The Credit Channel Transmission of Monetary Policy in Tunisia

Ali Mna and Moheddine Younsi

Department of Economics and Quantitative Methods, Higher Institute of Business Administration of Gafsa, Tunisia,, Unit of Research in Development Economics (URDE), Faculty of Economics and Management of Sfax, Tunisia,

28 December 2017

The Credit Channel Transmission of Monetary Policy in Tunisia

Ali Mna

Department of Economics and Quantitative Methods,
Higher Institute of Business Administration of Gafsa, Tunisia,
E-mail: Ali.mna@gmail.com

Moheddine Younsi

Unit of Research in Development Economics (URDE),
Faculty of Economics and Management of Sfax, Tunisia,
E-mail: younsimoheddine@gmail.com

Abstract

The purpose of this paper is to evaluate the importance of the credit channel in the monetary policy transmission mechanism in Tunisia. Using a VAR approach, we attempt to empirically examine the responses of the main aggregates of the Tunisian economy to monetary policy shocks over the period 1965-2015. Our empirical results showed that credit has a significant effect on investment and inflation. Indeed, the cointegration relationship, coupled with the weak exogeneity test, shows that credit is an endogenous variable and therefore the long-term equation found is a credit equation. The crucial role of credit channel is argued by the goal of price stability expected by any monetary policy. The analysis of monetary shocks shows the importance of exchange rate policy and the local currency devaluation on the financing mode. It is observed that Tunisian economy is dominated by external conditions. This dominance is confirmed by extensive using of external debts and trade agreements with the dominant countries. Ultimately, our findings suggest that policymakers should act on the level of economic activity and inflation, on two terms. The first is in short-run, by acting on the interest rate and the second is in long-run, by controlling the exchange rate.

Keywords: Credit channel, monetary policy transmission, VAR approach, impulse analysis, monetary shocks

JEL Classification Codes: E43, E51, E52

Introduction

The monetary policy transmission channels have been changed with the reforms and deregulation within the policy of monetary and financial liberalization that has been emerged since the late 1980s in most countries. If the interest rate channel now seems more direct, the effect of the monetary aggregates themselves on economic activity may have changed as their definitions evolved. This definition has undergone several modifications depending on the physical quality of the currency (degree of liquidity, maturity, immaterialization) and the theoretical view associated with money itself. In parallel, in the recent recession of United States that began in December 2007 and ended in June 2009, kept interest rates at very low levels have failed to revive economic activity in usual delays, because the distribution of credits has been inefficient (Barran, Coudert and Mojon, 1995). This has cast some doubts on the effectiveness of monetary policy transmission. To the interest rates channel, some authors have proposed to add a bank credit channel (e.g. Stephen and Glenn, 1996; Mishkin, 2011; White, 2009).

If it is now theoretically established that credit rationing may exist, the balancing of this market may involve variables other than the interest rate. Moreover, this rationing, generally carried out by banks during the recession periods, may certainly have a macroeconomic impacts that deserve to be studied. If bank credit is not perfectly substitutable for other financing sources - this is the case for small firms that do not have access to other financing sources - the rationing constraint may have a restrictive effect on demand for goods and also on supply. The work initiated by Bernanke and Blinder (1988, 1992) in the United States raised the issue of monetary policy transmission specific to bank credit. To the interest rates channel and the money demand, we would add a credit banking channel. This latter would regroup the specific effects resulting from the repercussions of monetary policy on bank credit. We can therefore consider the mechanisms of *'financial propagation'*, resulting from the fact that a shock on monetary policy can affect the wealth of firms and thus their access to the main financing resource.

Our objective in this paper is to demonstrate the importance of the credit channel in the monetary policy transmission mechanism in Tunisia. Using a VAR approach, we attempt to empirically examine the responses of the main aggregates of the Tunisian economy to monetary policy shocks over the period 1965-2015. Especially, our exercise consists to simulate the reaction functions of the different variables and the variance decomposition for the different series. In this context, we are concerned with the dynamics of economic activity and inflation in a bank credit model.

The rest of this paper is organized as follows. Section 2 presents the theoretical framework of the credit channel in IS-LM model. Section 3 describes the methodology based on credit channel modeling. Section 4 discusses the results of co-integration, causality and the response functions of the selected variables to monetary shocks. Section 5 concludes and gives annotations on our future work.

Theoretical Framework

The transmission by the credit channel has been the subject of an abundant empirical literature since the 1980s, where the various authors have noted the weakness of the traditional relations of the money view and attempted to demonstrate the specific role of bank credit (see inter alia; Lavoie 1984; Natke 1998; Eric Berr 1999; Rochon 1999; Mathias 2005; Ferreria 2009; Mishkin 2011). But their foundations do not form a truly unified theoretical corpus and the microeconomic explanations evoked may differ from one author to another. The approach is common to recognize the importance of banking assets, and therefore the credit, in the monetary policy transmission.

According to Barran, Coudert and Mojon (1995), the non-neutrality of money can result from the transmission by credit channel. The real effect of a monetary restriction can be reinforced by the decline in credit. Some businesses that do not have access to other forms of external financing are forced to reduce their investment.

The credit channel in IS-LM model

Although the IS-LM model now seems outdated compared to the theoretical developments that followed it, the interpretation of the effects of monetary policy it proposes still serves as a reference. In the basic model, bank credit is not identified in its nominal term. There is only one financing source (bonds), which implicitly amounts to assuming perfect substitutability between securities and credit.

In the case of monetary tightening or contraction of bank reserves, banks may react by increasing their requests for deposits not subject to compulsory reserves, certificates of deposit or term deposits, or well, possibly through the issuance of titles which leading to an increase in interest rates. This increase, by reducing investment, has a real effect. In this context, the behavior of banks, in response to an inflexion of monetary policy, therefore concerns only their liabilities. The asset composition does not appear to be affected. This hypothesis is called into question in the credit channel.

Two reasons could be causing that transmission by 'money channel' is less and less effective. First, a large proportion of bank deposits is today paid to the money market rates, which makes traditional substitutions between money and securities less likely. Second, the compulsory reserves on deposits tend to decrease or even disappear, in the majority of developed countries, which certainly makes the banks less attentive to managing their liabilities to avoid them.

