

## **Monetary Policy, Business Cycles and Sectoral Response in Pakistan**

**Muhammad Jamil<sup>1</sup>, Muhammad Irfan<sup>2</sup>**

**Abstract:** The study takes a first step in investigating the monetary transmission mechanism in Pakistan at a sectoral level in relation with business cycles. The key **objective** of the study is to empirically investigate the impact of monetary shocks on output of major sectors. Using VAR approach on quarterly data spanning from 1990:1 to 2012:4, we examine whether monetary policy shocks have different sectoral effects. We also incorporated business cycles to analyze whether sectoral effects of monetary policy undergone any changes during different phases of business cycles. Results obtained from VAR framework confirm the presence of sector-specific variation in the real effects of monetary policy. Our results also suggest that variation in output is more interest sensitive in recovery as compared to recessionary time periods. The results, therefore, seem to confirm potential disparities in the effect of monetary policy on real sectoral activities. It is a very unique contribution in empirical literature while at the same time it is a valuable input for accessing monetary policy implications for real sector growth in Pakistan.

**Keywords:** CMR; Sectors; output; Recession; Recovery

**JEL Classification:** E500; E520

### **1. Introduction**

Monetary policy is one of the key policy issues in any economy. The effects of monetary policy on real economic variables have extensively debated in theory as well as in empirical research. In recent times however, monetary economist as well as policy makers have agreed upon the fact that monetary policy affects the real economic activities at least in the short run (Ibrahim, 2005). Subsequently recent focus of monetary authorities have shifted towards other aspects of monetary policy, rather than addressing the question of whether money matters in the determination of real economic variables like output and employment level. One important aspect

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that has captured the interest of both policy makers and monetary economists is the disaggregated effects of monetary policy (Peersman & Smets, 2005).

Generally there are two main options for disaggregating an economy, either on regional basis or on the basis of major sectors contributing in the aggregate production of that economy. Being conducted in a small open economy, this study focused on second option i.e. the sectoral impacts of monetary policy. Since economy of Pakistan does not show smooth trend in output growth, therefore we extended our analysis by incorporating business cycles in our study. After completing three business cycles since independence, economy of Pakistan is currently passing through the recessionary phase of fourth business cycle (Mahmood & Arby, 2012).

Although the impacts of monetary shocks on aggregate production abound in the literature, an analysis of the sectoral response to monetary impulses had suffered neglect. For Pakistan it is vital to empirically investigate the transmission mechanism of monetary policy at the sectoral level for two important reasons. First, except Alam and Waheed (2006) we found not any other study that has been conducted by utilizing the latest data from major sectors. Therefore there is a need to incorporate the emerging sectors in analysis based on their contribution in aggregate production. Secondly, our analysis of sectoral response would assist in explaining the transmission mechanism of monetary policy to major sectors of the economy, and ultimately enhance the understanding of the monetary policy mix to be implemented in order to ensure balanced and sustainable growth in the economy.

Monetary policy affects the different sectors of an economy differently. There are many reasons for differences in sectoral response to monetary shocks including nature and volume of production, and access to credit markets of a specific sector (Ahmed *et al* 2005). A number of studies have justified the sectoral differences in response to monetary policy both in developing as well as developed countries. Leading explanations include Gertler and Gilchrist (1994), Ganley and Salmon (1997), Domac (1999), Serju (2003) and Ibrahim (2005). The general conclusion from this literature is that there exists heterogeneity across sectors in response to monetary shocks. Therefore there is a need to analyze the impact of monetary policy shocks on real output of different sectors in Pakistan economy.

We examine the sectoral impacts of monetary policy by utilizing quarterly data spanning from 1990:1 to 2012:4 from six major sectors. These sectors are: Livestock (S1), large scale manufacturing (S2), small scale manufacturing (S3), transport, storage, and communication (S4), wholesale and retail business (S5), and finance and insurance (S6). To this end, we utilized Vector Auto Regressive (VAR) framework to access the dynamic response of sectoral output to monetary shocks. Our study is based on following key objectives:

- To empirically investigate the impact of monetary policy shocks on sectoral output
- To analyze the changes in the sectoral effects during different phases of business cycle in response to monetary policy

This study is organized as follows. Coming section presents a brief and relevant literature on current research issues, while section three provides background information about monetary policy, business cycles and contribution of major sectors in Pakistan economy. Fourth section presents research methodology along with data sources and variables included in study. Results and discussions are included in section five, while section six concludes the study by discussing key outcomes and recommendations.

## **2. Related Work**

Previous research on monetary issues has conducted on investigating the impacts of monetary shocks on aggregate variables. In recent years, however the focus of researchers and policy makers has shifted to disaggregated impacts of monetary impulses, especially on regional and sectoral impacts of monetary shocks. One of the first remarkable attempts to investigate the monetary transmission mechanism at the disaggregated level was the study conducted by Gertler and Gilchrist (1994). Study compared the cyclical behavior of large and small manufacturing firms, and responsiveness of these two types of firms to monetary shocks in UK economy. Data obtained from quarterly financial reports were estimated over the period of 1958 to 1993 by using bivariate VAR methodology. Empirical findings revealed that in response to tight monetary policy, small firms face substantial contraction as compared to large scale manufacturing firms due to their liquidity constraints.

In order to investigate the possible asymmetric effects of monetary transmission mechanism at disaggregated level, Hayo and Uhlenbrock (1995) empirically investigated the output of major industries in Germany. Study utilized the macroeconomic setting by mean of a Vector Auto Regressive (VAR) framework and estimated the monthly output from above mentioned industries over the period of 1978 to 1994. Empirical results revealed that eight industries showed significant and positive output reaction while four industries exhibited negative and significant price effects.

Ganley and Salmon (1997) empirically estimated the output of different industries from 24 different sectors of UK economy. In line with existing literature on this issue, study utilized VAR framework for empirical analysis. Different industries were selected from four major sectors of economy including production, services, agriculture and construction. Results provided the evidences of sectoral

heterogeneity in response to unpredictable monetary impulses. Moreover interest rate channel was found significant in affecting the output of major industries.

