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## **Comparing Bank Lending Channel in India and Pakistan**

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## **Comparing Bank Lending Channel in India and Pakistan**

This paper investigates the presence and significance of bank lending channel of the monetary policy transmission in India and Pakistan using the Structural Vector Auto Regression (SVAR) approach. The results of econometric analysis support the presence of a significant bank lending channel in these countries. Changes in the monetary policy instruments affect the credit variable (private sector claims) which in turn transmits the shocks to the real side of the economy, i.e. output and prices. The output returns back to initial level in long run, while the effect of monetary policy changes on prices are persistent.

I also find that compared to the bank lending in other developing countries the channel in these countries is different and more vital. Another finding is that apart from interest rates, money also seems to play an important role in these economies and its shocks are significantly transmitted to the real macroeconomic activities through changes in the credit variable.

The mechanism by which monetary policy is transmitted to the real economy remains a central topic of debate in macroeconomics. Considerable research has recently examined the role played by banks in the transmission of monetary policy aiming at uncovering a credit channel and assessing the relative importance of the money and credit channels.

<sup>1</sup> Distinguishing the relative importance of the money and credit channels is useful for various reasons. First, understanding which financial aggregates are impacted by monetary policy would improve our understanding of the link between the financial and the real sectors of the economy. Second, a better understanding of the transmission mechanism would help monetary authorities and analysts to interpret movements in financial aggregates. Finally, more information about the transmission mechanism might lead to a better choice of intermediate targets.<sup>2</sup> In particular, if the credit channel is an important part of the transmission mechanism, then the banks' asset items should be the focus of more attention.

This paper focuses on determining the presence and significance of the bank lending channel for India and Pakistan.

Various econometric methodologies can be used to identify the presence and significance of this channel.<sup>3</sup> The traditional dynamic simultaneous model approach uses the system of equation to define a set of endogenous variables in terms of exogenous variables and lags of endogenous variables. One of the major problems in this approach is the difficulty of identifying truly exogenous variables that can be used as instruments. Moreover, for the same reasons it is hard to justify on a priori grounds that a given

variable has no influence on another variable. That is, there are hardly any compelling identifying restrictions.

In response to these difficulties, Structural Vector Auto Regression (SVAR) models treat all variables as endogenous. The sampling information in the data is modeled with the help of VAR models, which model each variable as a function of all other variables. Having modeled the reduced form of the model with the help of a VAR system, the SVAR analysis proceeds to identify the model. To this end a 'reaction function in surprises' is modeled, which expresses unexpected changes in the policy instrument as a function of unexpected changes in the non-policy variable and of monetary policy shocks. The objective is to identify the monetary policy shocks from this relation, which represent the discretionary component of policy.

Given these advantages, the paper also uses the SVAR methodology. Using the data for the economies of India and Pakistan, a model is constructed consisting of production, consumer prices, demand deposits, claims on private sectors, money (each in log level), exchange rate, interest rate and spread. The model is analyzed using the impulse responses and SVAR estimation (both short term and long term restriction results are discussed).

The rest of paper is organized in following way. Some of the interesting facts and figures about the unique banking structure of less developed countries are mentioned in section I. It also provides brief history and current trends of banking sector in India and Pakistan. The paper analyzes the different determinants of bank lending channel next. Section II describes theoretical background behind bank lending/ credit channel in detail. Section III talks about the dataset and variables used for the analysis. Section 5 reports

the econometric results. Then paper deals with the analysis of the effects of monetary policy shocks on bank lending. Section 6 introduces the Vector Autoregressive Regression (VAR) method in brief. Section 7 discusses the different econometric approaches used to solve the identification problem. In section 8 a VAR model is setup and then its estimation (using E-Views software) results are shown. Part IV of the paper discusses and analyzes the results. The results of this paper for India and Pakistan are compared with results from developed and other developing countries. The paper concludes with summarizing the findings and mentioning the directions for future work.

## **I. Descriptive Statistics**

Many of the recent research papers have established the importance of financial sector development for economic growth.<sup>4</sup> They have found that measures of the size of the banking sector and the size and liquidity of the stock market are highly correlated with subsequent GDP per capita growth. Moreover, emerging evidence suggests that both the level of banking sector development and stock market development exert a causal impact on economic growth. Recent financial crises in South East Asia and Latin America further underline the importance of a well-functioning financial sector for the whole economy. Some of the important highlights of the banking sector in “Less Developed Countries” (as defined by World Bank) are noted below.

### **A) Stylized facts on Banking Sector in LDCs**

Unlike the developed countries, the financial sector in developing countries (or LDCs) is still not mature enough. This contrast is evident from various measures like the size, activity and efficiency of financial intermediaries and markets. For example according to US Census Bureau, Statistics of U.S Business 2001; the number of

commercial banking firms was 7419. Compared to this number of commercial banks in India is 293 (source: Reserve Bank of India, June 2003) and the total number of scheduled banks in Pakistan is 46, including 22 foreign banks (based on Banking Statistics of Pakistan, 2002 & 2003, published by State Bank of Pakistan).

Based on the data from the World Bank and other sources, some stylized facts on banking sectors (in Less Developed Countries) can be noticed easily.

1. The first major point that differentiates developing countries from developed countries, such as United States, is the lack of legal enforcement of financial markets' rules and regulations. In LDCs collateral is scarce and contract enforcement is weak. There is less collateralizable wealth, which results in borrower being charged higher interest rate or rationed out of the market all together. Similarly the information is scarce. Hence the contracts are much harder to enforce and borrowers can wilfully refuse to pay back a loan without legally enforceable recourse. Moreover, in most LDCs, it is difficult to seize collateral, resell it and/ or to use legal action to collect bad debt.
2. The other observation is about interest rates. Compared to developed countries, developing countries have a lot of variations in interest rates. For example the real interest rates on deposits are either very high (Brazil 47%) or very low (Zimbabwe 19%). The average real interest rate on deposits for less developed countries is around 10.9%, while it is just 6.3% for developed countries. But more striking is the variation in these rates<sup>5</sup>. The variance of developed countries is 28.7, while for LDCs this is close to 115.

3. Another noticeable trend in LDCs is considerably high spreads and high interest rates being charged on the loans. Some of the probable reasons for spreads being higher are lack of enforceable and marketable collateral, high loan default probabilities and high bank operation costs. The average spread for developed countries is around 4.4% while it is 10.4% for LDCs. Similarly the variance for developed countries is just 4.6 compared to 65 for less developed countries.
4. In most LDCs, banks dominate the financial system; equity (stock) markets and corporate bond markets remain very shallow, concentrated and illiquid. Stock market value to GDP ratio in 2003 was 2.88 for US and 1.3 for UK, while for India and Pakistan this ratio was 0.5 and 0.2 respectively.
5. The ratio of private sector loans to GDP is very low (around 10%) for LDCs as compared to developed countries, where it is almost 60%. This along with the fact that equity and debt markets are shallow in LDCs leads to the trend that firms in LDCs are more likely to depend on internal finance.
6. As a consequence of all these factors, it is not possible for small private banks to operate profitably in less developed countries. Hence central banks and government banks are very powerful. For example, in 2003 the assets of three largest banks as a share of assets of all commercial banks for India and Pakistan is quite high (0.48 and 0.57) compared to US and UK (0.28 and 0.27). This means that there are few large banks dominating the banking sector rather than a large number of small and medium sized banks in these countries.

As documented by these stylized facts, there are institutional differences between industrialized countries and LDCs. So the bank lending channel may differ between the

two groups. Therefore, the paper attempts to investigate the bank lending channel in atypical countries not examined in previous literature.

India and Pakistan are chosen as the representatives of these LDCs. These two countries add few interesting directions to the study. Both the countries got independence at the same time and had similar social and economic condition. But, India followed a socialist approach to the economic development in the beginning opening the economy in 1990s while Pakistan has had an open market policy from start. Thus, the results for India and Pakistan could be similar or contrasting or both. These countries offer the potential to provide some insights into the relative merits of different policies.

#### **B) Institutional background of the banking sector in Pakistan**

Pakistan in the 1950s and 1960s had a liberalized banking structure open to both foreign and domestic banks. However, this changed in the early 1970s when the government decided to nationalize all private domestic banks in the country. The nationalization was interesting in the sense that only the domestic banks were nationalized. The foreign banks were left to operate as before, although limits were placed on the size of their operation. As a result of this institutional history, all foreign banks operating in Pakistan were set up as new banks, i.e. none of them were buyouts of existing private domestic banks. By 1990 government banks dominated the banking sector as they held 92.2% of total assets, while the rest belonged to foreign banks.

However, weaknesses and inefficiencies in the financial structure that emerged after nationalization, finally forced the government to initiate a broad based program of reforms in the financial sector in the beginning of 1991. These reforms included: (i) privatization of one of the government banks, (ii) allowing entry of new private domestic

and foreign banks, (iii) setting up of a centralized credit information bureau (CIB) to track loan-level default and other information, (iv) issuance of new prudential regulations to bring supervision guidelines in-line with international banking practices (Basel accord), and (v) granting autonomy to the State Bank of Pakistan that regulates all banks. As a result of these reforms, the country saw a spur of growth in the private (particularly domestic) banking sector.

During the fiscal year 2003<sup>6</sup>, even a strong 28.9 percent growth in net *government borrowings from scheduled bank*, and a stunning 284.9 percent rise in *private sector credit*, could not contain downward trend in interest rates for the second successive year – the weighted average auction yield for the benchmark 6- month T-bills fell 463 basis points during the year, taking the cumulative decline for the two years to a massive 1090 basis points. Fiscal year 2003 was as an exceptionally good year for the banking sector, as the important banking indicators witnessed further improvement over fiscal year 2002. Deposits of the banking sector grew by 19.5 percent (or Rs 275.1 billion) over the already strong double-digit increases in the preceding two years. This impressive deposit growth was largely driven by the unprecedented increase in workers' remittances, which reached US\$ 4.2 billion during FY03 – the highest one-year accumulation in the history of Pakistan.