Blinder (1987) showed the consequences of credit rationing on an IS-LM model. He highlighted the real effects of the transition from the economy to a rationing stance and the resulting growth regimes. Bernanke and Blinder (1988) have incorporated, to the stock market, a bank credit market in IS-LM model, and suggest that the standard results have been greatly affected because shocks in the credit supply can lead to divergent effects on both interest rates. Notably, a shock reducing the credit supply, resulting for example from a rise in the risk on bank borrowers, can reduce credit, national income and the rate on government bonds whereas the credit rate rises.

Bank credit and monetary policy transmission

The monetary policy transmission study has oriented academic research towards the credit channel. This channel concerns all the implications that the variations of key rates can react on the credit supply. The economic literature makes a distinction between two types of channels. The first channel is the strict bank credit channel – the key rate changes modify the refinancing conditions of the banks in the money and financial markets. In particular, a tightening of the conditions of banks refinancing weighs on their activity of monetary creation, on their production of credit to the economy and therefore on the business investment and households consumption –. The model of Bernanke and Blinder (1988) showed that, by reducing the banks access to lendable funds, open market operations limit the supply of bank loans.

The second channel is the broad channel of credit or balance sheet channel - as in the theory of the financial accelerator, the quality household's balance sheet structure is considered, but assuming nominal policy shock rather than real shocks on the external finance premium. A change in interest rates thus affects the structure of the balance sheets, hence the external finance premium. An increase in rates will then have significantly greater depressive effects when private agents are already heavily indebted and poorly solvent –.

Thus, the unfavorable impact of a monetary tightening on the ability of companies to repay their debts (the interest rate channel) and the cost of their capital (Q of Tobin) is reinforced by a recovery in the risk premium which banks are weighing on new borrowers. Behaviors in financial markets linked to a change in risk may accentuate the effects on monetary policy stances.

Since its introduction in the literature in the mid-1980s, the credit channel has been the subject of intense controversy. Several empirical studies (e.g. Stephen and Glenn 1996; Jordan 1999; Kalt 2001; Natal 2003; Ferreira 2009; Ioannidou et al. 2009) have sought to assess its importance in relation to other channels of monetary policy transmission (i.e. interest rate channel, exchange rate channel).

According to Curdia and Woodford (2010), the existence of the credit channel involves some conditions. First, companies' dependence on credit (in the case of the broad channel) and more particularly bank credit (in the case of the narrow channel). This implies an imperfect substitutability between titles and credits. Second, the banks are sensitive to their conditions of refinancing with the Central Bank and that they have little alternative possibilities of refinancing markets. Third, the activity of the banks is mainly oriented to the credit and contributes little to the economy by other types of receivables financing.

However, the acceleration of financial innovations and the concomitant development of capital markets, since the mid-1980s, have led many authors to believe that a movement of banking disintermediation of financing took place and followed many attempts of questioning of the credit channel (see Smant 2002).

Admittedly, the emergence of capital markets has offered companies a wider range of financing substitutes for bank credit. On their side, banks have had to adapt to this boom. They have, at the same time diversified their sources of financing (deposits and market resources) and their assets (credit and securities).

Pos-Keynesian credit model

Certainly, effective demand plays a central role in economic thought. Keynes (1936) said that if the propensity to consume and the investment rate give insufficient effective demand, the actual level of employment will be less than the supply of potentially available labor. Estenson (1992) argued that when entrepreneurs decide to produce more goods and services, thus they need to call for more monetary units to the banking system. Insisting on the chronology of operations leading to income formation, Bouvet (1996) has indicated that all contemporary theorists of endogenous money accept the simplified scheme shown in figure 1 which represents the necessity of bank credit in the economic circuit[1].

[1] In this regard, see the interesting contribution of Eric Berr (1999) and the thesis of Rochon (1999). It should be noted that Rochon (1999) used the horizontalistic view by offering a historical overview of endogenous money approaches such as that of the circuit and post-Keynesians. He started with the Franco-Italian circuit school. He first insisted on the early writings of Minsky, Kaldor and Tobin in the 1950s and Davidson (1988) and later Rousseas post-Keynesians followed by the interesting deepening of Joan Robinson and Richard Kahn in the theory of money-credit. Rochon (1999) then compared the present post-Keynesians contemporary structural theory with the new Keynesian monetary thought. He developed an innovative theory of banking on the basis of

Following the post-Keynesian approach, we can accept the following reasoning: an increase in the credit activity of banks, whether consumer credit granted to individuals or loans granted to companies for projects to increase their production, creates an additional demand. If the economy is underemployed, this demand can be met immediately by an increase in production equal to the additional demand. The increase in production gives rise to an equivalent increase in revenues. Indeed the companies which have increased their production have evidently distributed the value of the additional output in the form of wages and profits. By creating ex-nihilo of the money by an increase of their credits, the banks create additional rights on the production. But when the economy is underemployed, this has the effect of increasing production and incomes. These rights are therefore immediately validated, that is to say they can be satisfied without any other rights already created on production having to be reduced.