For analyzing the transmission mechanism of monetary policy to different sectors, Cimadomo (2002) empirically estimated the systematic effects of monetary policy to different sectors in US economy. Study included the output of industry, primary metals, food industry, textile, and electrical machinery for empirical analysis. Results obtained from factor model framework revealed that systematic monetary policy affects the different sectors of economy heterogeneously. Serju (2003) analyzed the response of the different sector to monetary policy shocks in Jamaica. The results obtained from a structural VAR model indicated that monetary shocks generate a cumulative deterioration in the value added of the economy. Empirical findings revealed that most of goods producing sectors affected negatively by tightening of monetary policy. On the other hand financial sector was found vulnerable to such interest rate shocks in the short term. Study confirms the presence of sectoral disparities in response to monetary shocks.

Most of the studies in the literature of monetary economics used VAR framework for analyzing the disaggregated impacts of monetary policy. Bernanke *et al* (2003) took an early step in modifying the traditional VAR methodology used for monetary transmission mechanism. Results revealed that for properly identifying the monetary transmission mechanism the information obtained from factor-augmented VAR (FAVAR) methodology is indeed important. Overall results of study provided a comprehensive picture of the effects of monetary policy on the economic performance of different sectors of an economy.

Ibrahim (2005) empirically estimated the effects of monetary policy shocks on aggregate output as well as on output of eight different sectors in Malaysia. Empirical estimations obtained from VAR framework revealed that output of manufacturing, construction, business services sectors, finance, insurance, and real estate decline more than total output in response to positive interest rate shocks. By contrast, agriculture, mining and quarrying, electricity, forestry and fishing, gas and water were found relatively less sensitive to interest rate changes. Study confirmed the existence potential disparities in the effect of monetary shocks on the real output of different sectors within an economy.

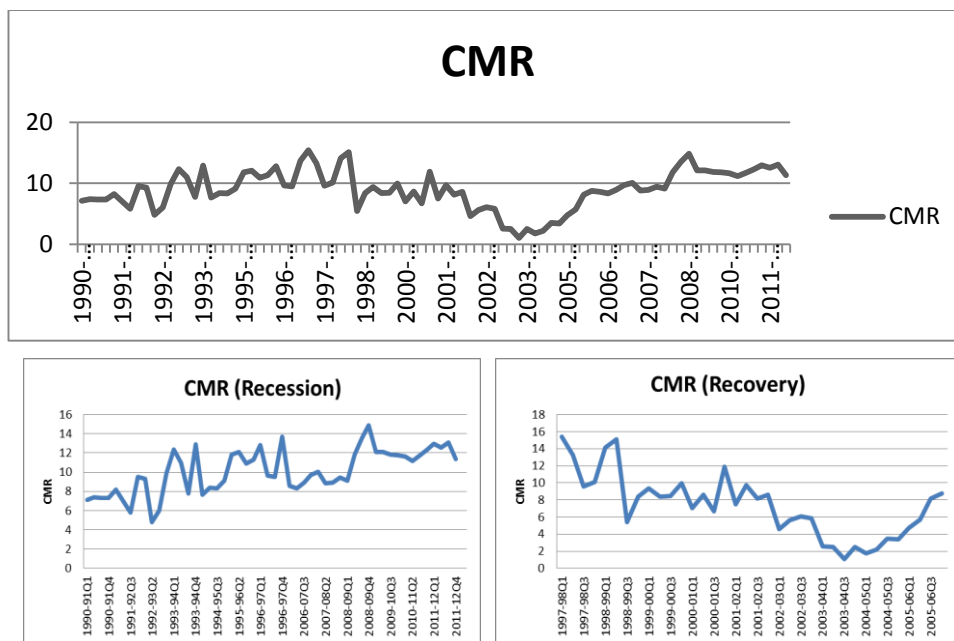
In case of Pakistan economy, Alam and Waheed (2006) took first step in investigating the monetary transmission mechanism at sectoral level. Study also incorporated the structural reforms of economy taken in 1990s. Following the literature, study estimated the VAR model by using quarterly output of major sectors over the period of 1973:1 to 2003:4. Empirical results confirmed the existence of sectoral differences in response to monetary shocks. Specifically results indicated that output of wholesale and retail trade, large scale manufacturing, and insurance and finance decline significantly in response to tight monetary policy.

Fuentes and Marrero (2010) empirically analyzed the sectoral asymmetries in response to monetary shocks in Spain over the period of 1988 to 1998. For the identification of monetary shocks quarterly data was estimated from different industries by employing VAR model. Results of the study were consistent with literature and confirmed the presence of sectoral differences in response to national monetary shocks. On the other hand Gabor (2012) used a structural factor model for analyzing the sectoral heterogeneity in response to monetary policy shocks in Hungary. In line with previous VAR based studies, aggregate variables indicated similar results for impulse responses. However, the sectoral responses to monetary policy shocks revealed considerable heterogeneity. In particular, sectors which are more dependent on external finance showed larger output responses, while healthier corporate balance sheet sectors implied weaker price responses.

### **3. Background Information**

Monetary management is the responsibility of central bank in any economy. The State bank of Pakistan (SBP) was established in July 1948 under the State bank of Pakistan order 1948. The prime objective for the establishment of central bank was to manage the monetary and credit system of the country. Central Bank was assigned broad macroeconomic management objectives including stability of prices, sustainable economic growth, minimum unemployment rate, stable exchange rate, effective management of financial market, and appropriate level of foreign exchange reserves. Before 1990s monetary policy was designed and implemented by controlling credit and interest rate in the economy. At that time banking and financial sectors were not playing active role in Pakistan due to the fact that almost seventy percent of commercial banks and financial institutions were operating under public sector. Subsequently in 1990s government of Pakistan introduced reforms in financial and banking sectors and reconsidered the monetary policy by focusing on indirect approach by introducing market instruments to achieve stable and sustainable macroeconomic environment in the economy. In order to maintain liquidity position in financial sector, after 1995 SBP switched towards different policy instruments including window discount borrowing, open market operation, Stationary legal reserve (SLR), and Cash reserve ratio (CRR) (Ahmed et al, 2005).