### **C) Evolution of the Indian Banking Sector**

Independent India inherited a weak financial system. Commercial banks mobilized household savings through demand and term deposits, and disbursed credit primarily to large corporations. Indeed, between the years 1951 and 1968, the proportion of credit going to industry and trade increased from an already high 83 percent to 90

percent. This increase was at the expense of some crucial segment of the economy like agriculture and the small-scale industrial sector. This skewed pattern of credit disbursal, and perhaps the spate of bank failures during the sixties, forced the government to resort to nationalization of banks in 1969.

However, despite the successes of bank nationalization in India, the banking sector remained mired in problems, and was incompatible with the emphasis on a market economy, which was gradually emerging as the dominant economic paradigm worldwide. With economic reform emerging as the primary agenda of the central government in 1990, the banking-financial sector in India witnessed a significant degree of liberalization since the early nineties. Between 1992 and 1997, interest rates were liberalized, and banks were allowed to fix lending rates subject to a cap of 400 basis points over the prime lending rate (PLR).

Monetary conditions closely tracked the evolution of real activity during 2002-03<sup>7</sup>. The growth of non-food bank credit, inclusive of banks' investments in non-Statutory Liquidity Ratio (non-SLR) instruments, was in consonance with the recovery of industrial output. Credit expansion was facilitated by conditions of ample liquidity in financial markets, engendered by massive capital inflows. Interest rates declined across the spectrum in response to the easy liquidity conditions. On the other hand, currency and deposit growth slowed down moderately reflecting the adverse impact of the drought on rural incomes and the lowering of deposit rates by banks. Broad money growth reflected these diverse impulses from real activity. Financial markets were flush with liquidity over the greater part of 2002-03, bolstered by sustained capital inflows and a liquidity

overhang. There was a general easing of market conditions in terms of turnover and rates, the latter enabled by the accommodative monetary policy stance.

These observations, facts, figures and numbers present a very interesting picture of economies of less developed countries. Existence of bank lending channel as an independent monetary policy transmission mechanism in developed countries has been shown by various researches. However this kind of literature is scarce for less developed countries. This paper applies the established theories and econometric methodologies of determining the presence and significance of bank lending channel for India and Pakistan.

## **II: Determinants of Bank Lending Channel**

Bank lending has been a major area of research in recent years due to its importance and the issues surrounding it. For example, following changes in monetary policy strong correlation between bank loans and unemployment, GNP, and other key macroeconomic indicators is observed by Bernanke and Blinder (1992). However, such correlations could arise even if the “bank lending channel” is not operative. Since contraction of bank loans in the wake of tight money cannot be unambiguous evidence for the lending view. This is primarily due to high correlation between monetary and credit aggregates. When bank loans contract, deposits are also likely to contract. Therefore, one can argue that a monetary tightening depresses aggregate demand through the conventional money channel resulting in a decrease of demand for bank loans (i.e. the money view). In other words, it is necessary to identify the shifts of the supply and demand schedules in the bank loan market. Thus, the contraction of bank loans is consistent with the lending view as well as the money view. This observational

equivalence is called the ‘supply-versus-demand puzzle’. The supply-versus-demand puzzle has made it common to test the lending view, particularly in the US literature, by examining the responses of banks to monetary policy with micro-data on banks’ balance sheets (e.g. Kashyap and Stein, 2000).

Hence unlike the traditional theory that emphasizes households’ preferences between money and other less liquid assets, the new theory of monetary policy asserts that the role of the banking sector is central to the transmission of monetary policy. The bank lending channel can be summarized as the impact of monetary policy on the amount and conditions of credit as supplied by the banking sector. Monetary policy actions get transmitted to the real economy through these changes in the loan supply behavior of banks.

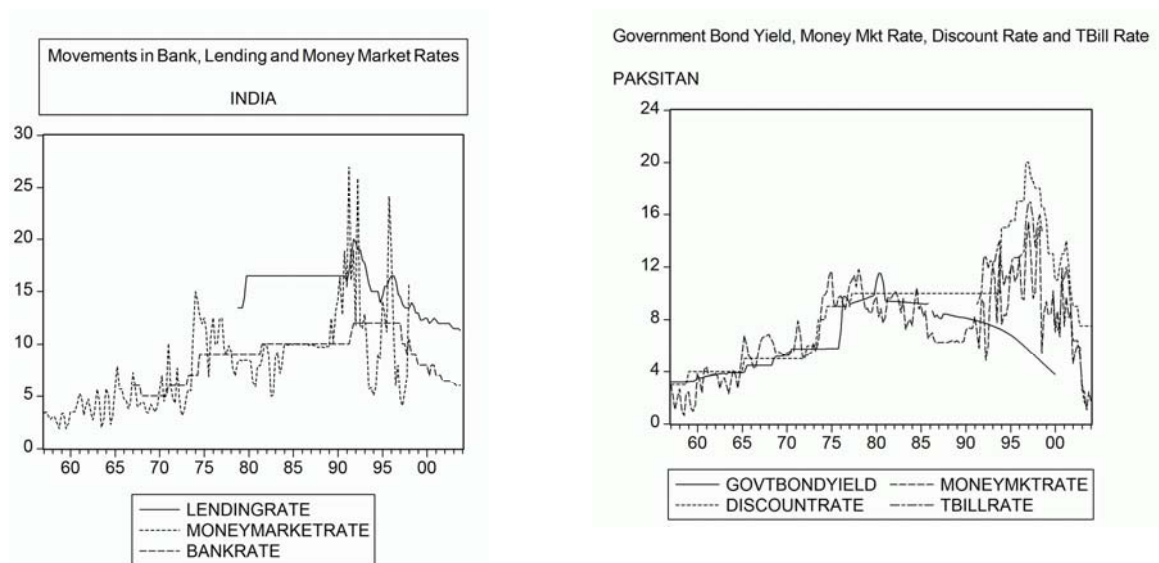
## **A. Data Set and Preparation**

To test the bank lending channel for India and Pakistan the paper uses the macroeconomic data since micro-level data is not available. The Statistics Department of the International Monetary Fund publishes the International Financial Statistics (IFS) database<sup>8</sup>. The data used here is taken from the Country Tables of the International Financial Statistics for India and Pakistan. The data for interest rate, exchange rate, CPI, bank loans, industrial production etc is taken on Quarterly basis. These series run from Q1:1957 to Q1:2004, but some data is available only for few years in between. Hence the effective estimation period varies.

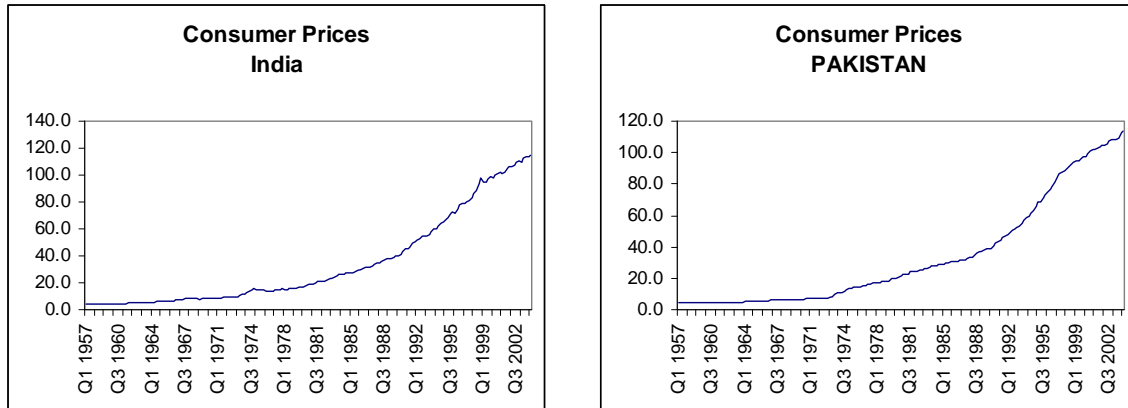
For India interest rates available are Bank Rate, Money Market Rate and Lending Rate, while for Pakistan Discount Rate, Money Market Rate, Treasury Bill Rate and Government Bond Yields are published. As a measure of real economic activity,

Industrial Production is used for India and Manufacturing Production is used Pakistan. Money is used as the monetary aggregate and consumer prices are used as a measure of general price level in the economy. Exchange rate against US dollar is also used to take care of the external effects on the economy.

The data is analyzed and plotted to see if there are any obvious trends between these variables. In both the countries the interest rates have fluctuated a lot and there seem to be no clear directions of movement to determine the intended monetary policy measures. But a general trend can be seen, for instance it starts slowly going up from 1960s to 1980s, and then a sudden jump in early 1990s with abrupt fall in late 1990s. Similarly the consumer prices have constantly moved up with slope increasing significantly after 1980s (as can be seen in figure 2).