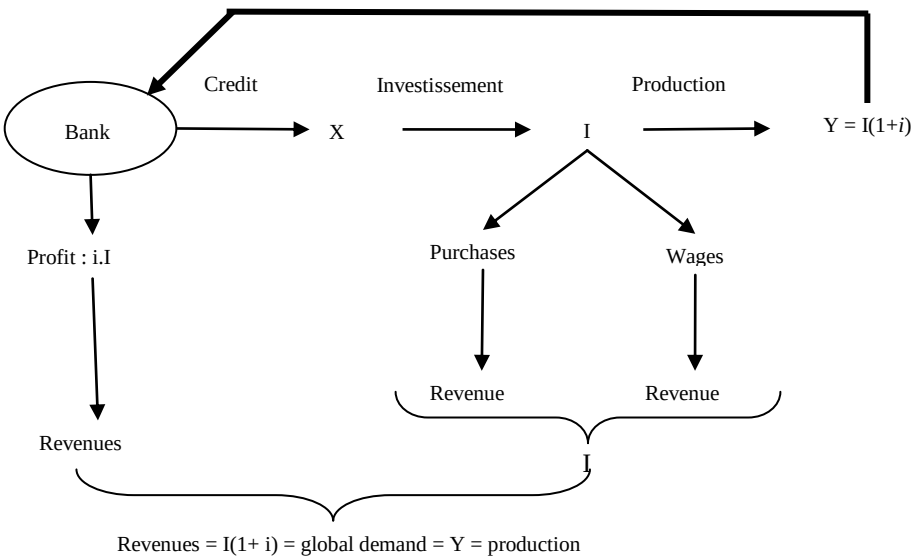

Figure 1. Necessity of Bank Credit in the Economic Circuit

Our approach is inspired by the idea of Natke (1998). The latter sought to integrate the motive of financing[2] into a function of demand for liquidity of the firms. He conducted a micro-econometric study of firms in Brazil to assess the importance of the funding motive in their liquidity demand function and its relationship to the transaction motive. His findings conclude that these two motifs are distinct and significant.

Keynesian uncertainty and in line with the horizontalist tradition taking into account credit restrictions, liquidity crisis and solvency.

[2] Indeed, this motive is considered at the heart of the idea of the endogeneity of money and the monetization of production (Lavoie 1984; Rochon 1999).

Natke (1998) used the work of Laumas (1980), which argued that the pattern of financing is more important in developed countries because of the liquidity lack in the public sector caused by the inefficiency of capital markets and major dependence on banks. To have an appropriate measure for the transaction motive, Natke (1998) proposed the value of sales made more than the current investment spending. The motive for financing in the post-Keynesian logic is introduced only when there is an increase in planned investment spending ($\Delta I > 0$).

Methodology

Credit Channel Modelling

Specify the variables in credit channel model returns to determine the indicative variables of monetary policy with an explanatory and significant power in relation to an indicator of real economic activity. The central variable in this model is represented by domestic credit that plays a crucial role in the economy of debt. In our case of Tunisia, this variable is defined as the sum of net claims on the government and the lending to the economy. The latter consists of credit to the economy and the securities portfolios. Thus domestic credit is the credit in a broad sense in the financing of the economy. The credit channel model is empirically analyzed by several economists (e.g. Paquier 1994; Barran, Coudert and Mojon 1995; Goux 1996; Payelle 1996).

In order to cope with capital spending, entrepreneurs use credits. The investment amounts and sources of financing are mainly short-term bank credits[3]. In financing demand function, it is necessary to introduce the interest rate that is, in basically theoretical, linked to the behavior of the banking system and to the mechanisms for creating appropriations intended to cover the needs of economic activity. We propose a model-based specification (1) which integrates the credit indicator into a macroeconomic aggregate system.

$$LSTC_t = \beta_0 + \beta_1 LINV_t + \beta_2 MMR_t + \beta_3 RER_t + \beta_4 LPCI_t + v_t \qquad (1)$$

With, LSTC is log Short-Term Credit, LINV is log Investments, MMR is Money Market Rate, RER is Real Exchange Rate; LCPI is log Consumer Price Index, and v_t is the error term. The data are sourced from the Central Bank of Tunisia (CBT) over the period 1965-2015. All variables are transformed in logarithms, with the exception of MMR and RER.

[3] The choice of short-term credit is justified by the importance of its proportion compared to other medium and long-term credits (more than 70% of total bank credit. (Statistical source: CBT).

In order to carry out an impulse study and analyze the shocks, we begin by highlighting the dynamism that exists between the variables. The aim here is to know the order of causality between these different variables that is necessary in the study of the decomposition of variability forecasts.

Highlight the dynamism

Each production flow requires a flow of a new credit or a renewal of a former credit (Lavoie 1984; Wray 1991; Natke 1998). Borrowers are the cause factor, and then the banks decide whether or not to make the production possible. We see as well that credit creation precedes production. Without this creation, production becomes impossible, or at least restricted. Thus, when one has at time t, the credit for this period is for the identification of the anticipated investments in (t + 1) and therefore the production. In a political sense, the preferred instrument affecting the amount of credit granted. In addition, the exchange rate can be constituted as an intermediate target for monetary policy in an open economy. Therefore, the order of dynamism in the VAR analysis is as follows:

However, Barran, Codert and Morjon (1995) used this order in their estimate of the credit channel. These authors added the money supply between the exchange rate and the credit. In our case, we have eliminated the money supply because it is much correlated with the credit variable, since the linear correlation coefficient between the aggregate LM2 (monetary aggregate in broad sense in log) and LSTC on our study period is about 0.98. Figure 1 shows the importance of the credit volume in the economic circuit, motivated us to built a model of demand for credit.

Results

To check the stationary properties of variables, we use the specification of the augmented Dickey-Fuller (ADF) unit root test. This test is applied first on the level of variables, then on their first difference. Table A1 (see appendix) reports the results of ADF test. The results show that all series are non-stationary in level, but they are stationary in first difference. This implies that the series of variables may exhibit no unit root problem after one differentiation and then we can use these series of variables to analyze the long-run relationship.

Graphical Analysis

Figure 2 provides us an idea on the evolution curves of MMR, RER, LSTC, LPCI, and LINV used in our model (1) during the study period (1965-2015). The RER is defined as the price of the Tunisian Dinar in terms of USD. We can conclude an extraordinary depreciation of the RER throughout the study period. The LPCI has been growing steadily, reflecting the purchasing power of Tunisian citizens, which has continued to deteriorate. LSTC and LINV showed a positive trend despite some passing feedback. For the MMR, the statistics release significant peaks on the rise on the eve of the implementation of the structural adjustment plan. However, this increase is under control and the MMR is gradually returns to its starting level. The MMR curve reflects clearly that this rate is administered.

