The credit channel of monetary transmission mechanizm

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Abstract

This paper looks into the existence of a credit channel of monetary policy for the Indian Economy from 1994 April 2002 March. For this we use the relative movements in bank loans, commercial paper, new capital issues and euro issues to see the presence of a loan supply channel of monetary policy transmission.Our analysis shows that during this time there was a fall in credit demand due to industrial recession reflected in the lack of growth of non bank sources of credit. Also we tested for causality between non food credit to industries (NFCI) and index of industrial production (manufacturing)(IIPM). We find that there is an unidirectional causality from NFCI to IIPM thus indicating that NFCI does possess a lead indicator characteristic.

Introduction

In a developing economy with emerging financial markets, the financing of industrial activity is heavily bank based which implies movements in bank credit has much information content in respect of the performance of the industrial sector. During the phase of liberalization especially after 1993-94 a close movement is observed between the growth of non food credit and growth of industrial production. However in the latter half of the decade, we see some abberation of this movement (RBI 2001). This has warranted a need for a critical re- examination of the interlinkages between bank credit and output growth. In particular, we look into the 'lead indicator'[1] characteristics ascribed to non food credit (NFC) in the context of industrial activity in India.

The interlinkages between bank credit and output growth has been analyzed in the context of the credit channel of transmission of monetary policy. Empirical evidence tends to favour the operation of the credit channel in emerging economies as well as developed economies particularly in the context of small business. (RBI 2001).

In this context we will investigate the relationship between non food credit and index of industrial production. Our study is different from the previous studies on this issue in the following respects-

(1) Previous studies have looked into the relationship between NFC and industrial production (Rath 2003). However NFC contains items such as credit to agriculture, wholesale trade, etc which are not required for testing the credit channel. So we focus only on that part of NFC given solely to industry (small, medium and large) as that is more relevant in the present context. Similarly in index of industrial production we restrict ourselves to the index of industrial production (manufacturing) which has a weight of approximately 80% of the total. We believe that bank credit has an important role in the performance of this sector.

(2) The studies so far has tested the relationship using Granger Causality approach using an unrestricted VAR framework. However, if two variables are cointegrated then the

[1] The leading indicator analysis of business cycles is woven around the view that economies experience cycles with expansions occurring at about the same time in many economic activities followed similarly by general recessions that merge into the expansion phase of the next cycle.

correct representation is Vector Error Correction rather than unrestricted VAR wherefrom we can test for causality. We have tried to use this framework in our analysis.

(3) The impulse response analysis is used to analyze the dynamic relationship among variables and also to corroborate the results of Granger Causality.

(4) We have also looked into some non econometric evidences of the credit channel through the composition of external finance which have given new light to the debate.

The remaining part of the chapter is arranged as follows. Section I we briefly review the literature on the credit view. In Section II, we analyze the composition of external finance. Section III explains the econometric methodology used in this chapter. In Section IV we discuss the data sources and definitions. Section V contains the results and finally Section VI concludes.

I Review Literature

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 mechanizms 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 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 Econometrica 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 endogeneity, it provides little evidence concerning the nature of the transmission mechanizm. 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 rediscountable 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 defence spending (G), the monetary base (B) and M1 (M). He estimates the VAR with instumental variable method and finds that—

(1) Credit shocks are important for output, the inability of the standard VAR methodology to find this being due to its failure to separate correctly the 'truly exogenous' component of credit from its endogenous part.

(2) The new estimates do not imply that the credit channel has replaced the monetary channel, instead money and credit are parallel forces of approximately equal importance.

The second strand of empirical research focusses on whether changes in monetary policy have the power to shift loan supply. These studies examine the comovements in the stance of monetary policy, loans and activity.This in turn requires one to quantify the stance of monetary policy. Bernanke and Blinder(1992) carries out a VAR exercise showing that changes in the funds rate do affect economic activity. They take changes in the funds rate to be indicative of changes in the stance of monetary policy and find that a tight monetary policy (represented by an increase in the funds rate) do indeed reduce the volume of deposits of banks. Banks react to reduced deposits in the short run by selling of securities. In the longer run, portfolios are rebalanced with the primary effect falling on loans. Thus over time, the borrowers who are dependent on bank loans for credit are adversely affected due to reduced supply of loans which can depress the economy.However another study undertaken by Romer & Romer(1990) suggests an independent role of money in affecting output. With regard to lending, it suggests that movements in lending are largely determined by movements in output.