**Figure 1: Different Nominal Interest Rates Movements**

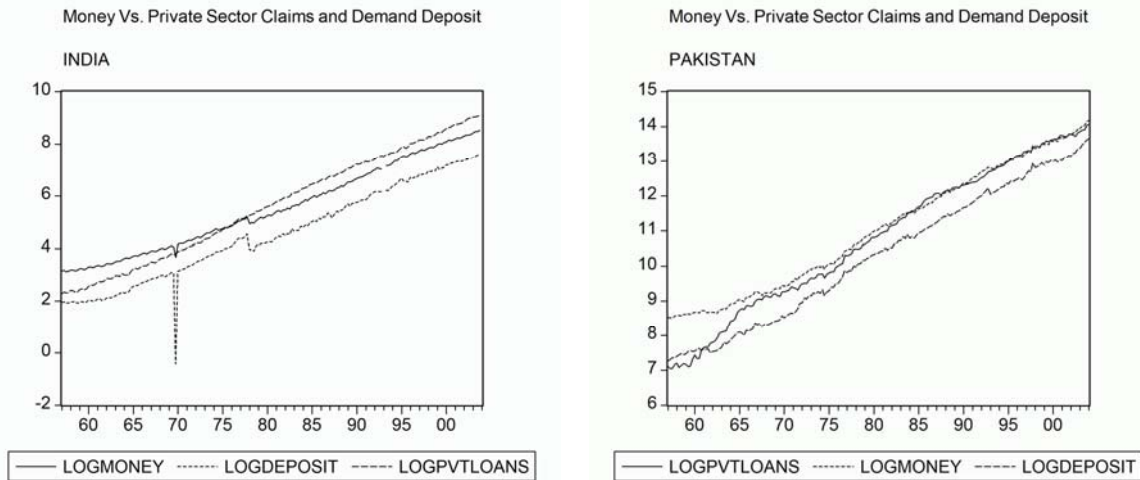


**Figure 2: Consumer Prices Movements**

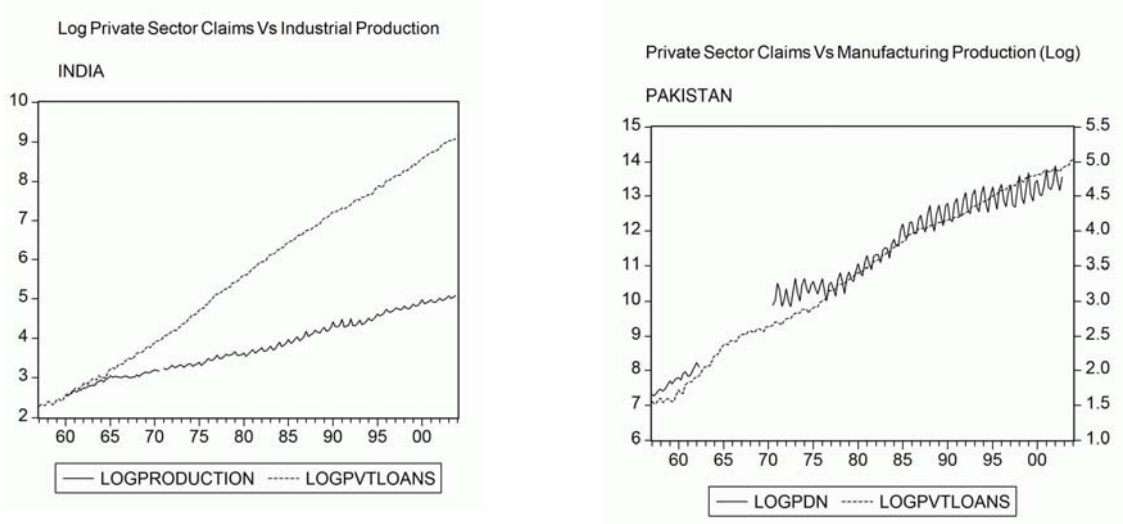
As discussed earlier, to test the bank lending channel view one needs to focus on finding answers of the following questions.

1. Do banks change their supply of loans when monetary policy changes?
2. Does spending respond to changes in bank loan supply?

On analyzing the sample data for these questions, definite trends in different macroeconomic variables can be spotted. For example in both countries money, demand deposit and private sector claims move along together (figure 3). Similarly for Pakistan, private sector claims and manufacturing production seem to be correlated. This correlation is not that linear in the case of India (figure 4).



**Figure 1: Money, Private Sector Claims and Demand Deposit**

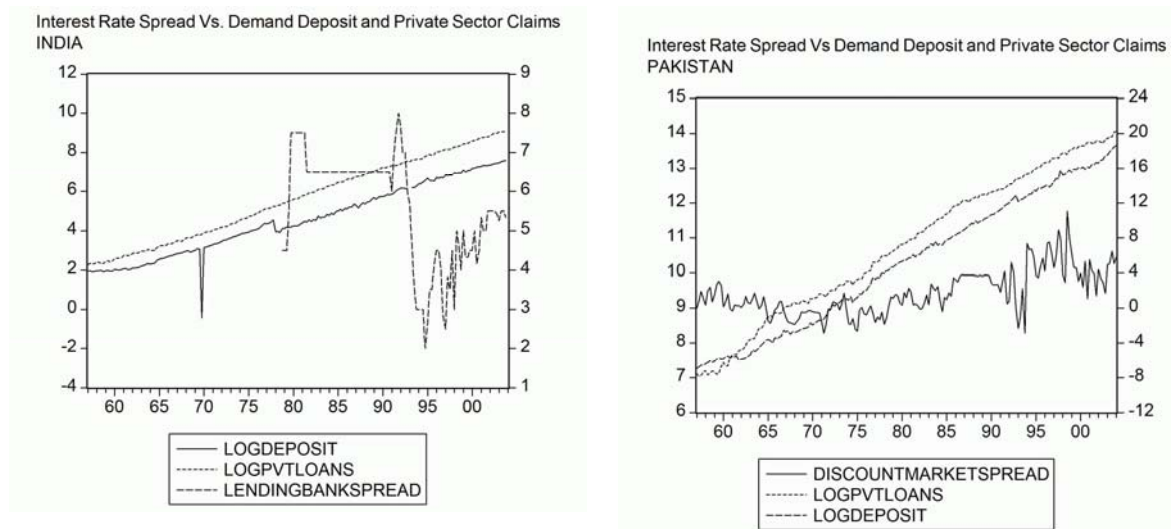


**Figure 2: Private Sector Claims Vs. Output (Industrial / Manufacturing Production)**

Notice that in figure 3, there is a small-period sudden drop in log deposit variables during 1970 and again in 1980 for India. Interestingly, in 1970 the ruling regime changed from Congress to Janata Party. The new government was expected to change all the policies supported by previous government and there was a general sense of political

instability. This sudden drop may be due to that volatility. Similarly, in 1980 Congress formed the government with a majority.

Similarly, a positive movement in the spread simply reflects that the monetary tightening is inducing a fall in long-term rates, since there are expectations of a drop in the short-term interest rate in the near future. On plotting different spreads, the effect of interest rate movements on demand deposit and private sector claims does not seem to be obvious.



**Figure 3: Interest Rate Spread Vs. Deposits and Loans**

These observations indicate the existence of few relationships between these variables. The money and private sector loans are moving together for almost all of the period. Similarly private sector loans and production are also moving together. This suggests that over time changes in money are always accompanied by changes in private sector loans and production, implying that these three variables are very closely related. Hence there should be some relationships between these variables by which changes in

money are causing private sector loans to change which in turn is affecting the production. But this simple analysis is not sufficient. Is it actually the changes in money which cause private sector loans to change or both these are affected by some other factors? There is a need to identify these relationships, to check if the relationships are in agreement with the bank lending view and to see whether or not those are significant.

## **B. Preliminary Investigation**

Proceeding further to investigate the bank lending channel in India and Pakistan, the time series data mentioned in previous section is regressed to identify the presence and significance of any relationships indicating the bank lending.

One of the issues involved in identifying the probable determinants of bank lending channel is the “Problem of identification”, that is, without an exogenous shock to either credit demand or credit supply, the system of two equations (one for credit supply and another for credit demand) can not be estimated. For this to be properly resolved there must be at least one variable present only in one of the supply or demand function (Barajas & Steiner, 2002). The demand equation is identified if there is a variable present in the supply equation that is not present in the demand equation. Similarly, the supply equation is identified if there is a variable present in the demand equation that is not present in the supply equation. Hence the major question becomes what macroeconomic indicators can be taken as a measure of credit supply.

Due to non-availability of micro-level data, the loan demand and loan supply can not be identified separately. The “claims on private sector” (monetary survey data of IFS publication) consolidates monetary authorities’ and deposit money banks’ data for private

loans in these countries. It indicates the equilibrium value between loan demand and loan supply. This is the “credit variable” used in this paper, representing the bank lending.

Another major assumption is that the paper treats money and interest rate both as the monetary policy instruments in India and Pakistan. The reason is that the governments of these countries have extensively used printing of new currency as a way to finance the budget deficits. Unlike developed countries, the budget and the proposed deficit have major impact on the economic decision making of agents in these countries (especially for the case of India).

As mentioned in previous sections the flow of causality between the variables as suggested by theory should be two folds. The changes in monetary policy should cause changes in loan supply. This in turn should have significant effect on real economic activity. Hence the major relationships for bank lending channel to be operative are:

1. Monetary Policy Instruments → Bank Credit
2. Bank Credit → Macroeconomic Activity

Two OLS regressions are run to identify the first relationship. The credit variable (log private sector claims) is the dependent variable and each of the monetary policy instruments (money, bank rate/ discount rate) is used as the explanatory variable. The results are shown in table 1 below. Please note that private loans and money are in log form. A time trend is also added in the second regression.

The second part of the channel is the affect of changes on this credit variable (private loans) on real macroeconomic activities (industrial/ manufacturing production).The results for simple OLS for this hypothesized relationship are shown in table 2. Log value is taken for both the variables.

		<b>India</b>		<b>Pakistan</b>	
	<u>Dependant Variable</u>	<u>Explanatory Variable</u>	<u>Coefficient</u>	<u>Explanatory Variable</u>	<u>Coefficient</u>
1.	Pvt. Loans	Money	1.246181 ( 0.010057 ) $R^2 = 0.988095$	Money	1.158518 ( 0.012354 ) $R^2 = 0.979177$
2.	Pvt. Loans	Bank Rate	0.419237 (0.095012) $R^2 = 0.438146$	Discount Rate	1.081293 (0.037859) $R^2 = 0.719822$

**Table 1: OLS results for effect of monetary policy on credit variable**

		<b>India</b>		<b>Pakistan</b>	
	<u>Dependant Variable</u>	<u>Explanatory Variable</u>	<u>Coefficient</u>	<u>Explanatory Variable</u>	<u>Coefficient</u>
1.	Production	Pvt. Loans	0.358788 ( 0.003492 ) $R^2 = 0.983874$	Pvt. Loans	0.446374 ( 0.005961 ) $R^2 = 0.973950$

**Table 2: OLS Results for effect of credit variable of real output**

On analyzing the above results, we find that:

1. Coefficient of relationship between money and private sector claims is significant, and has a very high explanatory power (based on R-squared statistics).
2. Similarly coefficient of interest rate on private sector claims (loans) is significant, but its explanatory power is not as high as that of the relationship with money. The  $R^2$  is much smaller for the case of India.
3. The coefficient of private sector loans on production is significant and explains most of the variations in the production.

The first two findings show that the relationships between monetary policy variables and credit variable exist in these countries. However, the relationships of credit variable with money are more significant than relationship of credit variable with interest rates. Also the relationship between bank rate and credit variable is not very strong in India.

The last finding indicates that private borrowings affect the output (production). So the relationship between macroeconomic activity and credit variable also exists in these countries.