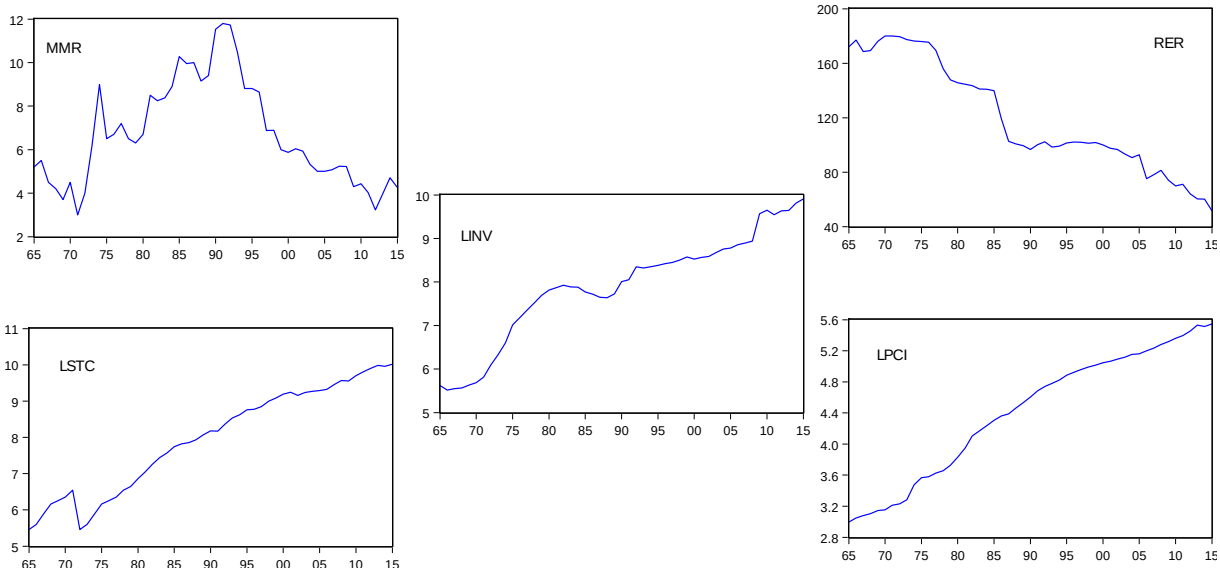

Figure 2. Evolution Curves of MMR, RER, LSTC, LPCI, and LINV, 1965-2015

Number of VAR lags

From table A2 (see appendix), we noticed that two criteria of information (SC and HQ) indicated the presence of a single lag in our VAR model. The other criteria are considered overestimating the order of the VAR for our case. Therefore, we accept that our model is VAR (1) expressed as follows:

$$Y_t = A + BY_{t-1} + \varepsilon_t$$

Where $Y_t = (MMR, RER, LSTC, LPCI, LINV)^T$ is the vector of our five variables, $A = (a_i)$: the vector of constants of the 5 equations, which express the current variables (at time t) in function of their period lags.

$B(b_{ij})$ is the (5x5) matrix of coefficients associated with first lag variables. ε_t is error terms vector. Error terms $\varepsilon_{i,t}$ represent the innovations that will be explored after in the impulse analysis.

Results of cointegration tests

The Johansen test shows, in two ways, the presence of one cointegration relation. Indeed, the Trace and Lamda-max statistics are not significant for r = 0, but they are significant for r = 1 at the 5% level. Table A3 (see appendix) provides the results of these two tests. However, the cointegration relations found by the Johansen tests, normalized with respect to LSTC, is as follows:

$$LSTC_t = 5.187 - 0.029MMR_t - 0.013RER_t + 0.558LPCI_t + 0.347LINV_t \qquad (2)$$

The general levels of prices and investment have a positive effect on the amount of credit granted. This relationship, which presented in Figure 3, is characterized by an enormous upward peak at the beginning of the period, apparently caused by the increase in inflation during the first oil crisis (1973). In addition, the coefficient of inflation is higher in the long-run relationship (Eq. (2)). Another peak, but less important, is observed during the start year of the implementation of the structural adjustment plan (1986). Afterwards, we noticed a certain stability that characterizes the rest of the period.

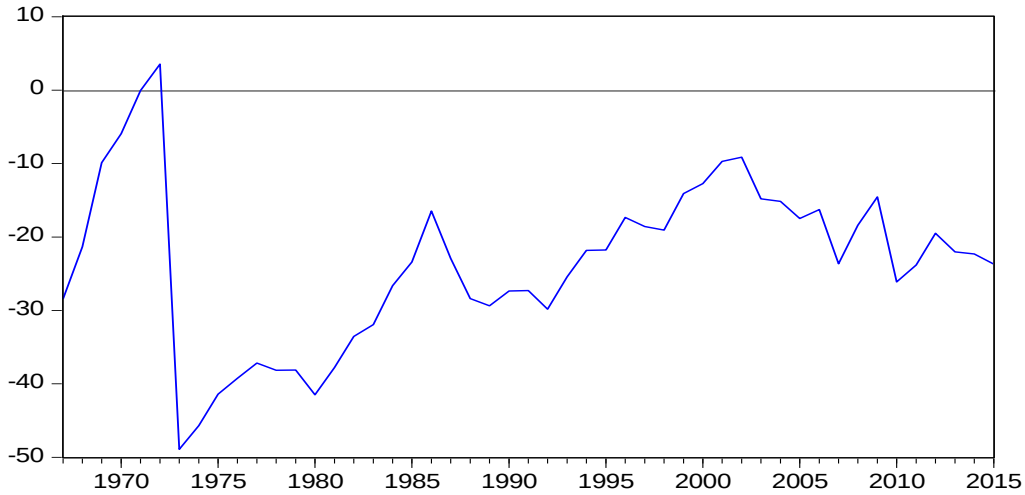

Figure 3. Long-term Relationship Curve

Moreover, the results of the weak exogeneity test show that LSTC and LPCI variables are not weakly exogenous. Therefore, the other variables are weakly exogenous. Table A4 (see appendix) reports the result of

this test for the five selected variables of the relation (1). We can deduce the importance of credit variable (LSTC) and its attachment to inflation (LPCI). This result shows that Eq. (2), normalized in LSTC, is well accepted because the hypothesis that the variable LSTC can be considered as endogenous is accepted according to this test. Inflation (LPCI) is also influenced by other variables. Indeed, the monetary authorities appear to have two policy instruments: the interest rate (MMR) and the exchange rate (RER). This fact need to be examined by a causality test.

