does not tally with Cheng''s (2006), whose results suggested insignificant influence of a monetary transmission shock to GDP of Kenya.

Moreover, our findings also indicate that there is a long-run relationship between credit channel and the consumer price index, investment, private sector credit. The Johansen cointegration test applied in our study indicated the existence of a theoretical relationship between the credit channel and investment, consumer price index that they are in symmetry in the long run.

 Furthermore, our results from VAR indicate that the credit channel has a causal impact on the consumer price index inflation, investment and credit to private sector. Both the error-correction model and the generalized variance decomposition analyses applied in this paper tend to indicate that the variable representing credit channel are relatively more exogenous or leading and the investment, consumer price index variable are relatively more endogenous or lagging.

Our findings are in line with the findings of kigabo (2008), who found the credit channel of monetary transmission in Rwanda tested and found to be significant is through credit to the private sector. The results indicate that an increase in the volume of credit to the private sector leads to an increase in real activity but not in the price level; the implication is that credit increases to the private sector are not inflationary. Such credit appears to finance production (aggregate supply) rather than consumption (demand). These results support the idea that monetary policy actions in Rwanda which facilitate private sector credit can help to manage inflationary pressures.

Furthermore our findings are in line with the findings of barebereho (2007) who found that the growing importance of the non-bank and informal financial sector is demonstrated by its contribution to the financing of the economy. In 2006, the financing of this sector represented 29.6% of total credit. This constitutes an important limit on the effectiveness of the credit and interest rate channels. Nonetheless, the upward trend of credit demand by the private sector observed for several years, stemming from the dynamism of the Rwandan economy, is evidence of the contribution of the credit channel in recent years.

5.4 Recommendations

There is need for constant revision of policy and instruments targeting framework and operating procedure to enhance monetary policy effectiveness particularly in stabilizing the exchange rate and keeping inflation levels at the generally recommended rate. There is need for NBR to harmonize and combine the functionality of all channels to achieve optimum output goals of monetary transmission mechanism. This could be complemented with adoption of one policy rate used to signal the market and by so doing will reduce on duplication of activities by different rates and lead to optimum outcomes of monetary policy goals.

Other factors could be used to control inflation other than monetary tools among them being diversification of energy sources large scale mechanized agriculture, engaging in avoidance activities so as to prevent the economy from price shocks occasioned by fluctuation of the dollar when importing this could assisting maintaining inflationary levels at a rate below the government recommended rate of 5%. In advent of financial innovation, it's advisable that the NBR combines other transmission channels of monetary policy to achieve optimum policy outcome as opposed to concentrating on single channel. By so doing, financial innovation may dampen the credit channel but through other channels it might be responsive.

5.5 Suggestions for Further Research

The study sought modeling the effectiveness of credit channel of monetary transmission mechanism on investment, inflation levels and private sector performance. The study suggests further research on modeling the effectiveness of credit channel when interacted with financial innovation variable on asset prices. With increased access to world financial markets by local firms as a result of the Euro bond, the Rwandan financial markets is projected to improve pass through effects on asset prices.

The study could also be further developed by including more variables to the regression model like the 90 days Tb rates and the recently formulated Rwanda Banks Reference Rate as policy rates. In addition, one can incorporate the interest rate channel interacted with credit to private sector.

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