The paper now looks at different possible explanatory variables for this credit variable, to check if there are any alternative relationships present in these economies. Some of the obvious choices for explanatory variables (based on theoretical foundations discussed above and on previous works) are Lending Rate, Deposit Rate, Spread, overhead costs, GDP, inflation, stock market index, liquid liabilities (as % of assets), lending capacity, non-performing loans or bank assets as % of central bank assets etc. But many of these choices involve micro level bank-panel data. Due to non-availability of

that kind of data, this paper only uses money market rate, lending rate/ government bond yield and the spread. The log value of credit variable (private sector claims) is regressed on each of the above mentioned variables separately for both the countries. The results for each regression are shown in table 3. A time trend is added in each regression.

On examining these relationships of credit variable with alternative instruments, the spread seem to have some explanatory power for the movements in private sector claims. However, the coefficient of determination for this relationship is less than the  $R^2$  with money as explanatory variable (which was around 0.98 for both the countries). Similarly, the regression coefficients for other interest rates are significant, but have small explanatory power.

Till now the paper has used “private sector loans” as the indicator of bank lending channel. Another indicator of bank lending may be “Investment Share of Gross Domestic Product per Capita”. The argument is that movements in macroeconomic activities can have a time trend associated with it, and this is especially true for the case of developing countries. This would mean that changes in credit supply due to monetary policy shocks may change the real macroeconomic activity via the investment share of GDP per capita. Hence taking the percentage share of investment rather than the actual value of investment may be a candidate for the credit variable. If there seem to be a significant relationship between this variable and the monetary policy instruments, then this may indicate the presence of a transmission channel.

	<b>India</b>		<b>Pakistan</b>	
	<u>Explanatory Variable</u>	<u>Coefficient</u>	<u>Explanatory Variable</u>	<u>Coefficient</u>
1.	Lending rate	- 0.509019 ( 0.022782 ) R <sup>2</sup> = 0.287015	Govt. bond yield	0.549185 ( 0.031540) R <sup>2</sup> = 0.416377
2.	Money market rate	0.352872 (0.030218) R <sup>2</sup> = 0.436953	Money market rate	0.409181 (0.028160) R <sup>2</sup> = 0.319804
3.	Spread (bank rate & lending rate)	-0.691344 (0.021061) R <sup>2</sup> = 0.591561	Spread (discount rate & govt. bond yield)	0.516543 (0.046309) R <sup>2</sup> = 0.308973

**Table 3: Relationship of Credit Variable with other possible instruments**

The data is taken from using the Penn World Tables<sup>9</sup>. Due to non-availability of the quarterly data, the yearly value is used for each of the four quarter. Separate regressions are run to identify if this variable, has the relationships with any of the other possible policy variables. The summary of least square regression results mentioning the coefficients are shown in table 4.

The regression results indicate that bank interest rates or the spread does not have any significant relationship with the investment share of per capita gross domestic product. Hence this does not get affected by changes in monetary policy instruments and thus not an indicator of bank lending channel in these countries.

To summarize, the preliminary investigation finds out that the credit variable (private sector loans) has a very significant relationship with monetary policy instruments for Pakistan. For India, the credit variable has a strong relationship with money but not with the interest rate. Moreover, the credit variable has a very high explanatory power (and significant relationship coefficient) with the macroeconomic activity (i.e. production) for both countries. This indicates that bank lending channel is present in these countries as a monetary policy transmission mechanism and it seems to be significant. Interest rate does not seem to affect the credit supply effectively in case of India. Any other alternative policy instrument - credit variable relationship does not seem to be significantly present in these economies.

Given these encouraging indications, the paper proceeds to find out more detailed information about the presence of bank lending in India and Pakistan by applying the structural VAR methodology of monetary policy analysis

<b>India</b>		<b>Pakistan</b>	
<u>Explanatory Variable</u>	<u>Coefficient</u>	<u>Explanatory Variable</u>	<u>Coefficient</u>
Bank Rate	0.023479 (0.034374) R <sup>2</sup> =0.003470	Discount Rate	-0.146374 (0.049574) R <sup>2</sup> = 0.047713
Lending Rate	-0.270386 (0.045854) R <sup>2</sup> =0.285554	Govt. bond yield	0.057877 (0.092197) R <sup>2</sup> =0.002313
Spread (bank rate & lending rate)	-0.106169 (0.060280) R <sup>2</sup> =0.034429	Spread (discount rate & govt. bond yield)	- 0.190090 (0.054645) R <sup>2</sup> =0.066452

**Table 4: Results for Investment Share regressed on different instruments**

### **III: Effect of a MP Shock on Bank Lending**

The VAR is a reduced-form time series model of the economy that is estimated by ordinary least squares. Initial interest in VARs arose because of the inability of economists to agree on the economy's true structure.<sup>10</sup> VAR methodologies<sup>11</sup> for modeling the structure of an economy and issues involved in using those for the study of monetary policy analysis have also been popular research topic.

#### **A. Econometric Methodologies to the Analysis of Monetary Policy**

The criticism of the reduced form model approach led to the development of "Structural" VAR approach by Bernanke (1986), Blanchard and Watson (1986) and Sims (1986). This technique allows the researchers to use economic theory to transform the reduced-form VAR model into a system of structural equations. As discussed earlier a VAR is a system where each variable is regressed on  $k$  of its own lags as well as on  $k$  lags of the other variables (and a constant and a deterministic time trend, if necessary).

To discuss the SVAR approach to identification, the structural model of economy is assumed to have the form –

$$\Gamma Y_t = B(L)Y_t + e_t \dots\dots\dots(1)$$

where  $B(L)$  denotes polynomials in the lag operator  $L$  and  $\Sigma_e$  is the variance-covariance matrix of the structural disturbances. The starting point of the SVAR analysis is the reduced form of (1), which in matrix notation is given by –

$$Y_t = \Gamma^{-1} B(L)Y_t + \Gamma^{-1} e_t \dots\dots\dots(2)$$

Next, the moving average (MA) representation of the reduced form is computed, meaning that the system is re-parameterized to express the endogenous variables in  $Y_t$  as a function of current and past reduced form innovations,  $u_t$ . ( $u_t = \Gamma^{-1} e_t$ ).

$$Y_t = C(L) u_t \dots\dots\dots(3)$$

with  $C(L) = ( I - \Gamma^{-1} B(L) )^{-1}$ . A comparison of the MA representation with the conventional autoregressive (AR) representation shows that in the AR representation the each variable is expressed as a function of past values of all the variables, whereas in the MA representation each variable is expressed as a function of current and past innovations in  $u$ .

Since no restrictions have yet been imposed on the model, it follows that the impulse response functions given by  $C$  do not have any economic meaning. In other words, even though they show the response of the economy to the reduced form disturbance  $u$ , this is not particularly interesting because these disturbances are devoid of economic content since they only represent a linear combination of the underlying structural innovations  $e$ , given by  $u_t = \Gamma^{-1} e_t$ . Hence some restrictions need to be imposed to get the real economic relationships and responses. These are known as identifying restriction.<sup>12</sup>

The identifying restrictions used in the SVAR model can be categorized as follows:

**1. Orthogonality Restrictions**

The identifying restriction that distinguishes the SVAR methodology from the traditional dynamic simultaneous equation approach is the assumption in SVAR models

that the structural innovations are orthogonal, that is the covariance terms in  $\Sigma_e$  matrix are zero. Since the reduced form disturbance is linked to the structural innovation by  $\Gamma u = e$ , the reduced form and the structural variance-covariance matrix are related to each other by  $\Gamma \Sigma_u \Gamma' = \Sigma_e$ . From this it follows that the orthogonality restriction imposed on  $\Sigma_e$  leads to the non-linear restriction on  $\Gamma$ .

To explain the intuition behind the orthogonality restriction in SVAR models, Bernanke (1986) writes that he thinks of the structural innovations “as ‘primitive’ exogenous forces, not directly observed by the econometrician, which buffet the system and cause oscillations. Because these shocks are primitive, i.e., they do not have common causes, it is natural to treat them as approximately uncorrelated.”

## **2. Normalization**

SVAR models are based on the MA representation of the structural model, and the empirical analysis seeks to estimate the impulse response functions. The impulse response functions are usually computed to show the response of the model to a standard deviation shock to the structural innovations. This makes it convenient to normalize the SVAR model by setting the variances to one, because the standard deviation shocks, with this normalization, correspond to unit innovations in  $e$ . From this follows that the variance-covariance matrix of the structural innovations is  $\Sigma_e = I$ .

## **3. Restrictions on Relationship matrix**

Finally exclusion restrictions are applied on matrix  $\Gamma$  for identifying the model exactly. The reason for stressing on the analysis of  $\Gamma$  is that SVAR models aim to identify the structural innovations  $e$  in order to trace out the dynamic responses of the model to these shocks, which yields the impulse response functions. To this end the SVAR model

focuses on the relation  $\Gamma u_t = e_t$ , and identifies the structural innovations by imposing suitable restrictions on  $\Gamma$ . Hence in other words we can say that in SVAR models the dynamic relationships in the economy are modeled as a relationship between shocks.

Any exclusion restriction on  $\Gamma$  automatically imposes a recursive order on the system. This is called Choleski decomposition. Nevertheless, the Choleski decomposition represents just one possible strategy for the identification of a SVAR model and should only be employed when the recursive ordering implied by this identification scheme is firmly supported by theoretical considerations. Alternatives include non-recursive restrictions on the matrix  $\Gamma$ . Besides the restrictions on contemporaneous interactions it is also possible to impose long-run restrictions on the effects of structural shocks. Finally, it is also possible to combine contemporaneous and long-run restrictions.<sup>13</sup>

### **Contemporaneous versus Long-run Identification Schemes**

A critical element in the estimation of the effects of policy shocks is the identification of these policy shocks, i.e. the determination of exogenous shocks to monetary policy. Two methods have been widely used in the VAR literature to identify structural shocks to monetary policy. One general approach employs restrictions on the contemporaneous relations among the variables of the vector autoregressive model, while the second general approach imposes restrictions on the long-run relations among the variables. Although economic and institutional arguments can be used to rationalize each identification scheme, there is no consensus as to which approach to identifying shocks is preferred, and the weaknesses of both approaches have been discussed in the research papers. For example, the structural VAR method developed by Shapiro and Watson (1988), utilizes long-run restrictions to identify the economic structure from the reduced

form. Papers by Blanchard and Quah (1989) and Gali (1992) stress the fact that long run restrictions are quite attractive for macroeconomic applications on real and nominal variables. The reasoning behind this argument is that economic theory itself suggests that nominal shocks have no long-run influence on real variables.