Kashyap, Stein and Wilcox (1993) (KSW) has stressed an identification problem in the empirical verification of the credit channel. They argue that 'Just because a fall in output coincides with a fall in loans does not establish that the former was caused by the latter. It is possible that the entire output response to the policy tightening was due to the conventional money channel and that the fall in the quantity of loans simply reflects a decrease in loan demand (due to reduced output) and not a reduction in loan supply. Thus they consider the relative fluctuations in bank loans and a leading substitute for bank loans- commercial paper. The intention behind this exercise is in their own words- 'Suppose that monetary policy operated solely through a money channel and that the fall in bank loans seen when the Fed tightens is due only to an output induced effect on credit demand. Then one should expect the demand for nonbank sources of credit to decline as well, leading to a reduction in say the volume of commercial paper issues. If on the other hand, Fed tightening reduces the supply of bank credit, one might expect an increase in commercial paper issuance, to the extent that business have some ability to substitute between the two sources of finance.'

To verify that the central bank can affect loan supply, KSW examine movements in the 'mix' (ie, ratio of the bank loans to the sum of bank loans and commercial paper) following changes in the stance of monetary policy. Using both the Federal Funds rate and the Romer's policy proxy, KSW find that when the central bank tightens, commercial paper issuance surges while loans (slowly) decline. This gives cresedence to the credit view as many potential borrowers who formerly relied on bank short term credit were forced to turn to the commercial paper market. Hoshi, Scharfstein and Singleton (1991) conduct an analogous set of tests using aggregate Japaneese data..

There have been a number of studies on the credit channel in the Indian context.

H Mukhopadhyay (1999) in his paper identifies a set of supply constrained firms during the year of tight credit policy in India and then tests the 'credit channel' hypothesis by selecting those firms only.He finds that bank credit do indeed influence inventory accumulations.Also
small bank dependent industries suffer most during the period of quantitative credit controls.

In the RBI (2001a) study an empirical investigation of the non food credit market is undertaken in the post reform period using monthly data from May 1993 to September 2001 using the framework of Bernanke- Blinder(1988). The results from the shock effects shows that a positive shock in advance rate has the predictable negative effect on credit demand and IIP. Also a positive shock to the bank's lendable resources has the predictable positive effect on the demand for credit and IIP although their impact is lower than the interest rate. This implies that the credit channel supplements the interest channel in monetary transmission in India.

In the RBI (2002) study the monetary transmission process is examined in the 1990s vis-a vis the 1980s using the vector autoregression (VAR) framework The variables chosen for the VAR exercise are – Index of Industrial production, Wholesale Price Index, Non food credit, Broad Money and Call Money rate. The VAR is estimated for the pre reform (1981:04 to 1990:06) and the post reform (1994:04 to 2002:12) period separately.The results of the empirical exercise in terms of impulse responses show that – a positive shock to non-food credit has a positive effect on output and the response during the post 1994 period is quicker showing evidence of the credit channel.Lastly Rath and

Bose (2003) tested the credit model for India in the post reform period using the cointegration approach. They find evidence of a bidirectional causality between non food credit (NFC) and index of industrial production (IIP). This implies that a fall in industrial output makes banks less inclined to offer credit to industry and also credit demand is predominantly and positively influenced by industrial activity.