Following figures shows call money rates during overall as well as recession and recovery time periods:



**Figure 3.1. Call money rate (CMR) during 1990Q1 to 2012Q4**

Above figures are obtained from quarterly data used for current study. Call money rate remain in the range of 2% to 15% from 1990 to 2012. However it is evident from above figures that central bank adopted tight monetary policy in recession while loose monetary policy in recovery time periods. As an economy is comprised of different sectors, with every sector having different financing needs, no inference can be drawn from aggregate results about sectoral effects of monetary policy. This is an emerging research area and current study is in line with investigating disaggregated effects of monetary policy on major sectors of Pakistan economy. Following table shows the contribution of major sectors in Pakistan economy as well as borrowing of these sectors from different banks and financial institutions.

**Table 3.1. Contribution of major Sectors in Pakistan Economy**

S/No	Sectors	%Contribution in GDP	Credit Borrowing (Million Rs) 2013
1	Live Stock	11.8	34271
2	Manufacturing (Large + Small)	12	1407763
3	Transport, S&C	13.7	88540
4	Wholesale and Retail	18.15	187169
5	Finance and Insurance	3	47626

Source: SBP; Handbook of statistics on Pakistan economy 2010

To this end we can say that there exists sectoral heterogeneity with regard to credit requirements as well as their contribution in aggregate economy. GDP being generally accepted indicator of economic growth comprises of four types of variations including short run fluctuations, long run trend, seasonal variations and business cycles. During a complete business cycle economy goes through four different phases i.e. recession, trough, recovery and peak. During different phases of business cycles macroeconomic variable react differently to monetary policy shocks. Moreover effectiveness of monetary policy fluctuates during different phases of business cycles. Current study will empirically test this line of argument in coming chapters. If we look at long run growth trend of Pakistan economy, there seems no sustainable path for economic progress. Following tables shows duration of different business cycles in Pakistan.

**Table 3.2. Business Cycles in Pakistan**

<b>Business Cycle</b>	<b>Recession</b>	<b>Trough</b>	<b>Recovery</b>	<b>Peak</b>
First cycle: 1949-1965	1949-58 (9 years)	1958	1959-65 (7 years)	1965
Second cycle: 1966-1985	1966-75 (10 years)	1975	1976-8 (10 years)	1985
Third cycle: 1986-2005	1986-97 (12 years)	1997	1998-2005 (8 years)	2005
Fourth cycle:	2006-12	2012		

*Source: Mahmood and Arby 2012.*

#### 4. Our Approach

In line with existing literature our research model includes three variables i.e. sectoral output, monetary policy indicator, and price level. We included six major sectors based on their contribution in GDP as discussed earlier. These sectors are: Livestock (S1), large scale manufacturing (S2), small scale manufacturing (S3), transport, storage, and communication (S4), wholesale and retail business (S5), and finance and insurance (S6). Following Alam and Waheed (2006), Ibrahim (2005), and many other studies, we represented price level by consumer price index (CPI), while call money rate has been used as monetary policy indicator in current study. Study utilized quarterly data spanning from 1990:1 to 2012:4. Business cycles have been incorporated by introducing dummy variables in model.

In line with existing literature on subject matter, we utilized Vector Auto Regressive (VAR) framework to access the dynamic response of sectoral output to monetary shocks. VAR is one of the methods that can be used for regression-based forecasting (one step ahead forecasting or multi step ahead forecasting). VAR models are also appropriate models for describing the data generation process (DGP) of time series variables (small or moderate data set) and all variables are often treated as endogenous (Sims 1980). Restrictions are usually imposed with the help of some

statistical techniques instead of prior beliefs based on uncertain theoretical considerations. When we have several time series and we want to check the interrelationship between them, then VAR can also be used. Sims (1980) proposed this model and it is time series generalization of AR model and it is easy to estimate as it uses the OLS estimation technique. In VAR models each variable is expressed as a linear combination of lagged values of itself and lagged values of all other variables in the group. In other words when a dependent variable has its own lagged variable on RHS and lagged independent variables then this model is called VAR model and number of independent variables are indigenous variables and there is no exogenous variables in the system of equations. The term Auto regressive is used due to presence of lagged values of dependent variable on RHS. The term vector is used because of presence of vector of all the variables (Stock & Watson, 1990).

The critical part of VAR model is estimation and there are two approaches to the estimation of VARS; one is the direct estimation of the system of equations (Unrestricted VAR) and it can be valid only when all the series are stationary. According to Ramaswamy and Slok (1998) the second approach is to determine the number of possible co-integration vectors (restricted VAR, where number of restrictions has been applied on the concerning co-integration vector) and this method is appropriate when the independent variables are not stationary.

Another important issue concerning with the estimation strategy is about selection of the appropriate specification of the VAR. Specification involves decision about whether the VAR should be estimated in pure differences, or in levels without imposing any restriction, or as a vector error correction model (VECM) to allow for the presence of co-integration. If the variables are non-stationary and are not co-integrated suggest a VAR model in first differences and if the dynamic interactions among co-integrated variables exist then VAR should be modeled using a VECM. In other words VECM will be used only if co-integration exists between the variables, and the true co-integrating relationship is known and should have an economic interpretation. And if the impulse response functions generated from VECM, then those will imply that the impacts of monetary shocks are permanent. If the impulse response function are generate from simple VAR (unrestricted VAR) then those will be decided by data whether the effects of monetary shocks are permanent or not (Ibrahim 2005). The goal of VAR analysis is not only to obtain estimates of parameter, but to assess the interrelationship among the variables.

This study is concerned with the finding the monetary transmission mechanism for Pakistan at a sectors output level by using the quarterly data of different sectors. VAR is effective to use because of the simultaneous effect of each of the concerned variables on each other; like Sectors outputs are affected by Money Market rate (Call Money rate) and money market rate is affected by sector output, and inflation (CPI) potentially affect the sectors output and sectors output potentially affect the inflation,



similarly the call money rate and inflation can potentially effect each other. So the system of equations will be as follows:

$$Si_t = \sigma_0 + \sum_{j=1}^k \beta_j CMR_{t-j} + \sum_{j=1}^k \gamma_j Si_{t-j} + \sum_{j=1}^k \theta_j CPI_{t-j} + \mu_t \dots (1)$$

$$CPI_t = \alpha_0 + \sum_{j=1}^k \beta_j CMR_{t-j} + \sum_{j=1}^k \gamma_j Si_{t-j} + \sum_{j=1}^k \theta_j CPI_{t-j} + \mu'_t \dots (2)$$

$$CMR_t = \delta_0 + \sum_{j=1}^k \beta_j CMR_{t-j} + \sum_{j=1}^k \gamma_j Si_{t-j} + \sum_{j=1}^k \theta_j CPI_{t-j} + \mu''_t \dots (3)$$

Where

CPI is consumer price index (Price variable), Si is the sectoral output (i = 1, 2... 6)

CMR is the call money rate (money market rate), K is the number of lags, t is the time period (22years, 88 Quarters), and  $\mu, \mu', \mu''$  error terms.

and each equation contains an error term ( $\mu, \mu', \mu''$ ) that has zero expected value given past information on all the variables and called Impulses or shocks or innovation.