### **Interpretation of SVAR Analysis**

It is tempting to use impulse response analysis to shed some light on the issue of how long it takes until a change in the monetary policy stance reaches its full effect on output, which is an important issue in applied business cycle analysis. But impulse response analysis is unlikely to be helpful in this regard, because most monetary policy actions represent a systematic response of the central bank to the state of the economy and do not come as surprises. That is, most monetary policy actions are not monetary policy shocks. It is therefore important for applied business cycle research to know what the output effects of systematic monetary policy are, while the output effects of unanticipated, discretionary monetary policy are only of secondary interest. But impulse response analysis only says something about the latter aspects, and remains largely silent on the output effects of systematic and hence anticipated monetary policy.

The shock analysis conducted in SVAR models is the closest approximation of a controlled experiment available in empirical economics. Once the monetary policy shock is identified, one can see the monetary transmission mechanism unfold by observing the response of the non-policy variables to this monetary impulse. The issue of reverse causality which usually plagues the analysis of dynamic relationships is not an issue in SVAR models, because by tracing out the dynamics of the system to an unexpected shock the causality is pinned down and runs unambiguously from the monetary policy

shock to the other variables in the model. This kind of structural inference is not possible using the conventional reduced form analysis of the lead/lag structure, which is often employed as an alternative tool to investigate the transmission mechanism.

## **B. Detailed Estimation**

Before the specification of the VAR model for detailed estimation, it is important to recall that three necessary conditions need to be satisfied conceptually for the bank lending channel to be effectively operative.

1. Firms must not be able to easily substitute bank loans with commercial paper or public equity (Kashyap, Wilcox & Stein, 1993).
2. Central bank must be able to affect the supply of loans (Gertler & Gilchrist, 1994).
3. There should be nominal price rigidity, so that monetary policy can have real effects.

The third condition exists in most of the economies. Due to semi-regulated environment of Indian and Pakistani economies (for example government decides the price of many basic things like petrol, food-grains etc.), nominal price rigidity can be assumed to be present. As mentioned in section about less developed countries' banking sector, the private bond and equity markets are still very immature in India and Pakistan. Hence the first condition is also met easily, because it is not possible for firms to sought loans from sources other than banks. The first condition, central bank's ability to affect the supply of loans, can not be determined due to lack of firm level data. The paper however treats the changes in the private sector loans as the indication of changes in loan supply. As the preliminary investigation finds, changes in interest rates (and money)

affect this credit variable. Hence the third condition is also satisfied (somewhat weakly for India).

The VAR model in this paper consists of the macroeconomic series and bank data mentioned in previous part. The output is captured using the industrial or manufacturing production as a proxy for the macroeconomic activity. The annual currency depreciation is included using the exchange rate and movements in relative prices are captured by consumer prices. These two variables are intended to control for demand side of the economy. Similarly money and interest rate are used for money market and instrument of monetary policy. To identify the changes in loan demand and loan supply, claims on private sector and demand deposit are included in the system. The spread is also introduced in the model to disentangle the supply and demand.

In a VAR, all contemporaneous correlation between two variables is attributed to the variable higher in the ordering. The paper uses a the following ordering –

1. Log production.
2. Log CPI.
3. Log deposit.
4. Log Pvt. Loans.
5. Exchange rate.
6. Spread.
7. Interest rate.
8. Log money.

This kind of ordering is justified using the fact that since Bank Rate and Money are the policy variables, shocks in these affect output and prices with a lag via the changes in deposit, loans and exchange rate.

### **1. Unrestricted VAR Estimation**

First, the unrestricted VAR model is estimated to further analyze the presence of bank lending channel and its role in transmission of monetary policy shocks.

The lag length selection tests for India suggested using either 4 (the sequential modified LR test statistic and final prediction error) or just 1 (Schwarz information

criteria) lags. For Pakistan the ideal lag length suggested by tests (LR, FPE, AIC) is 5 or 1 (SC). Since using four lag also takes care of seasonality in the quarterly data being used here, the optimal number of lags is taken as 4.

The VAR models for both the countries are stable. Since all the AR roots have modulus less than one and lie inside the unit circle.

To assess the importance of bank lending channel one needs to test for the marginal predictive power of the “credit variable” by carrying out Granger causality tests<sup>14</sup>. This evidence alone is not sufficient. It has to be complemented with two simultaneous conditions:

- The money and/ or interest rate (or term spread) is relevant for predicting the credit variable, signifying the monetary policy affecting the bank lending.
- This credit variable should be relevant for explaining the macroeconomic activity variable, implying that this channel has transmitted the monetary policy changes to real economy.

### 1.1 Pair-wise Granger Causality<sup>15</sup>

The simplest way to get the answer for the question “does the bank lending channel play any significant macroeconomic role as monetary policy transmission mechanism” is to analyze whether private sector claims in our model adds any explanatory power to any of the macroeconomic variables. The results for the pair-wise granger causality using the diagnosis of VAR lag structure are shown below. The number indicates the p-value based on the Wald statistics for the joint significance of each of the other lagged endogenous variables in the equation. The null hypothesis for the pair production – private (shown in bold) loans is that private loans does not Granger-cause production.

1. INDIA:

<u>Production</u>								
Exclude	Prices	Exchange Rate	Pvt. Loans	Deposits	Money	Spread	Bank Rate	All
Prob.	0.3730	0.0001	<b>0.6466</b>	0.1120	0.0001	0.5724	0.1020	0.0000
<u>Prices</u>								
Exclude	Production	Exchange Rate	Pvt. Loans	Deposits	Money	Spread	Bank Rate	All
Prob.	0.0239	0.1717	<b>0.8930</b>	0.2551	0.2660	0.8783	0.8646	0.0000

2. PAKISTAN:

<u>Production</u>								
Exclude	Prices	Exchange Rate	Pvt. Loans	Deposits	Money	Spread	Bank Rate	All
Prob.	0.1345	0.0072	<b>0.0728</b>	0.6298	0.3802	0.2942	0.2560	0.0000
<u>Prices</u>								
Exclude	Production	Exchange Rate	Pvt. Loans	Deposits	Money	Spread	Bank Rate	All
Prob.	0.0002	0.1772	<b>0.1828</b>	0.0145	0.0571	0.2221	0.6829	0.0000

**Table 5: Granger Causality Results: Private Sector Loans on Production and CPI**

A high p-value does not reject the null hypothesis, while a low p-value (less than 10%) rejects the null hypothesis. The results seem to indicate that private loans granger cause output in Pakistan. This re-iterates the earlier results about the existence of relationship between private loans and production in Pakistan. While for India, the null can not be rejected. Hence, it can not be said that private sector loans causes production. But since Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term. The rejection of null does not mean that there is no relationship between private loans and production. Hence, the Granger causality result for India is ignored. The paper still treats previous part's results as established for both the countries.

Finally, the unrestricted VAR estimation is done using 4 lags of each endogenous variable in the model. On examining the relevant relationship coefficients, the lagged values of “monetary policy” variables (money and interest rates) are significant in predicting the credit variable (private sector claims) for both the countries. The coefficients of the interest rate are not as significant as those of the money. The credit variable (and its lags) also seems very significant in explaining the macroeconomic variables.

Thus, the unrestricted VAR also indicates that there is bank lending channel present in these countries.

### 1.2 Impulse Responses

A shock to the policy variable not only directly affects that variable but is also transmitted to all of the other endogenous variables of the economy through the dynamic (lag) structure of the VAR. An impulse response function traces the effect of a one-time

monetary policy shock to one of the innovations on current and future values of these variables.

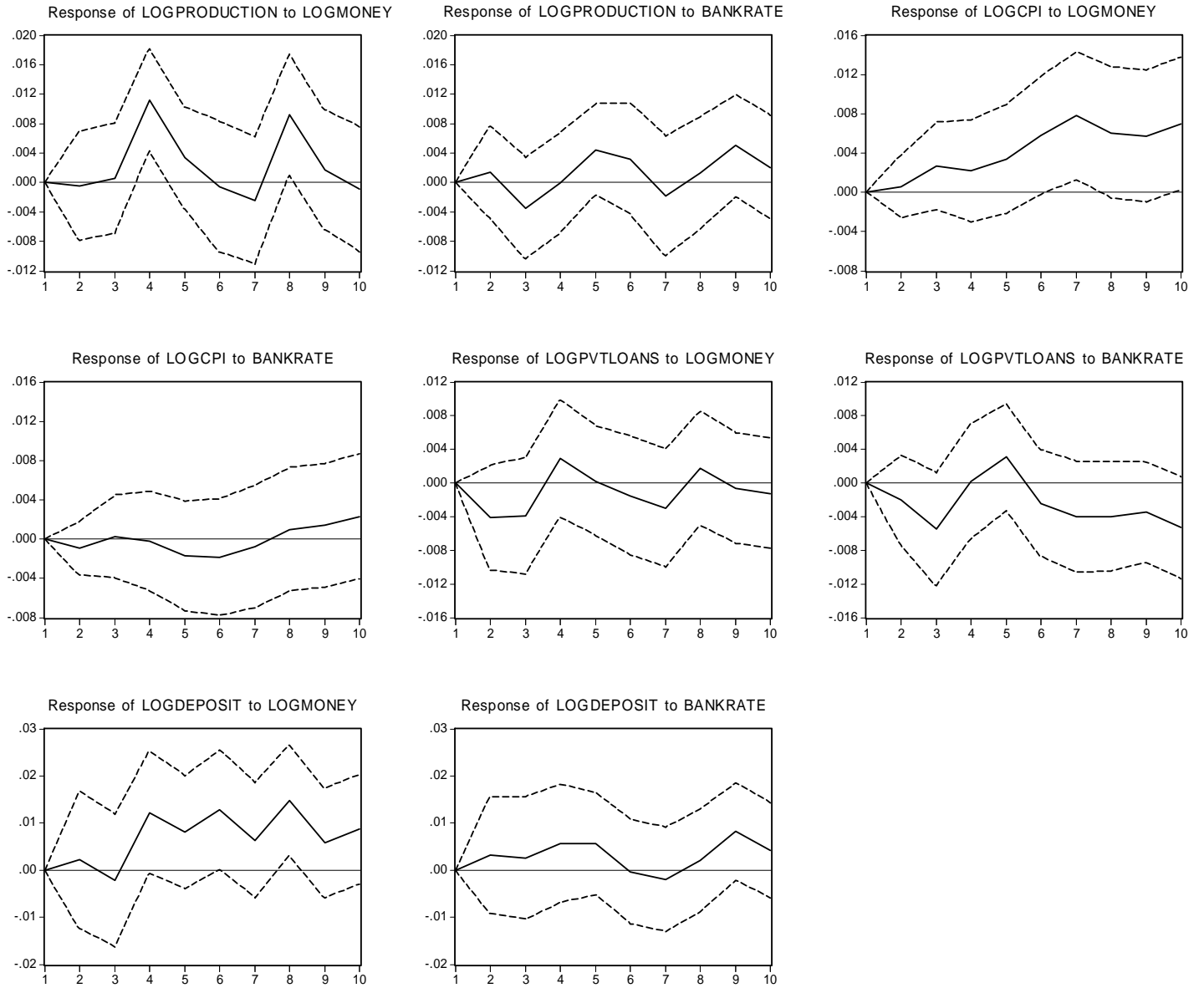
Responses of Macroeconomic variables (Output, Prices) to Cholesky One S.D. Innovations in Policy variables (Money, Interest Rate) along with responses of intermediate credit variables (loan demand and loan supply) are shown in figure 6 and figure 7.