Overall we find the existing results based on aggregate data fairly supportive of the credit channel. There is a significant body of evidence starting with very simple correlations and moving through a fairly precise set of tests that suggests that monetary transmission operates at least partially through induced shifts in loan supply

II Composition of External Finance

Before we proceed to the econometric exercise it will be worthwhile to examine the point raised in the KSW(1993) paper ie, the identification problem in the Indian context. The authors arguue that if monetary policy operated solely through the money channel and that the fall in bank loans, when the Central bank tightens, is only due to an output induced effect on credit demand then one should expect the demand for non bank sources of credit to decline as well. If on the other hand, Central bank tightening reduces the supply of bank credit then one might expect an increase in the non bank sources of finance as the private sector will then try to substitute between bank and non bank soures of finance.

We test this hypothesis with respect to the Indian data from 1994 April to 2002 March when bank credit to industries diminished due to huge investments of commercial banks in Govt. securities. In India the main sources of non bank finance for the private sector are – new capital (K) issues, CPs and euro issues. Figs (1), (2),(3) and (4) presents the data of the log of non food credit (LNFC), log of commercial paper (LCP), log of euro issues (Leuro) and log of new K issues (Lnewk) respectively. We see that during this period there was a steady growth of non food credit (although the magnitude is not very large) (fig 1) whereas there was a dip in the issue of commercial paper from 94-96 (fig.2). Commercial paper issues recovered after that but it didn't show a phenomenal growth in the later years. Coming to the new K issues, there is too much noise in the data but it shows a overall downward trend during the later half of the nineties (fig3).Lastly the noise

in the euro issues data is much more and the data doesn't show an increasing or a decreasing trend. (fig 4).

We now look into certain key ratios.Fig (5) shows the ratio of non food credit to the aggregate of all sources of external finance. We see that although the ratio did come down initially, it picked up from 95 onwards. This clearly indicates that the share of bank credit in the total external finance did not register a fall which means there wasn't a phenomenal growth in the non bank sources of finance to the private sector.It should also be noted that resources through euro issues can be raised only by big companies, whose dependence on bank credit is much less. So leaving out euroissues, we take the ratio of bank credit and the sum of all sources of external finance barring euroissues. It is seen that (fig 6) the ratio is still quite high thus supporting our previous conclusion.

The above analysis is damaging for the credit view as it shows that there wasn't a large growth of non bank sources of finance following a restrictive monetary policy. This highlights the presence of a fall in credit demand via the output effect of a restrictive monetary policy. The credit view on the other hand argues that a restrictive monetary policy works from the supply side and the banks' reduction in credit supply leads to a fall in output. This corroborates the earlier studies of Rath and Bose(2003), RBI (2001) where the importance of demand factors was stressed leading to a low offtake of credit from banks.

III Methodology

This paper uses a VAR model that includes non food credit to industry and index of industrial production (manufacturing). Tests for non stationarity are first conducted followed by tests of cointegration, estimation of a vector error correction model, tests for granger causality, impulse responses and variance decomposition.

Nonstationarity

The first step is to test whether the series are stationary. The classical regression model requires that the dependent and independent variables in a regression be stationary in order to avoid the problem of what Granger and Newbold(1974) called 'spurious regression'.

Nonstationarity or the presence of a unit root can be tested using the augmented Dickey-Fuller (1979,1981) tests.

The ADF test is valid under the assumption that the error terms follow an AR process of known order and that the error terms are homoscedastic. Phillips and Perron (PP) (1988) developed a non-parametric test which is valid despite the presence of serial correlation of unknown form and hetroscadasticity in the error terms. Thus we also conduct the Phillips-Perron (1988) test for a unit root. The test statistics for the PP test are modifications for the t-statistics employed for the ADF tests.

If the variables are nonstationary, we test for the possibility of a cointegrating relationship.

Cointegration

The possibility of a cointegrating relationship between variables is tested using the Johansen and Juselius (1990,92) methodology. If the variables are indeed cointegrated, we can construct a vector error ccorrection model (VECM) that captures both the short run and long run dynamics.

Consider the n variable p-dimensional vector autoregressive model

. $X_t = A_1X_{t-1} + A_2X_{t-2} + \ldots\ldots + A_pX_{t-p} + \varepsilon_t$

Where X_t = the $(n\times1)$ vector $(X_{1t}, X_{2t}, \quad X_{nt})$ of I(1) variables.