Another important issue faced while estimating the VAR model is the selection of lag length because appropriate lag length selection is very important otherwise inclusion of too many lag lengths can lead to loss of degree of freedom and can also cause multicollinearity. And inclusion of less lag lengths may cause specification errors. One way to avoid these problems is to select the lag length with the help of certain criterion like AIC criteria, Beysian Criteria, Akaike criteria or Schwarz criteria. Some of these methods favor the trial and error methods and Akiake and Schwarz criteria favor the model with the lowest values of these criterions (Gujarati & Porter, 2008). Finally one can estimate the VAR model with the help of OLS by using certain Econometric packages and an interpret the results of coefficients and Impulse Response Functions and Variance Decomposition can also be obtained for forecasting purposes for any event of specific time series.

VAR model has many advantages and disadvantages as well. Advantages include that it's a simple methods having all the variables set as indigenus and we don't have to specify the indigenus and exogenous variables. It uses OLS method to estimate the coefficients which is the simplest and one of best econometric

techniques of estimation that can be used for estimation of each equation separately. Results of VAR model are better than complex nature simultaneous equations methods. It gives us the methods for forecasting like Impulse Response Functions and Variance Decomposition with a single click.

Everything has some goods and some bad and VAR is no exception to them. Disadvantages of VAR are such that it is a theory based method which requires existing information where simultaneous equation model does not need it. VAR is better for forecasting than policy analysis. One of the critical issues faced while employing VAR is selection of lag length and if more lags are used then problem of loss of degree of freedom can be faced, and if less number of lag lengths are used then we may face the issues regarding specification of VAR model. Unless the sample size is large enough or some appropriate selection criterion is used, these problems will persist with VAR models. If we have large number of independent variables and all the variables are not stationary then problem of infinite vector of co-integration will exist and that lead to no solution model. Coefficients of VAR are difficult to interpret some times and need to estimate the Impulse response function, which traces out the response of dependent variable on the error term (Gujarati & Porter, 2008).

Following Alam and Waheed (2006) the unrestricted VAR model is applied and identified using Cholesky decomposition. For each system of equation, the following ordering was used: consumer prices, real output of sectors, and call money rate. The basic argument which is backed here is that a shock to interest rate has no contemporaneous effect on output. This assumption is implemented by enlisting real output and prices before call money rate. Technically, this assumption involves identification of monetary policy by using the residuals from the reduced form equation of interest rate and after that regress them on the residuals from the output and price equations. From the VAR estimates, we generate Impulse Response Functions which trace the response of shock on a variable through time to an unanticipated change in itself or other interrelated variables.

The main objective of this study is to find the reaction of real output of different sector of Pakistan economy to a monetary shock, so we only intend to derive the impulse-response functions which trace the reaction of real sectoral output to a one standard deviation shock to the interest rate (call money rate). In other words we use standard vector auto regression (VAR) framework and generate impulse-response functions of different variables and variance decompositions to assess dynamic responses of sectoral production as well as sectoral production to monetary policy shocks.

## 5. Results and Discussions

### 5.1. Unit Root Analysis

As our research is based on time series data, therefore before proceeding we tested the stationarity of each variable. We subject each variable to standard augmented Dickey-Fuller (ADF) test. This is most commonly used unit root test in applied research. Results obtained from ADF test are summarized in table 5.1 below:

**Table 5.1. Unit root (ADF) Results**

Variab les	Definition	t-stat	P-value	Level
S1	Livestock	-3.568	0.0085	I(1)
S2	Large scale manufacturing	-4.925	0.0001	I(1)
S3	Small scale manufacturing	-18.58	0.0001	I(1)
S4	Transport, S&C	-4.941	0.0006	I(0)
S5	Wholesale and Retail	-29.89	0.0001	I(1)
S6	Finance and Insurance	-11.97	0.0001	I(1)
CPI	Consumer Price Index	-4.339	0.0007	I(1)
CMR	Call Money Rate	-8.977	0.0000	I(1)
Critical values of ADF test for model with 'c, t' are (-3.96, -3.41, -3.13) respectively for 1%, 5% and 10%; Mackinnon (1991).				
Critical values of ADF test for model with 'c' are (-3.43, -2.86, -2.57) respectively for 1%, 5% and 10%; Mackinnon (1991).				

Based on the critical values for both constant and, constant and trend models of ADF test obtained from Mackinnon (1991), it is observed that all variables are stationary at 1% level of significance. Moreover our unit root test provided mixed results regarding the stationarity of variables. All variables are stationary at first difference levels with the exception of S4, which is stationary at levels. Data temporal properties presented in above table are necessary for selecting appropriate VAR specification. Based on these results we estimated unrestricted VAR model for each sector and results of VAR estimates are presented in next section.

### 5.2. VAR Results of Sectoral Output

Based on data temporal properties, we estimated unrestricted VAR model for each sector by following the strategy used by Ramaswamy and Slok (1998). As objective of the study is to analyze the impact of monetary shocks on sectoral output, we classify six sectors under consideration into two bases. First, we categorized the sectors according to magnitude of response to one standard deviation shock to interest rate shown by variance decomposition. Secondly we also classified the sectors according to duration of response shown by impulse response functions.