The cholesky impulse is used, which imposes an ordering of the variables in the VAR and attributes all of the effect of any common component to the variable that comes first in the VAR system. The graph shows the plus/minus two standard error bands about the impulse responses.

One important thing to notice is that as a result of positive innovation in money the mean response of private loans goes down (the usual predicted response is that loans should go up). However, a zero response lies within the two standard deviation band.

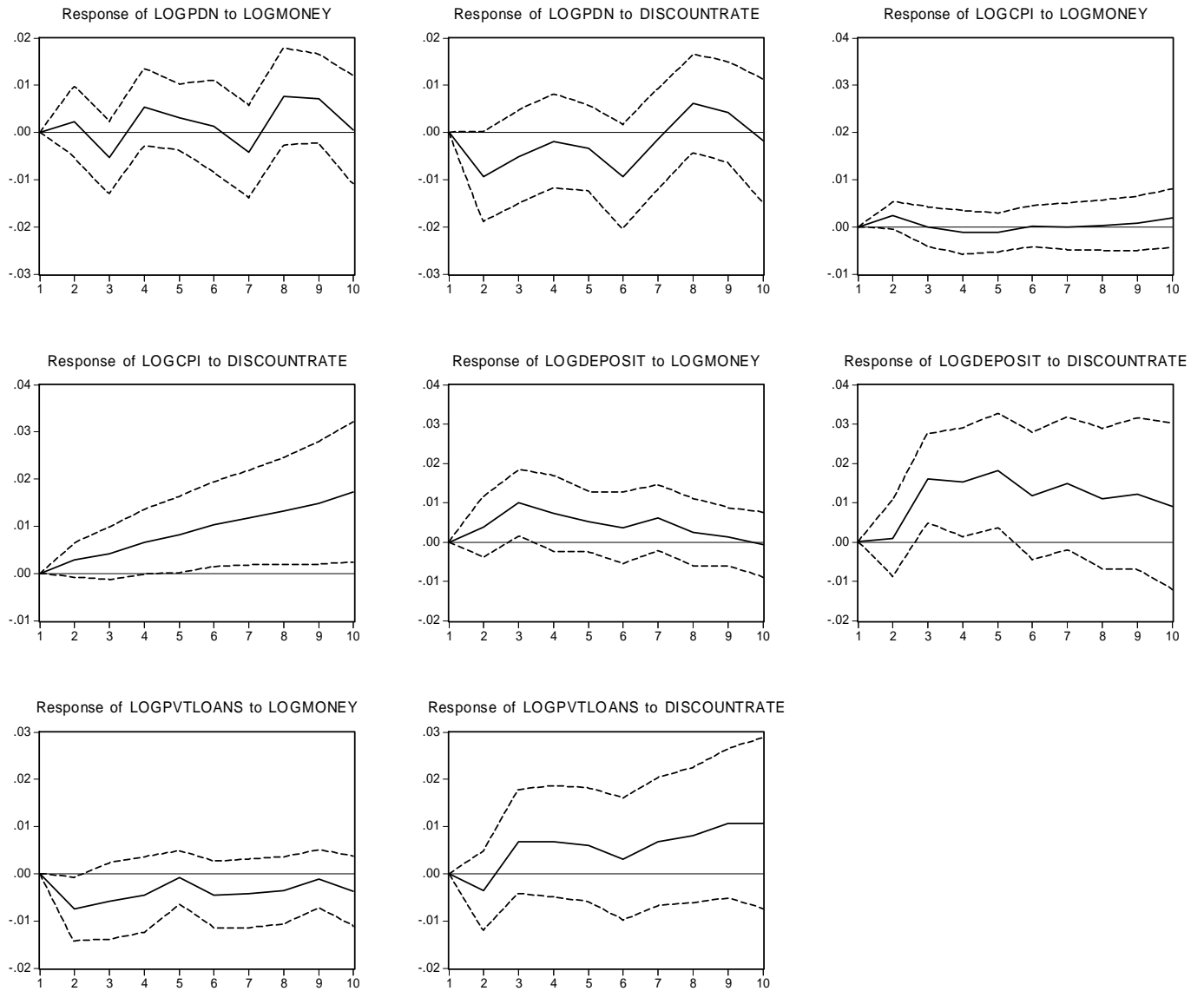
As is clear from figure 6 and 7, these impulse responses show that for both India and Pakistan shocks in interest rates and money affect output and prices. While the output returns to initial level, the effects on prices are persistent. The shocks in interest rates and money also affect the credit variable, it goes down and then goes up (further than initial level). The final level of credit variable after the interest rate shock is above the initial level for Pakistan (while for India it is somewhat below the starting value). Basically, the figures show changes in money induce a change in private sector loans and the real economic variables (output and prices) respond to these changes in the loans.

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.



**Figure 4: Cholesky Impulse (MP Shocks) Responses (Macroeconomic variables) for India**

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.



**Figure 5: Cholesky Impulse (MP Shocks) Responses (Macroeconomic variables) for Pakistan**

Hence the impulse responses indicate that the bank lending channel seem to be operative and the shocks in money and interest rates are transmitted to the real side of economy (output and prices) via the changes in private loans (credit variable). These observations are in agreement with previous results, indicating the presence of bank lending.

### 1.3 Variance Decomposition

While impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VAR, *variance decomposition* separates the variation in an endogenous variable into the component shocks to the VAR. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR.

The variance decomposition of the VAR model shows that exchange rate and money play more important role than interest rate or term spread in determining the private sector claims. Similarly an innovation in private sector claims affects the production somewhat significantly, but not the price levels. The results are alike for both the countries and are in agreement with previous results.

## **2. Structured (Identified) VAR**

The main purpose of structural VAR (SVAR) estimation is to obtain non-recursive orthogonalization of the error terms for impulse response analysis. This alternative to the recursive Cholesky orthogonalization requires the user to impose enough restrictions to identify the orthogonal (structural) components of the error terms.

### 2.1 Short Term restrictions

The ordering used to put short term restrictions is:

- |                 |          |                 |          |
|-----------------|----------|-----------------|----------|
| 1. output       | 2.cpi    | 3.deposit       | 4. loans |
| 5.exchange-rate | 6.spread | 7.interest rate | 8.money  |

This kind of identification scheme is used by other researchers as well (McMillin, 1999). The assumption that monetary policy affects output and prices only with a lag and that it has a contemporaneous effect upon the exchange rate is uncontroversial. With same kind of reasoning monetary policy will have more immediate effect on private sector loans and demand deposit (since monetary policy affects these variables first, which in turn transmit the monetary shocks to the real economy).

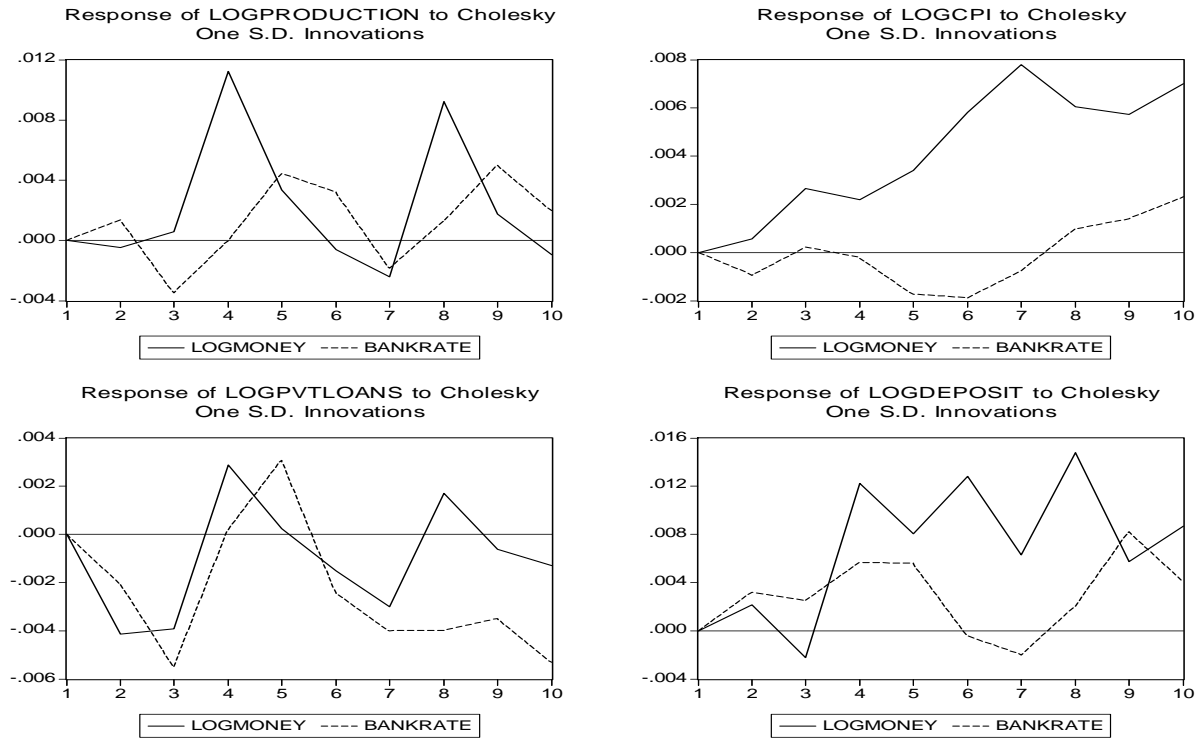
The SVAR is identified by specifying the standard short run restriction matrices. That is for the relationship  $u_t = \Gamma^{-1}e_t$ , between reduced form and structural disturbances,  $\Gamma^{-1}$  is restricted as the lower triangular matrix.