ε_t = an independent and identically distributed n dimensional vector with zero mean and variance matrix Σ_ε

For testing the hypothesis of cointegration the model is reformulated in the vector error correction form.

$$\Delta X_t = \sum_{i=1}^{p-1} \Pi_i \Delta X_{t-1} + \Pi X_{t-p} + \varepsilon_t$$

where $\Pi = -[\, I - \sum_{i=1}^{p} A_i]$ $\qquad$ $\Pi_i = -[\, I - \sum_{j=1}^{p} A_j \,]$

Here the rank of $\prod$ is equal to the number of independent cointegrating vectors. If the vector X_t is I(0), $\prod$ will be a full rank $n\times n$ matrix. If the elements of the vector Xt are I(1)

and cointegrated with rank(Π) =r, then $\Pi=\alpha\beta'$, where α and β are n×r full column rank matrices and there are r<n linear combinations of X_t.

Johansen and Juselius(1990,92) suggest the LR test based on the maximum eigenvalue (λmax) and trace (λtrace) statistics to determine the number of the cointegrating vectors. The λtrace statistic tests the null hypothesis that the no. of distinct cointegrating vectors is less than or equal to r against a general alternative. The λmax tests the null that the no. of cointegrating vectors is r against the alternative of r+1 cointegrating vectors.

If the presence of cointegration is established, the concept of Granger causaity can also be tested in the vector error correction VECM framework. For example, if two variables are cointegrated, ie, they have a common stochastic trend, then causality in the Granger (temporal) sense must exist in at least one direction (Granger, 1986, 1988). Thus in a two variable vector error correction model, we say that the first variable does not Granger cause the second if the lags of the first variable and the error correction term are jointly not significantly different from zero. This is tested by a joint F or Wald χ^2 test.

. **Impulse Response Analysis**

Dynamic relationships among variables in VAR models can be analyzed using innovation accounting methods that include impulse response functions.. An impulse response function shows the dynamic response of the dependent variable to a standard deviation shock in an independent variable as a function of the forecast horizon.

The impulse responses can be described in the following way-

If we take a VAR model of standard form ie,

$$xt = Ao + A1xt\text{-}1 + et$$

Where xt is an (n×1) vector containing n variables.After some manipulation this can be written in a moving average representation, represented as

$$xt = \mu + \sum_{i=0}^{\infty} \varphi t\text{-}i$$

The moving average representation is an especially useful tool to examine the interaction among the variables included in the VAR. Suppose we have two variables yt and zt. The coefficients of φi can be used to generate the effects of εyt and εzt shocks on the entire time paths of yt and zt sequence. The four elements of φjk (0) are impact

multipliers. The accumulated effects of unit responses in εyt and εzt can be obtained by the appropriate summation of the coefficients of the impulse response functions.The four set of coefficients φ11(i), φ12(i), φ21(i), &φ22(i) are called impulse response functions. Plotting the impulse response function is a practical way to visually represent the behaviour of yt and zt series in response to the various shocks.

Variance Decomposition

Understanding the properties of the forecast errors is exceedingly useful in uncovering the interrelationship among the variables in the system. If we have a VAR model in the standard form

$$x_t = A_o + A_1 x_{t-1} + e_t$$

and we know that the coefficients of A_o andA_1 and we want to forecast the variance values of x_{t-1} conditional on the observed values of x_t. Updating the above equation for one period and taking the conditional expectation of xt+1 we obtain,

$$E_t x_{t+1} = A_0 + A_1 x_t$$

One step ahead forecast error is

$$x_{t+1} - E_t x_{t+1} = e_{t+1}.$$

More generally the n step ahead forecast is

$$E_t x_{t+n} = (I + A_1 + A_1^2 + \ldots + A_1^{n-1}) A_0 + A_1^n x_t$$

And the associated forecast error is

$$e_{t+n} + A_1 e_{t+n-1} + A_1^2 e_{t+n-2} + \ldots + A_1^{n-1} e_{t+1}$$

If x_t contains two sequences y_t and z_t, it is possible to decompose the n step ahead forecast error variance of each due to the other's shocks.