**Table 5.2. Variance Decompositions of Sectoral Output (% Response to CMR)**

Period	S1 (LS)	S2 (LSM)	S3 (SSM)	S4 (TSC)	S5 (W&R)	S6 (F&I)
1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	2.143232	0.536655	1.962947	0.438290	3.563529	1.338378
3	2.423996	0.504443	5.948705	2.034429	4.926051	2.987797
4	3.792436	1.086293	9.827771	4.762503	11.06028	3.329253
5	6.688344	3.442445	11.36721	7.666191	7.832588	3.731412
6	9.839859	4.544201	15.95144	10.66013	17.01449	3.702588
7	12.74996	6.793507	18.56723	12.10300	17.08250	4.611819
8	15.88609	6.932076	21.38911	12.42856	17.66951	4.565550
9	16.83455	6.656781	19.72183	12.48672	14.82073	7.032169
10	18.88759	6.396326	20.88762	<b>12.58609</b>	19.44173	6.794854
11	20.25314	<b>6.779684</b>	22.26994	12.37407	19.52830	8.446414
12	21.96673	6.310716	<b>23.30041</b>	11.88119	19.77638	8.355062
13	21.21882	5.592030	21.70007	11.27212	17.39664	10.11374
14	21.80734	5.079904	21.95955	10.73304	<b>20.49584</b>	9.939128
15	22.71317	4.818586	22.43289	10.27224	19.73430	11.48169
16	23.97736	4.477433	22.36126	9.863586	19.60003	11.21313
17	23.30818	3.977329	20.81933	9.498292	18.10104	12.49617
18	23.82808	3.566655	20.28544	9.138243	19.89222	12.26003
19	24.53185	3.311906	20.30641	8.777529	19.41963	12.96067
20	25.49753	3.151197	20.04751	8.410387	19.28658	12.87235
21	24.85624	2.920250	18.78029	8.050544	18.11221	13.58284
22	25.13085	2.696862	18.17040	7.720270	19.24535	13.62238
23	25.64780	2.547367	18.09171	7.439265	18.68516	14.22216
24	<b>26.34562</b>	2.500980	17.74832	7.228959	18.47990	14.17041
25	25.61780	2.414549	16.77257	7.085784	17.62111	<b>14.60363</b>

Variance decomposition confirms the existence of heterogeneity among the sectors in response to interest rate shocks. Among six sectors included in study, output of livestock (S1), small scale manufacturing (S3), and wholesale and retail business (S5) seem to be affected more as compared to output of large scale manufacturing (S2) transport, storage and communication (S4), and finance and insurance (S6). Moreover more than 20 percent variation in the output of livestock, small scale manufacturing, and wholesale and retail business is explained by interest rate shocks. Finally large scale manufacturing is the least affected sector due to monetary policy shocks.

Our results are consistent with other studies conducted in developing as well as developed studies suggesting that there exist potential disparities among different

sectors in response to monetary policy shocks. Specifically our results are in line with Bouakez et al (2009). From above results we are inclined to agree with existing literature on subject matter which provides significant evidences for the presence of sectoral heterogeneity in response to interest rate shocks. As mentioned in chapter three, in case of Pakistan economy, manufacturing, wholesale and retail business, and livestock sectors are heavily dependent on bank loans. Therefore these sectors are more interest sensitive as compared to other sectors included in our analysis. Following the Ibrahim (2005) we believe that credit dependency is the major reason for the existence of potential disparities among sectors in the effects of interest rate shocks. Finally, based on above results we can conclude that credit channel is dominant in transmission mechanism of monetary policy in Pakistan.

### 5.3. Impulse Response Functions:

While variance decomposition shows the magnitude of response, impulse response function obtained from VAR estimates shows the duration of response of sectoral output to a one standard deviation shock in interest rate. Note that impulse response functions obtained from VECM suggest that monetary shocks are permanent. As we generated impulse response functions from unrestricted VAR model, therefore decision about whether effects of monetary shocks are permanent or temporary is based on actual data set. Impulse responses of different sectors included in study are shown below:

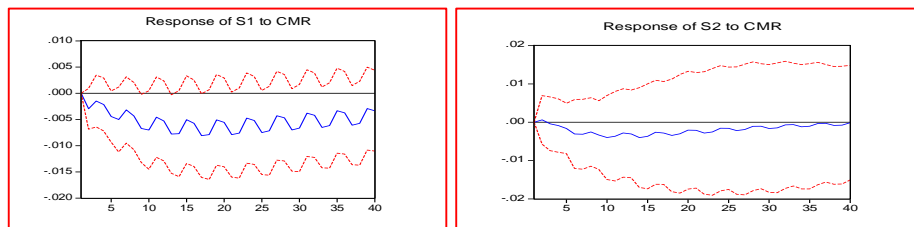
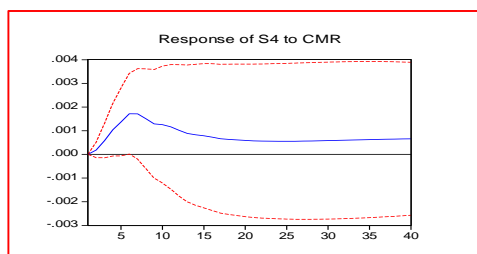
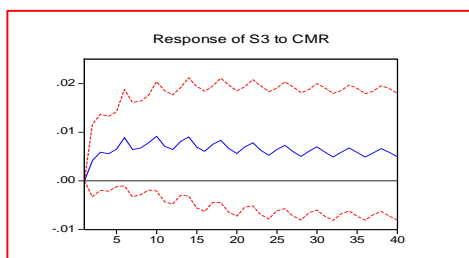


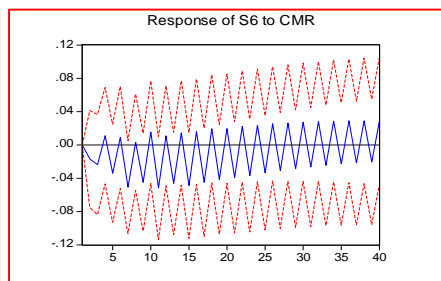
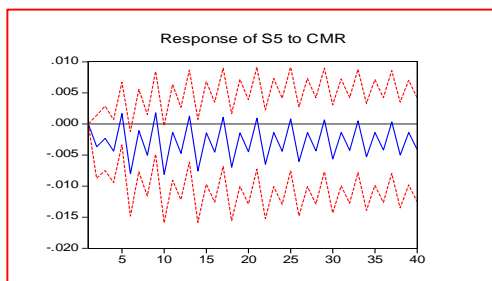
Figure 5.1. Livestock (S1) Figure 5.2: Large Scale Manufacturing (S2)

Above figure shows that interest rate shocks are persistent on Livestock for 25 quarters, and showed no convergence even after 40 quarters, which indicate that monetary policy affects the output of livestock in the long run. One possible explanation for this outcome is that this sector takes bank credit for developmental purpose rather than for financing working capital and short term business expenditures. Although magnitude of response is high in case of large scale manufacturing, during of response is comparatively low for this sector as shown in figure 5.2. After reaching its minimum in 13<sup>th</sup> quarter, interest rate shock starts convergence and it bottoms out at 36<sup>th</sup> quarter. From this result it can be concluded that monetary policy does not effects the real output of large scale manufacturing in long run.