Causality Analysis

We adopt the VECM model under the constraint of one cointegration relation and applied the Wald causality test on the variables in first difference. The number of lags is that of the VAR (1). The short-term effect of the interest rate (MMR) on credit (LSTC) and inflation (LPCI) can be derived from this causality test (see table 1). The latter was highly influenced by the MMR variation, since the associated *p-value* is less than 1% level. The credit, on its part, influences only inflation in short-term. Inflation is affected also by MMR. We conclude the importance of a MMR instrument and the bidirectional causality between inflation and credit.

Table1. Results of Granger Causality Test

Dependent variable : D(MMR)			
Excluded	Chi-sq	df	Prob.
D(RER)	0.030765	1	0.8608
D(LSTC)	2.579291	1	0.1083
D(LPCI)	0.235134	1	0.6277
D(LINV)	0.213319	1	0.6442
Dependent variable : D(RER)			
Excluded	Chi-sq	df	Prob.
D(MMR)	0.200106	1	0.6546
D(LSTC)	0.032625	1	0.8567
D(LPCI)	0.222312	1	0.6373
D(LINV)	1.620572	1	0.2030
Dependent variable: D(LSTC)			
Excluded	Chi-sq	df	Prob.
D(MMR)	3.957491	1	0.0467
D(RER)	1.426395	1	0.2324
D(LPCI)	3.163684	1	0.0753
D(LINV)	1.517700	1	0.2180
Dependent variable: D(LPCI)			
Excluded	Chi-sq	df	Prob.
D(MMR)	14.80417	1	0.0001
D(RER)	0.677022	1	0.4106
D(LSTC)	4.159233	1	0.0414
D(LINV)	0.931298	1	0.3345
Dependent variable: D(LINV)			
Excluded	Chi-sq	df	Prob.
D(MMR)	0.234040	1	0.6285
D(RER)	2.686443	1	0.1012
D(LSTC)	0.072846	1	0.7872
D(LPCI)	0.391211	1	0.5317

As already mentioned, the short-run causality test did not yield much to the interdependence between the considered variables of our system with the investment rate. To better refine our analysis, in the next section, we will examine through an impulse study the reaction functions between the different variables to monetary policy shocks.

Results of Impulse Response Functions

In this section, we attempt to simulate the reaction functions of the main aggregates to monetary policy shocks represented by MMR, RER and LPCI as well as the variance decomposition of the prediction error for the different series. Indeed, these three instruments may be controlled by the monetary authorities. The influences of these variables are registered by the reaction functions of the different variables following positive shocks on these instruments.

Figure (4a) presents the impulse response functions of MMR following to shocks on the above three indicators (MMR, RER, LPCI). We observe that MMR is self-explanatory. In the short-term, the effects of RER and -with a lower level- the inflation rate are negative. In the medium-, and long-term, these effects fade.

Figure (4b) presents the impulse response functions of RER. The effect of MMR is positive in the short-and medium-term. But, in the long-term, this effect begins to disappear. Similarly LPCI has a positive impact in the short-term. We noticed that after four years, this impact becomes significantly negative.

Figure (4c) presents the impulse response functions of inflation rate according to monetary indicators. We take care from this figure that inflation is positively affected by the MMR and negatively by the RER.

We can conclude here that inflation increase with MMR and currency depreciation. These phenomenons are two faces of the economic crash. Indeed, highest interest rates can lead to real economic degradation thought the 'inflation channel'. This act due to the last American financial crisis which has engulfed the most developed economies. In its part, currency depreciation can affect local inflation by growing the importation prices for commodities.

Figure (4d) traces the impulse response functions of LSTC. The impact of MMR shock is observed to be negative in the short, medium and long term. Therefore, the monetary authorities can act on the volume of credit by their action on MMR (credit rationing policy). The inflation rate, on its part, has a negative impact in the short- and medium-term. This effect vanishes and becomes positive after five years. In the long-term, the credit reaction becomes higher. The influence of the external exchange rate influences positively in the short-term. However, monetary appreciation plays a restrictive role on the amount of domestic credit.

For investment, there is an immediate negative effect of MMR (Figure 4e). After two years this effect becomes positive, grows and becomes more stable in the long-term. Similar to its effect on credit, the RER influences positively in the short-term, but in the medium- and long-term this effect becomes more and more negative. So, we note that there is certain coherence between the responses of the investment and the financing resources. Exchange rate policy is important in this regard. Thus, the devaluation of the local currency may have an adverse role on investment in the short-term, but in the long-term this effect is reversed and becomes profitable.