Thus the forecast error variance decomposition tells us the proportion of the movements in a sequence due to its own shocks versus shocks to other variables. If ε_{zt} shocks explain none of the forecast error variance of y_t at all forecast horizons, we can say that the y_t sequence is exogenous. In applied research, it is typical for a variable to explain all its forecast variance in short run horizons and smaller proportions in long run horizons.

.IV Data

For empirical verification of the credit channel, data on Non food credit (NFC) of scheduled commercial banks is used.(RBI 2001). This comprises of several items like agriculture, small scale industries, large and medium industries, wholesale trade and others. We felt that to test the proper spirit of the credit channel the NFC disbursed solely to industries (small, medium, large) should be the relevant variable. However data on sectoral deployment of non food credit is available only on an yearly basis whereas data on NFC is available on a monthly basis. So we calculate the monthly data of NFC given to industries– NFCI through a linear interpolation formula.(It is to be noted that the range of variation of the percentage of non food credit going to industries based on yearly data is between zero and three within any two years in the entire sample period.) We then convert the data into logs defined as LNFCI.

The proxy for the output variable is taken to be the index of industrial production (IIP). However a sector wise classification of the IIP comprises of Mining &Quaring, Manufacturing, Electricity. The items consist of weights of 10%, 80%,10% (approx) respectively. We use the Index for Industrial Production (Manufactoring) (IIPM) which consists of seventeen major industry groups – Food products, Cotton textiles, Jute, Metal products etc. This to our opinion is the relevant output variable of industry for which data is obtainable on a monthly basis... The series is then converted into logs defined as LIIPM

IV Results

This section analyzes the results of the analysis. First of all we check whether the variables are non stationary. The ADF and PP tests (Table1-2) show that both the variables are I(1) variables with respect to at least one of the tests.

As the variables are integrated of the same order, we test whether they are cointegrated using the Johansen's methodology.The first step in the Johansen's procedure is to find the optimal lag length. We use the likelihood ratio test which suggests that the optimal lag length is two.

The next step is the selection of the deterministic terms in VAR. As the data exhibit a linear trend, we select an intercept in VAR but no trend. The results show that there is a cointegrating relationship based on both λtrace and λmax statistic.(Table 3)

The cointegrating equation is as follows-

LNFCI = 1.93LIIPM+2.39

As the variables are cointegrated, the Vector Error Correction Method is the ideal method for testing Granger Causality and not unrestricted VAR. The reason for this is that the time paths of cointegrated variables are influenced by the extent of deviation from the long run equilibrium. If the system containing LNFCI and LIIPM is out of equilibrium at any point in time and if the system is to return to the long run equilibrium the movements of at least one of the variables must respond to the magnitude of the disequilibrium.

Thus we use the Vector Error Correction framework to test whether (1) LIIMP is not Granger caused by LNFCI and (2) LNFCI is not Granger caused by LIIMP. The results (Table 4) reject the null hypothesis that LIIMP is not Granger caused by LNFCI but cannot reject the null hypothesis that LNFCI is not Granger caused by LIIMP. Thus there is a unidirectional causality running from LNFCI to LIIPM.This finding contradicts the results of RBI(2001) of a bidirectional causality between NFC and IIP.

Impulse responses are shown in figures 7& 8. The direction of changes observed in the impulse responses conform to the results of Granger causality. Fig. 7 shows that the response to LIIPM to a one standard deviation shock to LNFCI is positive and does not converge to zero in the subsequent periods. Fig. 8 shows that the response to LNFCI to a one standard deviation shock to LIIPM though positive initially, falls rapidly towards zero in the later periods. This conforms the results of uniform causality (LNFCI to LIIPM) obtained from the VAR exercise.