**Figure 5.3. Small Scale Manufacturing (S3) Figure 5.4. Transport S&C (S4)**

Interest rate shocks affect the output of small scale manufacturing for longer period of time as compared to large scale manufacturing. After reaching its maximum in 13<sup>th</sup> quarter, interest rate shocks starts to converge but do not bottom out even after 40 quarters. Since small scale manufacturing heavily depends on bank credit as mentioned in chapter 3, our results are in line with the argument of credit channel of monetary transmission mechanism. Figure 5.4 shows the duration of interest rate shock’s response on transport, storage and communication sector. Results indicate that output response reaches its maximum in 6<sup>th</sup> quarter and then starts convergence. Duration of response is comparatively low for this sector as compared to livestock, large scale manufacturing, and small scale manufacturing.



**Figure 5.5. Wholesale and Retail (S5) Figure 5.6. Finance and Insurance (S6)**

Figure 5.5 shows the duration of response of the wholesale and retail businesses to interest rate shocks. Impulse response function generated from unrestricted VAR model reveal that although there is no consistent response in the output of this sector, but deviation of output due to monetary shocks start decreasing after 10<sup>th</sup> quarter. Finance and Insurance (S6) also follow the similar trend as shown in figure 5.6. From these results we can conclude that duration of response is comparatively low for these sectors as compared to other sectors included in study.

#### 5.4. Business Cycles and Sectoral Response

For incorporating the impact of different phases of business cycles on real output of sectors we used two dummy variables i.e. D1 representing recession period while D2 shows recovery. We estimated unrestricted VAR model for each sectors while treating dummy variables as exogenous variable. From VAR we estimated variance decompositions to analyze the response of sectoral output to interest rate shocks in recession as well as in recovery. As mentioned earlier, in our study recession prevailed from 1990 to 1997 and from 2006 to 2012, while recovery period spanned from 1998 to 2005. We generated variance decompositions for 40 quarters and summarized maximum response of each sector in each phase of business cycle in following table.

**Table 5.3. Maximum sectoral response during Recession and Recovery time periods**

Sectors	Recession	Recovery
S1	17.85366	15.66884
S2	17.13609	36.64514
S3	40.95158	48.16958
S4	12.47741	13.32728
S5	18.90389	34.21617
S6	16.13043	16.24379

Values are obtained from variance decomposition and show % response to CMR.

Results obtained from Variance decomposition indicated several interesting outcomes. First, magnitude of response in the output of different sectors is different in different phases of business cycles. Secondly, magnitude of response is higher in recovery as compared to recession for all sectors with the exception of livestock. This outcome is mainly due to the fact that central bank of Pakistan has adopted loose monetary policy during recovery time periods as compared to recessionary time periods. Due to low interest rate and appropriate investment climate during recovery time periods, loose monetary policy shows higher and significant impact on growth rates of real output in different sectors. Thirdly, our results also indicated that large scale manufacturing (S2), and wholesale and retail businesses (S5) are those sectors which derived the economy from recession to recovery; since output differential is almost double between recession and recovery time periods for these sectors. Although other sectors also showed higher output response in recovery time periods, but difference in the output during different phases of business cycles is much higher for above mentioned sectors as compared to other sectors included in study. As discussed in chapter 3, these two sectors are mostly dependent on bank borrowings, therefore a little decrease in interest rate provide significant opportunity

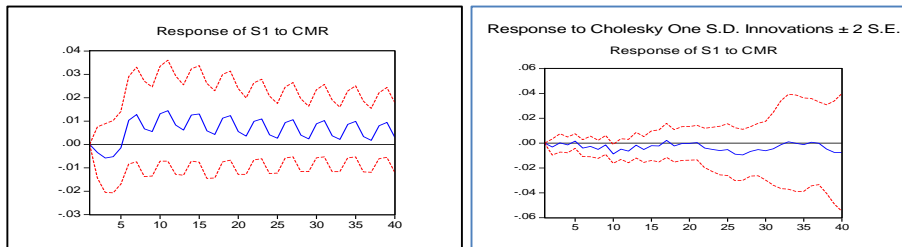
to increase output for these sectors. Finally, we can conclude that credit channel is more dominant in monetary transmission mechanism in case of Pakistan economy.

**Duration of sectoral response during recession and recovery time periods:**

As mentioned earlier, impulse response function obtained from VAR framework can be used to analyze the duration of output response to interest rate shocks. For incorporating the different phases of business cycles, we generated impulse response functions for recession as well as recovery time periods. Results are shown in following figures:

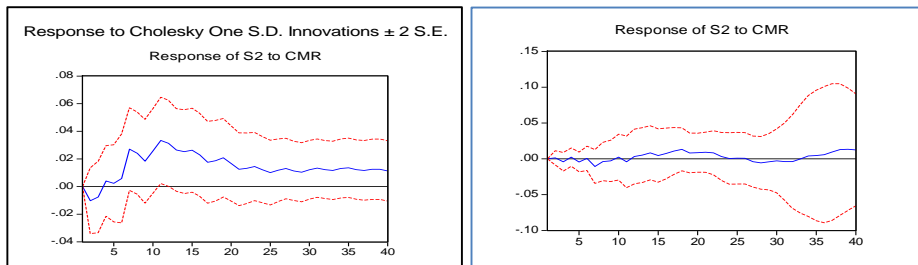
**Figure 5.7. Livestock (S1)**

**5.7A. Recession, 5.7B. Recovery**



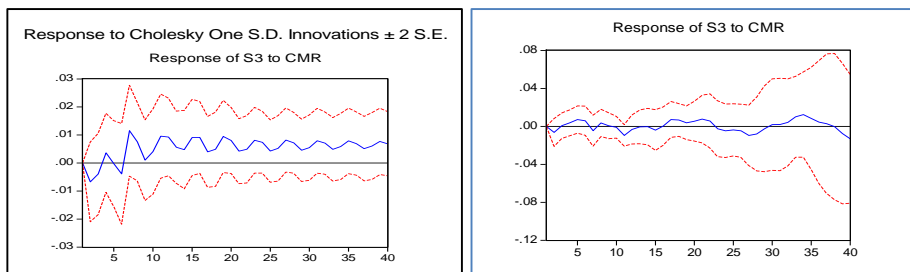
**Figure 5.8. Large Scale Manufacturing (S2)**