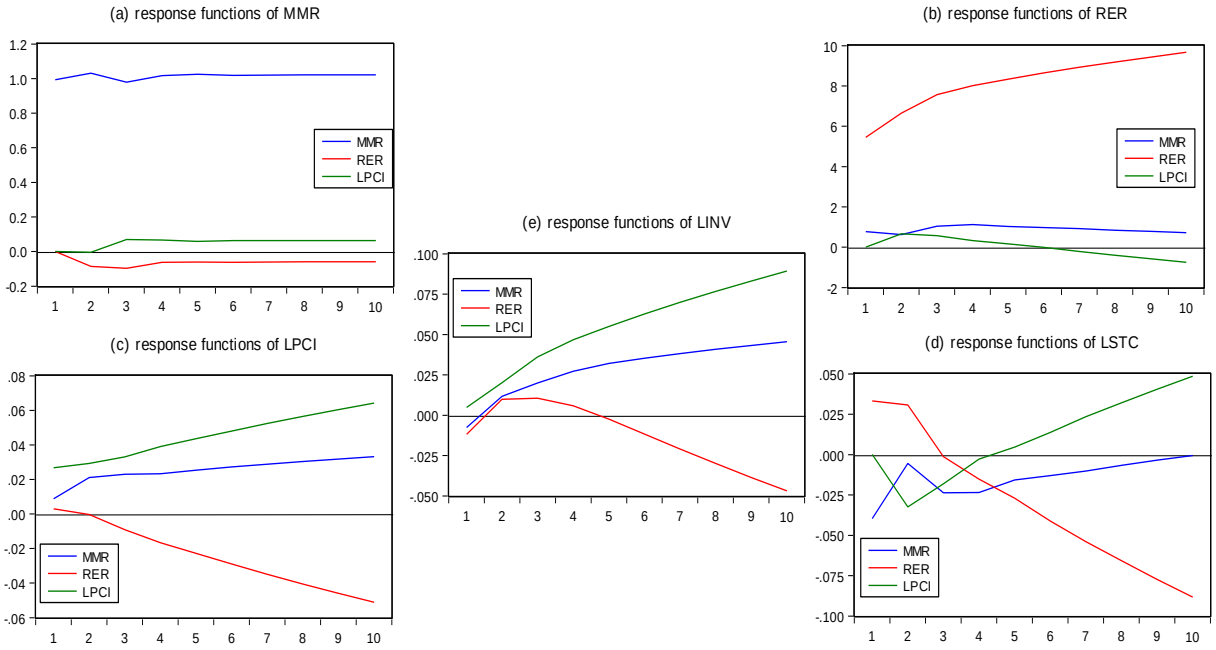

Figure 4. Impulse Response Functions

Variance decomposition of (MMR, RER, LSTC, LPCI, LINV)

On the variance decomposition of MMR, we observe that MMR is characterized by an important self-explanatory power (see Table 2a). Indeed, even at 10-year horizon, the MMR yielded only 10% of its variability. The ceded part is captured by the credit (7.67%). This result shows that the interest rate is too much administered in Tunisia. In addition, it leaves a small portion of interdependence with the amount of credits granted.

From the result of the variance decomposition, RER is also self-explained (see Table 2b). We can conclude that this variable is not explained by the domestic economic aggregates. The Tunisian economy is clearly dominated by international circumstances. Indeed, the value of local currency is a quantity which internal sizes cannot play a significant role in its determination.

For the variance decomposition of LSTC (see Table 2c), we observe that the credit does not have the same attitude as the two previous variables (MMR and RER). Indeed, it ceded its explanatory power to other variables, notably the RER. After 10 years, the credit keeps only 50% of its explanatory power. The most important variable contributing to LSTC variability is RER. The latter maintains 35% of this variability. The rest is not large enough, is subdivided between MMR and LINV (6%, 7%, respectively). This result confirms the previous idea of the importance of exchange rate policy in determination of long-term internal aggregates. To these effects, monetary policy, on long horizons, must take into account exchange rate expectations.

According to the monetarists, inflation is a monetary phenomenon. This is true for our case in Tunisia. Indeed, in the short-, and medium-term, an important part of the variability of LPCI is caused by MMR (see Table 2d). In medium-, and long-term, the contribution of credit (LSTC) becomes more and more important. The RER receives its share of 17.5% in this long-term contribution. These three factors summarize the monetary and financial situation inside and outside the country.

The variance decomposition of LINV reflects a certain increasing contribution over time of the credit amount in the investment activity (see Table 2e). We observe, from this result, the utility of the credit variable in the determination of the volume of domestic investments. This contribution reflects the importance of the credit channel in the transmission of the effects of monetary policy actions through its classical instruments.

Table 2a. Variance Decomposition of MMR

Horizon	S.E.	MMR	RER	LSTC	LPCI	LINV
1	1.000869	100.0000	0.000000	0.000000	0.000000	0.000000
2	1.478666	94.64043	0.232210	4.708409	0.093045	0.325908
3	1.796489	91.64202	0.372699	6.971937	0.090509	0.922833
4	2.077893	91.32538	0.314322	7.112150	0.101292	1.146857
5	2.334627	91.12522	0.268147	7.259031	0.089897	1.257703
6	2.562531	90.83526	0.242437	7.474233	0.084597	1.363472
7	2.770870	90.68408	0.220730	7.572442	0.082817	1.439927
8	2.965276	90.60762	0.202237	7.618836	0.080298	1.491007
9	3.147425	90.54973	0.187470	7.654514	0.077865	1.530422
10	3.319186	90.51311	0.175120	7.674406	0.075874	1.561490

Table 2b. Variance Decomposition of RER

Horizon	S.E.	MMR	RER	LSTC	LPCI	LINV
1	5.608409	1.327843	98.67216	0.000000	0.000000	0.000000
2	8.881208	0.748194	98.11750	0.184145	0.135399	0.814764
3	11.88864	0.849410	97.10090	0.919685	0.130472	0.999536
4	14.59837	0.935029	96.36012	1.613011	0.092047	0.999796
5	17.10208	0.919427	95.68489	2.389802	0.067069	0.938809
6	19.49789	0.885416	94.89452	3.326763	0.055506	0.837790
7	21.82042	0.845912	94.01944	4.348650	0.058783	0.727217
8	24.09039	0.799593	93.08754	5.414048	0.075139	0.623681
9	26.32815	0.751227	92.10451	6.509717	0.102122	0.532424
10	28.54610	0.703878	91.08602	7.616844	0.137992	0.455270

Table 2c. Variance Decomposition of LSTC

Horizon	S.E.	MMR	RER	LSTC	LPCI	LINV
1	0.167708	6.282025	2.540715	91.17726	0.000000	0.000000
2	0.218248	3.734585	2.608287	90.94083	2.260370	0.455926
3	0.234956	5.027578	2.528445	88.99350	3.030407	0.420069
4	0.247363	6.600174	3.579454	86.30125	2.870186	0.648940
5	0.256146	7.226630	5.936996	83.08092	2.702028	1.053430
6	0.265527	7.653442	10.37963	77.59842	2.518687	1.849823
7	0.279139	7.770471	16.49051	70.32104	2.392885	3.025094
8	0.298418	7.427113	23.26735	62.55998	2.386880	4.358679
9	0.324623	6.734136	29.71530	55.40751	2.490850	5.652213
10	0.358067	5.870732	35.05502	49.63695	2.683072	6.754230

Table 2d. Variance Decomposition of LPCI

Horizon	S.E.	MMR	RER	LSTC	LPCI	LINV
1	0.024579	16.79018	2.054930	1.445882	79.70901	0.000000
2	0.042610	37.84844	0.689987	5.413961	56.04704	0.000576
3	0.062907	32.52027	3.189751	22.00056	41.69807	0.591347
4	0.086832	24.04904	6.790449	33.61361	33.97724	1.569654
5	0.113284	18.84125	9.632517	40.31274	28.94924	2.264253
6	0.142543	15.16805	11.95199	45.04375	25.05537	2.780845
7	0.174257	12.41839	13.83046	48.39557	22.16002	3.195558
8	0.207875	10.40784	15.32010	50.74900	20.00381	3.519239
9	0.243143	8.907946	16.51400	52.47252	18.33310	3.772431
10	0.279864	7.752954	17.48757	53.77569	17.00780	3.975991