The variance decompositions are reported in Table 5.For each variable in the left hand column, the percentage of the forecast error variance for six, twelve and twenty four months ahead that can be attributed to shocks in each of the variables is reported.If a variable is exogenous in the Granger sense ie, if the other variables in the model are not useful in predicting it, a large proportion of that variable's should be explained by its own innovations. If another variable is useful in explaining a left-hand column variable, that variable will explain a positive percentage of the prediction error variance.

Table 5 reports the variance decompositions of the LIIPM and LNFCI variable.At the forecast horizon of 24 months innovations in LNFCI explain about 38% of the total forecast error variance of LIIPM. However innovations in LNFCI is explained

mostly by its own innovations (at the 24 year period 99.8% of the total forecast error variance of LNFCI is explained by its own innovations.). Since innovations in LNFCI explain a large proportion of the fluctuations in LIIPM, NFCI is potentially useful in predicting IIPM. These results are consistent with the unidirectional causality tests.

Thus from our econometric exercise we have obtained that commercial banks' reluctance to provide credit to industry has a detremental effect on output and credit has a 'lead indicator' property.

Conclusion

In this paper we have carried out two exercises. One, we have looked into the magnitude of other sources of external finance besides bank credit and analyzed certain key ratios.This exercise highlights the importance of demand factors manifested in the low credit offtake from banks. This hints that the conventional 'money view' may be working in the Indian economy in the second half of the nineties decade where a restrictive monetary policy had an output induced effect on credit demand. Second we have carried out econometric tests which shows a unidirectional causality running from non food credit to the index of industrial production. This provides evidence of the 'credit view' which says that a decrease in credit supply adversely affects industrial activity as small and medium enterprises cannot readily shift to other sources of finance.

.Thus our conclusions from the study are-

(1) Both the 'credit channel' and the 'money channel' of transmission are relevant for the Indian economy be in India in the second half of the nineties decade.

(2) There was a lack of demand due to industrial recession during this period which resulted in a low credit offtake from banks.