**5.8A. Recession, 5.8B. Recovery**



**Figure 5.9. Small Scale Manufacturing (S3)**

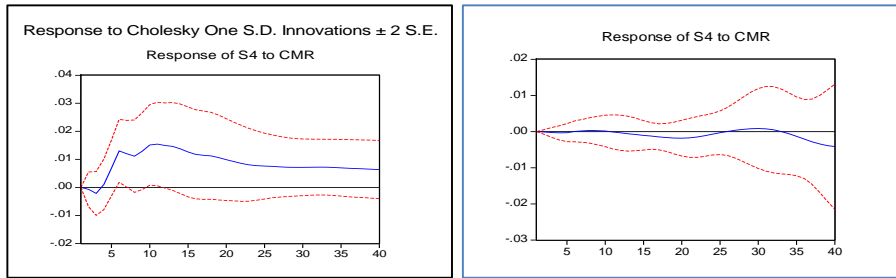
**5.9A. Recession, 5.9B. Recovery**





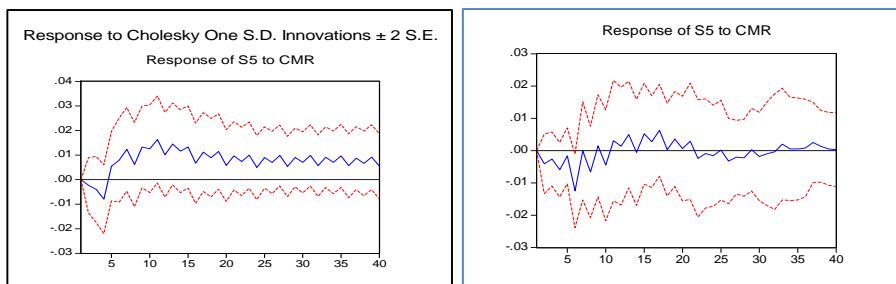
**Figure 5.10. Transport, Storage, and Communication (S4)**

**5.10A. Recession 5.10B. Recovery**



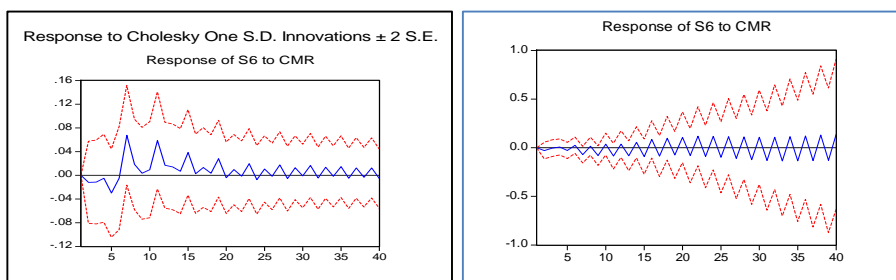
**Figure 5.11. Wholesale and retail businesses (S5)**

**5.11A. Recession, 5.11B. Recovery**



**Figure 5.12. Finance and Insurance (S6)**

**5.12A. Recession 5.12B. Recovery**



All sectors included in our study showed similar results regarding duration of response during different phases of business cycles. It is quite clear from figures 5.7 to 5.12 that duration of response is higher in recession as compared to recovery time periods. As mentioned earlier, duration of response can be analyzed by the convergence of output deviation toward horizontal axis within upper and lower bounds. Earlier the convergence in graph; less will be the duration of response and

vice versa (Jansen et al, 2004). Since convergence occurred at latter quarters in recession as compared to recovery time period, therefore it can be concluded that interest rate shocks prevailed for longer period of time during recessionary time periods. Although there may be other logical reasons for this sort of outcome, for current study higher duration of response during recession is due to the fact that our data set consisted of total 88 observations (Quarters) out of which 58 observations fall under recessionary time periods.

## 6. Conclusion

The present study for the first time investigated the monetary transmission mechanism in Pakistan at sectoral level in relation to the business cycles. Study on one hand analyzed the sectoral impacts of monetary policy while on the other hand incorporated business cycles in order to investigate monetary policy stance during different phases of business cycles. For empirical analysis we included real output of six major sectors over the period of 1990 to 2012. Empirical analysis is based on Vector Auto Regressive (VAR) framework. From VAR we obtained variance decompositions and impulse response functions. For incorporating business cycles we used dummy variables. Our data set comprises of one recovery while two recession time periods. In line with existing literature on monetary issues, results obtained from empirical analysis confirmed the presence of sectoral differences in response to interest rate shocks. Among six sectors included in study, output of livestock (S1), small scale manufacturing (S3), and wholesale and retail business (S5) seem to be affected more as compared to output of large scale manufacturing (S2) transport, storage and communication (S4), and finance and insurance (S6). As these sectors are heavily dependent on borrowings from banks, it can be concluded that credit channel is prominent in transmitting monetary impulses to real economic activities.

As for as duration of response is concerned, we find evidence that livestock and small scale manufacturing are affected for longer time period as compared to other sectors included in study. We found no consistent response in the output of wholesale and retail businesses and finance and insurance. The disparities among sectors in the effects of interest rate shocks were also present when we incorporated business cycles in our study. Magnitude of response is higher in recovery as compared to recession time periods. This outcome is mainly due to the fact that central bank of Pakistan has adopted loose monetary policy during recovery time periods as compared to recessionary time periods.