Table 2e. Variance Decomposition of LINV

Horizon	S.E.	MMR	RER	LSTC	LPCI	LINV
1	0.130574	0.512907	1.154508	12.11155	0.752413	85.46862
2	0.217999	0.340735	0.576578	17.27194	1.614962	80.19579
3	0.299360	0.448679	0.417055	21.08573	2.330118	75.71842
4	0.375369	0.586767	0.278586	24.22181	2.867024	72.04581
5	0.448310	0.690403	0.207392	27.10979	3.268104	68.72431
6	0.519678	0.751800	0.243952	29.76498	3.592181	65.64708
7	0.590260	0.788318	0.388347	32.17198	3.863171	62.78819
8	0.660633	0.809644	0.624273	34.35207	4.091039	60.12297
9	0.731176	0.820227	0.931684	36.32394	4.284742	57.63941
10	0.802086	0.823670	1.290844	38.10299	4.451143	55.33135

Table 3, which based on the impulse response functions, provides a recapitulation of the role of the policy instruments in our empirical analysis. We thus noticed the importance of the three instruments (MMR, RER, and LPCI) and their short-term effects, in the case of MMR, and long-term in the case of the RER. In addition, Figure 5, which based on the variance decompositions, provides a recapitulation of the long-term causal relationships. We can conclude the usefulness of the credit channel in the determination of the volume of investments and its role in the transmission of the effects of monetary policy actions based on the MMR and the RER. Inflation, as we have already seen, is as a consequence of monetary factors and expansionary credit policies.

Table 3. Role of Policy Instruments

	MMR			RER			LPCI		
Response variables	ST	MT	LT	ST	MT	LT	ST	MT	LT
MMR	+	+	+	-	-(*)	0	-	0	0
RER	0	+	0	+(*)	+(*)	+(*)	0	0	-
LPCI	+	+(*)	+(*)	0	-(*)	-(*)	+	+	+
LSTC	-	-(*)	-	+	-	-(*)	-(*)	-	+(*)
LINV	-	+	+	-	+	-	+	+(*)	+(*)

Notes: ST, MT, LT denote short-, medium-, and long-term respectively, (*) denotes the importance of the associated effect, (0) denotes the absence of effect.

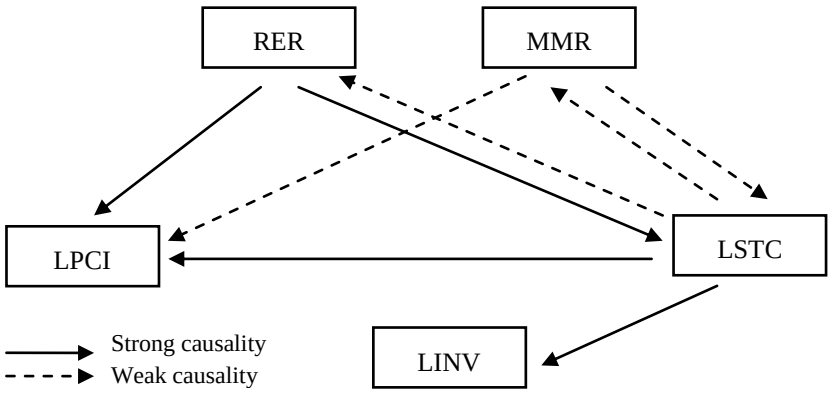

Figure 8. Long-run Causal Relationships

Concluding Remarks

In this study, we have examined the importance of the credit channel in the transmission mechanism of monetary policy in Tunisia. Our contribution is to empirically examine the responses of the main aggregates of the Tunisian economy to monetary policy shocks over the period 1965-2015, using a VAR approach.

Our empirical results showed that credit has a significant effect on investment and inflation. Indeed, the cointegration relationship, coupled with the weak exogeneity test, shows that credit is an endogenous variable and therefore the long-term equation found is a credit equation. The crucial role of credit channel is argued by the goal of price stability expected by any monetary policy. The empirical analysis of monetary shocks shows the importance of exchange rate policy and the local currency devaluation on the financing mode. It is observed that the Tunisian economy is extremely dominated by external conditions. This dominance is confirmed by the recourse to external debts and trade agreements with the dominant countries.

Moreover, our policy of instrument has its effectiveness due to credit channel to overall horizons. However, for short horizons, the interest rate occupies the first place. For medium and long horizons, it leaves its place to the exchange rate. The importance of the latter reflects that the Tunisian economy is dominated by external conditions. This dominance is confirmed by extensive using of external debts and trade agreements with the dominant countries.

Ultimately, our findings suggest that policymakers should act on the level of economic activity and inflation, on two terms. The first is in short-run, by acting on the interest rate and the second is in long-run, by controlling the exchange rate. The latter should be stable to protect the local currency against devaluation and its hurmfull risks.

In the future research it is anxious to make an empirical examination on the role of the interest rate within the CBT's reaction function according to the Taylor's rule in its dynamic approach.

References

Barran,F., Coudert, V., Mojon, B. ''Transmission de la politique monétaire et crédit bancaire. Une application à trois pays de l'OCDE''. *Revue économique* 46, 2 (1995): 393-413.

Bayangos, Veronica, B. "Does the bank credit channel of monetary policy matter in the Philippines?" available at www.bis.org/repofficepubl/arpresearch201003.12.pdf, 2010.

Bernanke, B.S., Blinder, A.S. "Credit, money an aggregate demand." *American Economic Review* 78, 2 (1998): 435-439.

Bernanke, B. S., Blinder, A.S. "The federal funds rate and the channels of monetary transmission." *American Economic Review*, 82, 4 (1992): 901-921.

Blinder, A.S. (1987). Credit Rationing and Effective Supply Failures. The Economic Journal, 97 (386): 327-352.