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Fig 1

Movement of Lnfc

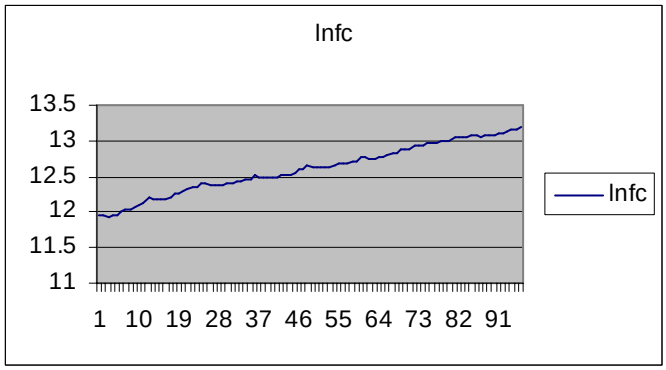


Fig 2

Movement of Lcp

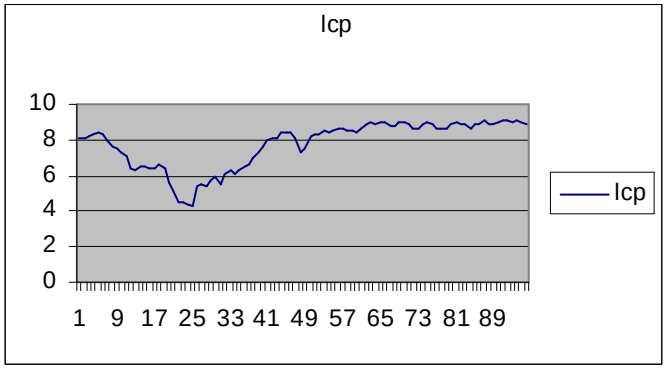


Fig 3

Movement of Leuro

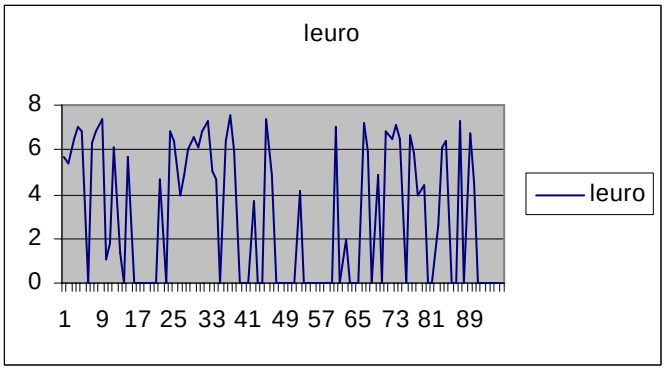


Fig 4

Movement of LnewK

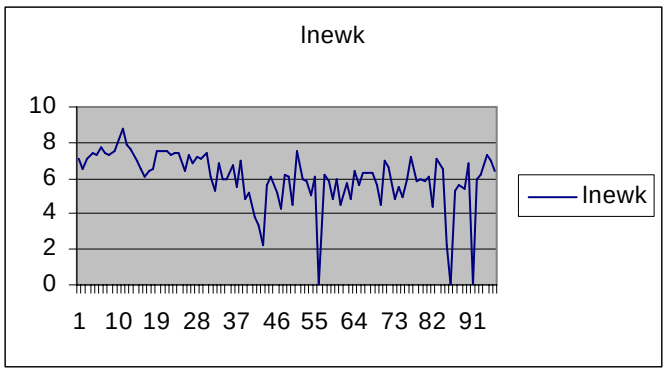


Fig 5

Movement of nfc/agg

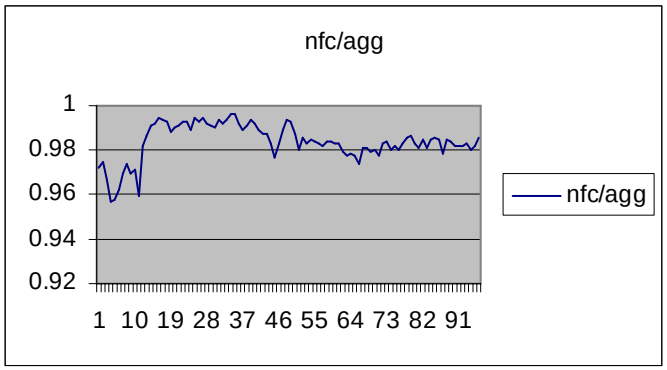


Fig 6

Movement of nfc/all

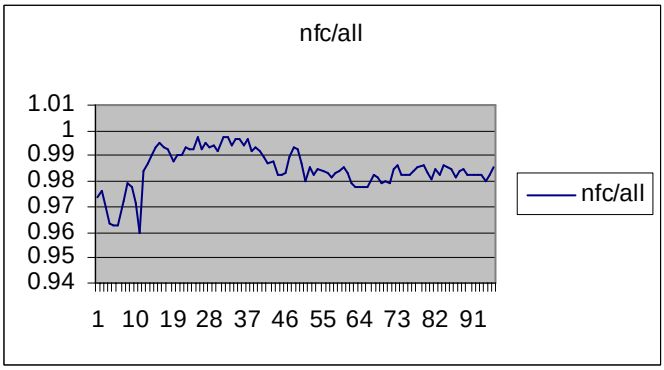


Table1

ADF Test -LNFCI LIIPM

Variables	LNFCI	LIIPM	CV(10%)
No. of lags	8	8	
Const, Trend			
δ =0 (Z test)	_	_	-18.2
δ =0 (T test)	-2.96	-3.03	-3.13
a0 =δ =a2 =0	12.7	9.63	4.03
a0 =δ =0	9.26	6.0	5.34
Constant, No Trend			
δ =0 (Z test)	_	_	-11.2
δ =0 (T test)	-3.5	-2.12	-2.57
a0 = δ =0	15.39	10.08	3.78