Our results also indicated that large scale manufacturing and wholesale and retail businesses are those sectors which derived the economy from recession to recovery. Moreover duration of response is higher in recession as compared to recovery time

periods due to long lasting recessions in our economy. The differential effects of monetary policy across the sectors and different phases of business cycles are important for designing and implementation of monetary policy in Pakistan economy. As we have observed from data, monetary policy stance does not follow the standard theory of business cycles in our economy. Monetary Policy remained loose in the periods of booms when it was supposed to be tight while it remained tight in recessions when it was supposed to be loose.

Finally results of the study also raise a very important question regarding the reasons underlying sectoral differences in response to monetary policy shocks. One possible explanation may be the dominance of credit channel as sectors which are affected more are those that heavily depend on bank loans and therefore seems to be more interest sensitive. However this explanation is not enough for describing monetary transmission mechanism. A concrete analysis of this issue in the context of a small open economy is an important avenue for future research.

## 7. References

- Ahmed, N.; Shah, H; Agha, A.I. & Mubarak, Y.A. (2005). Transmission mechanism of monetary policy in Pakistan. *SBP working paper 09*, State Bank of Pakistan.
- Alam, T. & Waheed, M. (2006). *The monetary transmission mechanism in Pakistan: a sectoral analysis*. Online at <http://mpira.ub.uni-muenchen.de/2719/MPRA Paper No. 2719>, posted 13. April 2007.
- Bernanke, B.S.; Boivin, J. & Elias, P. (2003). Measuring the Effects of Monetary Policy: A Factor-Augmented Vector Autoregressive (FAVAR) Approach. *Quarterly Journal of Economics*, vol. 12, no. 1, pp. 387–422.
- Bouakez, H.; Cardia, E. & Ruge-Murcia, F.J. (2009). The Transmission of Monetary Policy in a Multi sector Economy. *International Economic Review*, vol. 50, no. 4, pp. 1243–1266.
- Cimadomo, J. (2002). *The Effects of Systematic Monetary Policy on Sectors: a Factor Model Analysis*. Presented at Center for Financial Studies seminar Frankfurt, August 2002, available online at <http://www.eabcn.org>.
- Dedola, L. & Lippi, F. (2005). The Monetary Transmission Mechanism: Evidence from the Industries of Five OECD Countries. *European Economic Review*, vol. 49, no. 6, pp. 1543–1569.
- Domac, I. (1999). The distributional consequences of monetary policy: Evidence from Malaysia. *World Bank Policy Research Working Paper No. 2170*, World Bank.
- Fuentes, J. Carlos Rodriguez & Marrero, David Padrón (2010). *The industry effects of monetary policy in Spain*. Department of Applied Economics University of La Laguna, e-mail: [cjrodrig@ull.es](mailto:cjrodrig@ull.es).
- Forni, M. & Gambetti, L. (2010). The Dynamic Effects of Monetary Policy: A Structural Factor Model Approach. *Journal of Monetary Economics*, Vol. 57(2), pp. 203–216.
- Gabor, P (2012). The sectoral effects of monetary policy in Hungary: A structural factor analysis. Magyar Nemzeti Bank (Mnb) *Working paper 1*.

- Ganley, J. & Salmon, C. (1997). The industrial impact of monetary policy shocks: Some stylized facts. London: Bank of England Working Paper, Bank of England.
- Gertler, M. & Gilchrist, S. (1994). The role of credit market imperfections in monetary transmission mechanism: Arguments and evidence. *Scandinavian Journal of Economics*, 95, pp. 43–64.
- Gujarati, D. & Porter, D. Basic econometrics. 5th edition
- Hanif, M.N.; Iqbal, J. & Malik, M.J. (2013). Quarterisation of National Income Accounts of Pakistan. *SBP Research Bulletin*, Volume 9, Number 1.
- Hayo, B. & Uhlenbrock, B. (1999). Industry Effects of Monetary Policy in Germany. Manuscript
- Ibrahim, Mansoor H. (2005). Sectoral effects of monetary policy: Evidence from Malaysia. *Asian Economic Journal*, 19, pp. 83-102.
- Jansen, Dennis W.; Kishan, Ruby P. & Vacaflores, Diego E. (2004). Sectoral Effects of Monetary Policy: The Evidence from Publicly Traded Firms. *American Economic Review*, 94: pp. 1055-1084.
- Jarocinski, M. (2010). Responses to Monetary Policy Shocks in the East and the West of Europe: A Comparison. *Journal of Applied Econometrics*, vol. 25, no. 5, pp. 833–868.
- Kemal, A.R. & Arby, M. Farooq (2004). Quarterization of annual GDP of Pakistan. *Statistical paper series 05*, Pakistan Institute of Development Economics.
- Mahmood, T & Arby, M.F (2012). Business Cycles in Pakistan. *International Journal of Business and Social Science*, Vol. 3, No. 4 [Special Issue - February 2012].
- Neumeyer, P.A. & Perri, F. (2005). Business Cycles in Emerging Economies: The Role of Interest Rates. *Journal of Monetary Economics*, vol. 52, no. 2, pp. 345–380.
- Philip, I. (2012). The Monetary Transmission Mechanism in Nigeria: A Sectoral Output Analysis. *International Journal of Economics and Finance*, Vol. 4, No. 1, January.
- Peersman, G. & Smets, F. (2005). The Industry Effects of Monetary Policy in the Euro Area. *The Economic Journal*, vol. 115, no. 503, pp. 319–342.
- Ramaswamy, R. & Slok, T. (1998). The Real effects of monetary policy in the European Union: What are the differences?. *IMF Staff Papers*, 45, pp. 374–96.
- Ricardo, L (2007). Monetary Policy Shocks In a Two-Sector Open Economy an Empirical Study. *European Central Bank Working Paper Series No 799*.
- Serju, P. (2003). Monetary policy and the Jamaican economy: a sectoral analysis. *Bank of Jamaica, Research Service Department, Working Paper no. 02/09*.
- Sims, Christopher (1980). Macroeconomics and Reality. *Econometrica*, 48, pp. 1-49.
- Sims, C.; Stock, J. & Mark, W. Watson (1990). Inference in linear time series models with some unit roots. *Econometrica*, 58, pp. 113-144.
- Uhlig, H. (2005b). What Are the Effects of Monetary Policy on Output? Results from an Agnostic Identification Procedure. *Journal of Monetary Economics*, Vol. 52, no. 2, pp. 381–419.