Bouvet, P. ''Les théoriciens contemporains de la monnaie endogène : consensus et désaccords.'' *L'Actualité économique* 72, 4 (1987): 451-470.

Curdia, V., Woodford, M. "Credit Spreads and Monetary Policy." *Journal of Money Credit and Banking* 42, s1 (2010): 3-35.

Davidson, P. "Endogenous Money, the production process and inflation analysis." *Economie Appliquée tome* 4, 1 (1988): 151-169.

Davidson, P. "Money: Cause or Effect? Exogenous or Endogenous?" in Nell and Semmler, editors, Nicholas Kaldor and Mainstream Economics, 1992.

Eric Berr. ''Demande effective, monnaie et prix de production : une extension circuitiste de la Théorie générale.'' 51ème congrès de l'Association Internationale des Economistes de Langue Française, Marrakech, 31 mai-02 juin, 1999.

Estenson, P.S. "Keynesian Theory of the Price Level: a vector auto-regression model." Journal of Post Keynesian Economics 14, 4 (1992: 547-560.

Ferreria, C. "The Credit Channel Transmission of Monetary Policy in the European Union." WP 08/2009/DE/UECE. 2009.

Goux, J.F. ''Le canal étroit du crédit en France (essai de vérification macro-économique, 1970-1994).'' Revue d'Économie Politique 106, 4 (1996): 655-681.

Ioannidou, V., Ongena, S., Peydrò, J. "Monetary policy and subprime lending: a tall tale of low federal funds rates, hazardous loans and reduced loan spreads." European Banking Centre Discussion Paper, No 2009-04S, 2009.

Jordan, T. "The information content of bank credit for forecasting output and prices: results from Switzerland." Swiss National Bank, unpublished working paper, 1999.

Kalt, D. "The credit channel as a monetary transmission mechanism: some microeconometric evidence for Switzerland." *Schweizerische Zeitschrift für Volkswirtschaft und Statistik* 137 (2001): 555-578.

Keynes, J. M. "The General Theory of Employment, Interest and Money." London: Harcourt Brace. 1936.

Laumas, P.S. "Some evidence of Keynes' finance motive." *Journal of Development Economics* 7, 1 (1980): 123-126.

Lavoie, M. (1984). The endogenous Flow of Credit and the Post-Keynesian Theory of Money. *Journal of Economic Issues* 18, 3 (1984): 771-797.

Mathias, Z. "Credit in the monetary transmission mechanism: an overview of some recent research using Swiss data." Swiss National Bank Economic Studies No. 2005-1. 2005.

Mishkin, F.S. "Monetary Policy Strategy: Lessons from the Crisis." NBER Working Paper No. 16755. 2011

Natal, J.M. "The credit channel in Switzerland: empirical evidence using a (B) SVAR." Swiss National Bank, unpublished working paper, 2003.

Natke, P.A. "Keynes' finance motive and firm behavior: empirical evidence." *JPKE* 20, 2 (1998): 275.

Natke, P.A. "The firm demand for liquid assets in an inflationary environment." *Applied Economics* 33, 4 (2001): 427-436.

Paquier, O. ''Les effets de la politique monétaire sur l'activité passent-ils par le canal du crédit?'' *Revue française d'économie* 9, 2, (1994): 71-104.

Payelle, N. ''Conditions de fonctionnement du canal du crédit et gestion des bilans bancaires: Une approche empirique dans le cas français.'' *Revue d'Economie Politique*, 106, 4 (1996): 683-703.

Rochon, L.P. "Credit, money and production an alternative post Keynesian approach." Edward Elgar Cheltenham, UK, Northampton, MA, USA. 1999.

Smant D. "Bank Credit in the Transmission of Monetary Policy: A Critical Review of the Issues and Evidence." Miméo, Erasmus University Rotterdam. 2002.

Stephen, D.O., Glenn, D. R. "Is There a Broad Credit Channel for Monetary Policy?" *Federal Reserve Bank of San Francisco Economic Review*, No. 1 (1996): 3-13.

White, W.R. "Should Monetary Policy 'Lean or Clean'?" Federal Reserve Bank of Dallas Working Paper No 34. 2009.

Wray, L.R. "Alternatives approaches to Money and Interest Rates." Journal of Economics Issues, 26, 4 (1991): 1145-1178.

Appendix

Table A1. Augmented Dickey-Fuller (ADF) Test

Variables	Level		First difference	
	ADF statistic	Prob.	ADF statistic	Prob.
MMR	-1.291	0.626	-6.477**	0.000
RER	-1.946	0.615	-5.603**	0.000
LSTC	-2.346	0.402	-6.875**	0.000
LPCI	-1.100	0.708	-4.211**	0.001
LINV	-1.089	0.712	-5.032**	0.000

** indicates significance at the 5% level.

Table A2. VAR Lag Order Selection Criteria

Lag	FPE	AIC	SC	HQ
0	0.612415	13.69900	13.90175	13.77419
1	1.24e-05	2.881661	4.098154*	3.332795*
2	1.08e-05	2.702939	4.933176	3.530019
3	7.12e-06*	2.161963	5.405944	3.364987
4	7.55e-06	1.973875	6.231600	3.552845
5	8.01e-06	1.572454*	6.843923	3.527369

Notes: * indicates lag order selected by the criterion; FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

Table A3. Determination of the Number of Cointegrating Relations

Hypothesized No. of CE(s)	Trace statistic	Prob.	Lamda-Max statistic	Prob.
r= 0*	98.70169	0.0005	56.31103	0.0000
r= 1	42.39066	0.3562	22.67050	0.2369
r= 2	19.72017	0.7441	9.809199	0.8497
r= 3	9.910968	0.6486	6.278102	0.7561
r= 4	3.632866	0.4695	3.632866	0.4695

* indicates number of cointegration relations according to the null hypothesis.

Table A4. Weak Exogeneity Test

Variable	Likelihood Statistics	Deg. of freedom	Prob.
MMR	0.719283	1	0.396379
RER	3.158376*	1	0.075538
LSTC	13.37786***	1	0.000255
LPCI	27.17474***	1	0.000000
LINV	1.713580	1	0.190522

*, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.