Table2

PP test – LNFCI_LIIPM

Variable	LNFCI	LIIPM	CV(10%)
No. of lags	1	1	
Const,Trend			
δ =0(Z test)	-8.07	-31.7	-18.2
δ =0(T test)	-2.16	-4.05	-3.13
a0 =δ=a2=0	10.33	7.69	4.03
a0=δ=0	3.03	10.13	5.34
Constant, No trend			
δ=0(Z test)	-1.10	-3.51	-11.2
δ=0(T test)	-1.55	-1.51	-2.57
a0=δ=0	13.69	2.61	3.78

Table3

Johansen's Cointegration test LNFCI = c + b_1LIIPM

Eigenvalue	λtrace	CV(5%)λtrace	λmax	CV(5%)
(1) 0.20	25.39	15.41	21.43	15.75
(2) 0.041	3.6	3.76	3. 6	9.09

Lag Length 1-The λtrace and the λmax stat show the presence of one cointegrating relationship.

Table 4

Granger Causality Tests LNFCI LIIPM

Null Hypothesis (Ho)	No. of Lags	$\chi 2$(calculated) p value in paranthesis	Conclusion
LNFCI is not granger caused by LIIPM	1	0.24 (0.88)	Accept Ho
LIIPM is not granger caused by LNFCI	1	16.08 (0.00)	Reject Ho

Table 5

Variance Decompositions of LNFCI LIIPM

Variable	Forecast	LNFCI	LIIPM
LIIPM	6	9.80	90.19
	12	23.43	76.56
	24	38.12	61.87
LNFCI	6	99.92	0.07
	12	99.86	0.13
	24	99.82	0.17

Impulse Response

Fig7

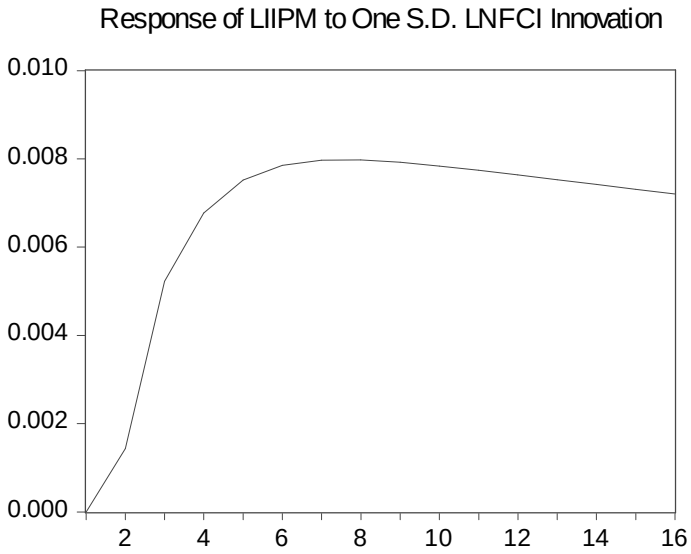
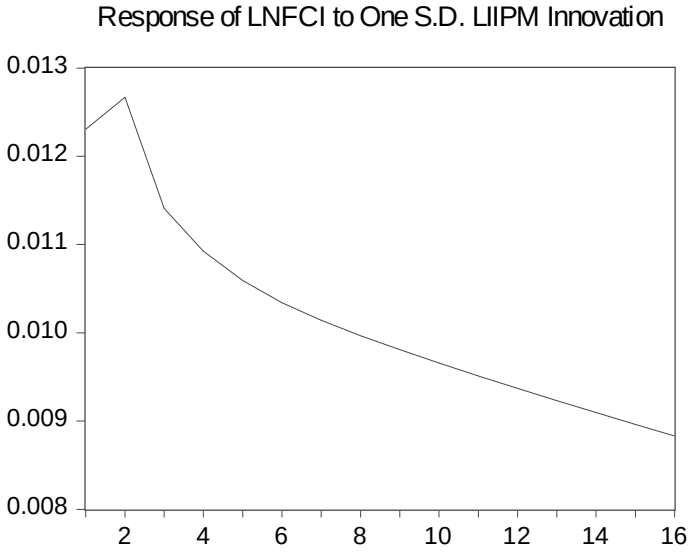


Fig 8



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