The impulse response results are shown in figures 8 and 9.

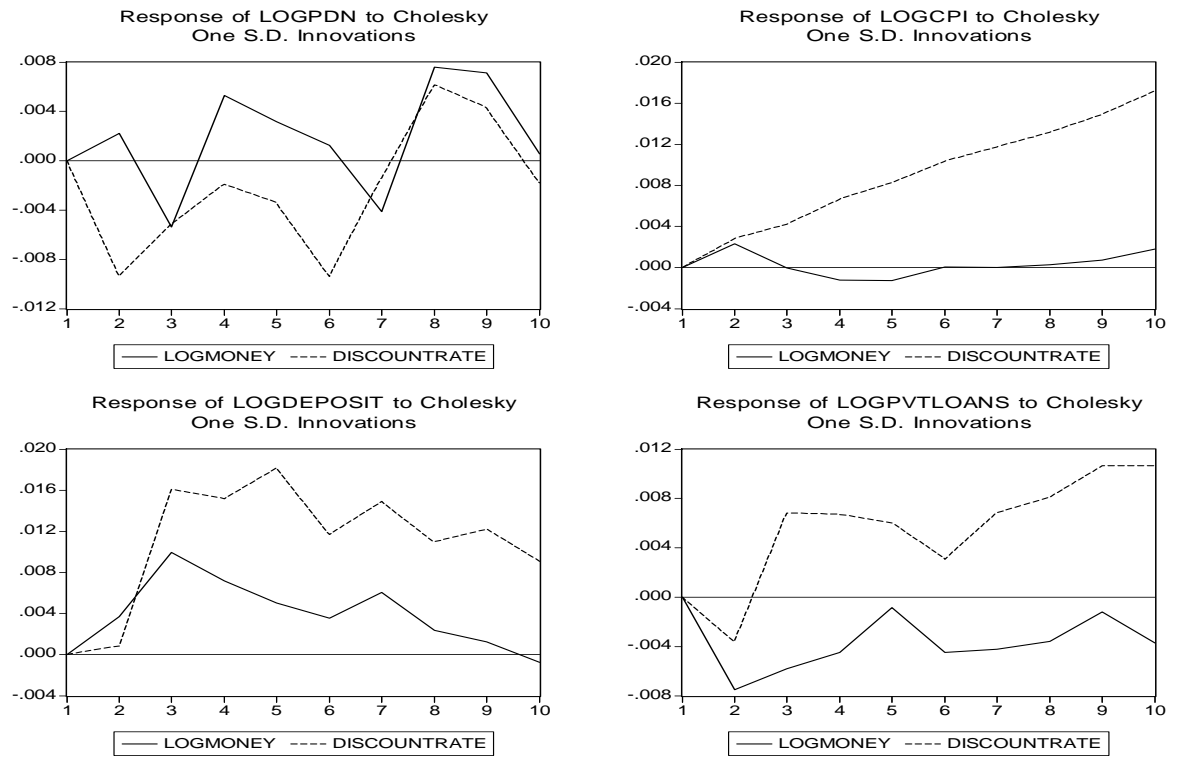
Notice that, the “credit variable” gets affected by shocks in either of the monetary policy instruments, and gets back to its initial level. The same is true for the output levels. But for both the countries, this identification scheme shows a permanent effect of monetary policy on consumer prices for both the countries. So the results of this SVAR analysis are similar as the earlier results.

## 2.2 Long Run restrictions

One advantage of the use of LR is that no restrictions are placed on the contemporaneous relations among the variables. Thus, a restriction that monetary policy shocks have no contemporaneous effects on output or prices is not imposed, as was done in the short run scheme (lower triangular).



**Figure 6: Impulse Response of SVAR with Short Run restrictions for INDIA**



**Figure 7: Impulse Response of SVAR with Short Run restrictions for PAKISTAN**

The first restriction used to identify the monetary policy shock is that money or interest rates shocks have no long-run effects on output. A second restriction is that monetary policy shocks have no long-run effects on the interest rate. These are familiar results from a sticky-wage/price aggregate demand-aggregate supply-type model with IS-LM underlying aggregate demand. Interest rate and spread are not affected by any of the other variables. It is also assumed that exchange rate or price level does not have any influence on output in long run.

The model is estimated applying these long run restrictions. The results of estimations (the matrix  $I^{-1}$ ) are as shown in tables 7 and 8. The coefficient in each cell represents the contemporaneous relationships of error terms/ shocks of row variable with the different column variables.

As can be seen from these tables, private sector loans have a positive relationship with the shocks in money (and negative relations with shocks in interest rate and spread). The changes in the private sector claims affect the output positively. The results show that the relationships of policy instruments with credit variable and of credit variable with macroeconomic activities exist in these economies.

Impulse responses for this identification are similar to the ones obtained from contemporaneous restrictions earlier.

Hence the detailed estimation, again affirms the preliminary investigation results of bank lending channel being present in these countries as a mechanism of monetary policy transmission. It reveals that shocks in the policy instruments (interest rates and money) transmit to the macroeconomic activities (production and prices) of these economies via the bank lending channel (credit variable).

Estimated Relationship matrix: <b>INDIA</b>								
	Output	Prices	Exchange Rate	Pvt. Sector Loans	Deposits	Money	Spread	Interest Rate
Output	-0.409397 (0.019335)	-0.456411 (0.005022)	-0.020028 (0.003028)	-0.495360 (0.060161)	0.625472 (0.002394)	-0.441435 (0.022934)	0.003789 (0.086403)	-0.000865 (0.059351)
Prices	-0.001042 (0.004691)	-0.011334 (0.059351)	-0.007838 (0.065948)	-0.234446 (0.098731)	0.011189 (0.019856)	-0.003741 (0.008329)	-0.003790 (0.050527)	-0.000523 (0.003305)
Exchange Rate	4.985983 (0.085794)	5.557096 (0.030483)	0.179344 (0.004653)	6.029751 (0.069745)	-7.552790 (0.024772)	4.484849 (0.003236)	0.159798 (0.046723)	-0.408838 (0.054246)
Pvt. Sector Loans	0.036271 (0.057635)	0.043570 (0.047625)	0.007153 (0.006423)	0.041001 (0.050385)	-0.041820 (0.067574)	0.758432 (0.043593)	0.018747 (0.003785)	-0.207678 (0.002368)
Deposits	-0.533826 (0.064862)	-0.600091 (0.007534)	-0.012034 (0.003541)	-0.665065 (0.004924)	0.876585 (0.070456)	-0.596376 (0.003588)	0.021716 (0.075623)	0.036462 (0.004763)
Money	-0.206352 (0.076357)	-0.241505 (0.004562)	-0.001950 (0.067635)	-0.277660 (0.009471)	0.342680 (0.034565)	-0.251694 (0.006523)	0.005550 (0.007024)	0.011635 (0.069913)
Spread	3.206759 (0.068624)	3.458569 (0.013028)	0.109651 (0.063052)	3.718781 (0.053274)	-5.164326 (0.049748)	3.130781 (0.079725)	0.243803 (0.019539)	0.062175 (0.004783)
Interest Rate	-1.197172 (0.007551)	-1.054037 (0.045642)	-0.190304 (0.029475)	-1.404653 (0.054656)	1.929425 (0.009431)	-1.138668 (0.089134)	-0.142652 (0.064052)	-0.016091 (0.005406)

**Table 6: SVAR Estimations using Long Run identifying restrictions**

Estimated Relationship matrix: <b>PAKISTAN</b>								
	Output	Prices	Exchange Rate	Pvt. Sector Loans	Deposits	Money	Spread	Interest Rate
Output	0.000276 (0.006405)	0.003437 (0.049164)	0.004330 (0.050236)	0.277891 (0.002057)	0.026869 (0.004531)	-0.042037 (0.096291)	-0.039933 (0.005491)	0.034302 (0.015374)
Prices	0.014752 (0.020436)	0.009095 (0.003465)	0.002062 (0.005759)	0.310291 (0.054124)	-0.003242 (0.067651)	0.019144 (0.009128)	0.002948 (0.007431)	-0.012067 (0.065625)
Exchange Rate	0.158459 (0.068545)	0.335979 (0.043769)	-0.179822 (0.003215)	-2.669775 (0.013400)	-0.998229 (0.006052)	1.243500 (0.054766)	0.732730 (0.004334)	-0.153593 (0.072064)
Pvt. Sector Loans	-0.006401 (0.001605)	-0.001878 (0.004306)	-0.006972 (0.001204)	-0.022109 (0.005465)	-0.027566 (0.034306)	0.540360 (0.095230)	-0.012212 (0.003651)	-0.402790 (0.002854)
Deposits	-0.037021 (0.033954)	-0.036409 (0.007504)	0.006903 (0.009020)	0.077049 (0.054763)	0.041400 (0.006932)	-0.067809 (0.082062)	-0.051723 (0.005004)	-0.004009 (0.045043)
Money	-0.017751 (0.056690)	-0.001982 (0.004946)	0.002578 (0.003651)	0.006497 (0.004595)	0.003402 (0.003910)	0.013366 (0.045737)	-0.011522 (0.002307)	0.001276 (0.006524)
Spread	-0.072563 (0.043065)	0.548751 (0.000551)	-0.291594 (0.019340)	-0.217812 (0.006523)	0.042878 (0.008430)	-0.120213 (0.061302)	-0.088930 (0.005641)	-0.116240 (0.020548)
Interest Rate	0.014761 (0.073062)	0.447960 (0.058302)	-0.492315 (0.006103)	-0.369468 (0.008209)	0.104915 (0.035052)	-0.025117 (0.009305)	0.005054 (0.041121)	-0.084015 (0.072503)

**Table 8: SVAR Estimations using Long Run identifying restrictions**

## **D. Explanations and Analysis of Results**

The results of econometric analysis in previous two parts should be analyzed keeping basic economical structure and the macroeconomic policies of these two countries in mind. While there has been evidence of association between movements in interest rate (or yield spread, to be more precise) and real economic activity in most of the developed countries, these kinds of results are virtually absent in the case of developing economies. In part, this is because in developing economies with administered interest rates yield curve has not been market determined. Moreover, both the countries started as agricultural economies with not very developed banking system and have struggled even with the stability of political regimes (especially in the case of Pakistan). Hence one can reason why the results for interest rate as monetary policy instrument are not as apparent as in case of developed countries. Even the presence of informal credit market, which is operable mostly in rural economies (forming a large percent of total till late 1980s), can be blamed for usual monetary policy shocks (interest rates) not affecting the loans that much.

As mentioned earlier, the other important point to consider is that unlike developed countries, India and Pakistan have sought to printing of currency as a measure to finance the government deficit. Hence usual open-market operations loose some of the significance in impacting the real macroeconomic activity via credit channel.

Now the results are compared with previous such works on the bank lending channel for developed and less developed countries.

## **1. Comparison with Developed Countries**

Perhaps the simplest aggregate empirical implication of the bank-centric view of monetary transmission was suggested by Bernanke and Blinder (1992). They showed that for US, following changes in monetary policy, there is a strong correlation between bank loan and key macroeconomic indicators like unemployment, GNP etc. The simple OLS results in part-II show that this kind of aggregate level relationship exists in India and Pakistan.

The presence and significance of bank lending channel as monetary policy transmission mechanism in developed countries like US, Canada or other European countries has been established by many research papers in past. These papers used different indicators or proxies for bank lending. For example, 'ratio of bank vs. non-bank debt' is observed to decline positive innovation in the federal fund rates<sup>16</sup>.

In this paper due to availability of only aggregate level financial data, the credit variable used is "private sector claims". The results show that there exists a significant relationship between this credit variable and macroeconomic activity (production). The levels of significance of bank lending channel shown in studies for developed countries should not be compared with results in this paper, because the credit variables used are different. However, one fact to note is that the effect of interest rate shocks on the credit variable is not as significant as the effect of a shock in money supply.

Another most commonly used variable, term spread has been shown to explain the presence of credit channel for the developed countries. Again since interest rate is not a very effectively used instrument in India and Pakistan, the spread does not seem to have much explanatory power for macroeconomic activity and hence can not be considered as

a good indicator of bank lending channel for India and Pakistan (unlike the results from developed countries, where the spread is very promising credit channel variable).

There are similarities in results of impulse response and variance decomposition analysis for these two countries and developed countries like US, Canada. The effect of monetary policy shock on output gradually dies, and output reaches the initial equilibrium level, while changes in prices are persistent.

## **2. Comparison with other Developing countries**

Agung (1998)<sup>17</sup> finds significant different responses across the bank-size classes to a change in monetary policy for Indonesia. In particular, a monetary contraction does not significantly influence lending by state banks, but it leads to a decline in lending by smaller banks. A lot of papers have focused on discussing the bank lending channel in European countries like Spain, Poland, and Sweden<sup>18</sup> etc. Again many of these studies have been done on the micro level bank panel data, which unfortunately is not available for the case of this paper. But on aggregate level the results for India and Pakistan also suggest that a monetary policy shock induced by changes in money supply leads to changes in private sector loans, as is the case with many of the developing countries. Whether there is a distributional aspect of this relationship can not be inferred from this study due to data constraints.

For Sweden households and firms are found to be constrained to bank lending, which imply that any policy induced shifts in the supply of bank loans should also cause real spending effects<sup>19</sup>. Similarly, it is observed that banks are significantly deposit constrained and that they have only limited access to external forms of finance, which suggest that banks may be unable to dampen the effect of slower deposit growth on loan

growth. Similar studies have been done for Latin American countries like Chile, Brazil etc.<sup>20</sup> For Chile Alfaro, Franken, García and Jara (2003) use the panel data of banks to identify the presence of bank lending channel. They introduce a new variable (low/ high quality ratio) to capture the asymmetric nature of different financial agents. But most of the studies have either focused just on identifying the determinant of bank lending using bank panel data or stressed only on analyzing the effects of monetary policy shocks on bank lending using macroeconomic series.

This paper is unique in the sense that it attempts to address the both issues and create the complete picture of the economy vis-à-vis bank lending channel as transmission mechanism of monetary policy. Private sector loan is used as the credit variable and seem to have marginal predictive power on other macroeconomic variables. Hence the bank lending channel is present in India and Pakistan. The monetary policy shocks (specially the ones in money supply) are transmitted to real economic activities via this channel.

### **3. Contrasts between India and Pakistan**

The results for India and Pakistan are similar in most of the aspects. Both the countries have bank lending channel present in their economies and it is a significant transmission mechanism for monetary policy shocks. For both the countries money supply appears to be the more effective in affecting the macroeconomic activities (via credit variable) rather than interest rate. But the discount rate in Pakistan appears to be much significant instrument than the bank rate in India. This may be attributed to the fact that Pakistan has a more market oriented and liberal policies compared to India which tried to follow the socialist approach.

The discount rate shocks have a large positive impact on deposits and private loans, while the shocks in money have positive impact for deposits but give rise to negative movement in private loans in Pakistan. For India, the behavior of demand deposits is similar, but private loans move go up and down to the initial level as a result of shocks in either bank rate or money. The other contrast is the relative influence of money and interest rate shocks on deposits and loans. For Pakistan these responses for discount rate impulse are more in magnitude as compared to the responses for money impulse. While for India it is the other way round.

## **V. Conclusions and Remarks**

As discussed above we can conclude that the bank lending channel has operated as a monetary policy transmission mechanism in India and Pakistan, with an independent but significant effect in terms of macroeconomic activity. The way that the bank lending channel seems to have operated in these developing countries is consistent with the international empirical evidence. First, banks are forced to curtail their supply of credit following a monetary policy shock. Second, the access of households and small/ medium sized enterprises to external financing is restricted following the drop in the supply of bank credit; third, the drop in the supply of bank credit has a significant influence in terms of macroeconomic activity.

By pushing toward a better understanding of the way in which the bank lending channel operates as a transmission mechanism of monetary policy, this paper contributes to an improvement of understanding the economies of India and Pakistan. Another major contribution is the result that money also plays a non-trivial (rather significant) role in these economies.

This study underscores few avenues for future research that may deepen our knowledge of the functioning of the credit channel, in general, and the bank lending channel, in particular, as transmission mechanisms for the monetary policy in these economies. First of all the need for better measurement and identification of the monetary policy shocks is eminent, especially in semi-controlled regimes, where open market operations are not the only instruments being used. Similarly measuring the costs for bank-dependent borrowers associated with a drop in banks' credit supply as a result of changes in monetary policy is also very important. There is need to develop the methodology and framework to quantify the effects of policy changes. This would be a great help for policy makers to understand, foresee and hopefully control the transmission of unexpected shocks in the economy. Since the bank lending channel theory relies on asymmetry of information among heterogeneous agents, improvements in assembling more comprehensive datasets at the microeconomic level would help testing these theoretical foundations more accurately.

The other major area of focus should be the application of these theories and methodologies to analyze, to evaluate and to forecast the performance of various monetary policy stances. This could later be used as a useful tool for policy makers to choose right kind of actions for achieving their desired monetary policy objectives. Based on the feedback about the accuracy of predictions, these theories and methodologies then can be modified to enable researchers to come up with a more correct picture of real economies.

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<sup>1</sup> For critical review of the issues and evidence of bank lending channel, see Smart (2003).

<sup>2</sup> See Kashyap and Stein (1994) for details.

<sup>3</sup> For detailed methodological issues of monetary policy analysis, see McCallum (1999)

<sup>4</sup> For an overview over this literature see Levine (1997).

<sup>5</sup> Based on data from Beck, Demirgüç-Kunt and Levine (1999).

<sup>6</sup> Source: State Bank of Pakistan annual report (2003)

<sup>7</sup> Source: Reserve Bank of India annual publication (2003)

<sup>8</sup> See <http://ifs.apdi.net/imf/> for details about the IFS database.

<sup>9</sup> The data is available at <http://pwt.econ.upenn.edu/>

<sup>10</sup> Theoretical critiques by Lucas (1976) and Sims (1980) played an important role in rationalizing the failure of reduced form models.

<sup>11</sup> See Bagliano and Favero (1997), Bernanke and Mihov (1998) for details on VAR analysis of the monetary policy

<sup>12</sup> See Gottschalk (2001) for detailed SVAR methodology.

<sup>13</sup> See Keating (1992) for a critique of Structural approaches to VAR.

<sup>14</sup>  $y$  is said to be Granger-caused by  $x$  if  $x$  helps in the prediction of  $y$ , or equivalently if the coefficients on the lagged  $x$ 's are statistically significant.

<sup>15</sup> It tests whether an endogenous variable can be treated as exogenous.

<sup>16</sup> Oliner and Rudbusch (1995).

<sup>17</sup> See Juda Agung, 1998.

<sup>18</sup> For example, Farinha and Marques (2001); Schmitz (2003); Suzuki (2004); Havrylchyk and Jurzyk

<sup>19</sup> Westerlund (2003).

<sup>20</sup> Nakane,Rocha and Takeda (2003).