

Monetary Policy Effects: Evidence from Provincial Data

By

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12/MPhil-Eco/PIDE/2014

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**Department of Economics
Pakistan Institute of Development Economics, Islamabad**

(2016)

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“Dedicate to my loving late sister
Who is my actual source of inspiration”

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Monetary Policy Effects: Evidence from provincial data

"I believe that a successful theory of development (or of anything else) has to involve more than aggregative modeling." - Lucas (1988)

Abstract

After the 18th constitution amendment it has become important to plan provincial development strategies. When we look at provincial economies we observe vast economic and geographic differences. In this study we have studied monetary policy effects at provincial level in Pakistan. Using the time series data from 1972 to 2014 and VAR model we find that Punjab and Sindh are most affected by monetary policy shocks while Khyber Pakhtunkhwa and Balochistan is not affected by monetary policy shocks. Under current institutional setup it is not possible to make monetary policy a provincial matter. On the fiscal side provinces are autonomous to much extent. Province can setup fiscal policy at their end. They should set fiscal policy in such a way that the coordination of monetary and fiscal policy minimizes these differences in effects of monetary policy among the provinces.

Chapter 1

1 Introduction

The debate among economists that how monetary policy affects economy dynamically remains unbolt and challenging theoretically and empirically. Monetary policy is objectively designed for output and price stability. Prevailing monetary theory suggests that monetary policy has uniform effect. But this ignores the fact that a nation consists of different although connected states that might react differently to monetary policy shocks. As one size does not fit all, this might obscure macroeconomic policies of central bank. So the central bank will have to deem the varying consequence of its policies. It is so important for developing countries like Pakistan which are geographically vast and contains diverse socio economic conditions, to consider regional level effects of monetary policy.

Costs and benefits of monetary confederacy remained hot issue among researchers before Economic and Monetary Union came into being. After EMU came into existence, attention is shifted towards asymmetric transmission of uniform monetary policy innovation instigating from European Central Bank, from asymmetric shocks. Dornbusch et.al (1998), Favero and Giavazzi (1999), OECD (1999), Eijffinger and De Haan (2000) and De Grauwe (2000) have checked the monetary transmission in European Union. The studies documented the difference in monetary transmission in Euro area. Carlino and Defina (1998) said that a common monetary policy may be controversial because the cost of disinflation will be distributed unequally across the Economic and Monetary Union countries.

A lot of research [Carlino and DeFina (1998); Arnold and Vrugt (2002); Cortes and Kong (2007); Georgopoulos (2009)] is done worldwide in different countries like USA, Canada, and

China etc on the regional effects of monetary policy. All of above mentioned studies reported different regional effects of monetary policy.

Now in Pakistan after 7th national finance commission award provinces have more shares in revenues. Provinces now collect sales tax from services if they desire. Punjab Revenue Authority (PRA), Sindh Revenue Board (SRB), Khyber Pakhtunkhwa Revenue Authority (KPRA) and Board of Revenue (BOR) Balochistan are the revenue collecting authorities at provincial level. These authorities can collect sale tax in their respective province if any province desires to collect by him.

Table 1.1 Share of provinces in divisible pool is as follows.

Sr.No	Fiscal year	Percentage share
1	2006-07	41.50
2	2007-08	42.50
3	2008-09	43.50
4	2009-10	45.50
5	2010-11	46.25
6	2011-12 onward	57.50
Source: Report of the National Finance Commission 2009. Pakistan Economic Survey 2008/09 to 2014/15		

As we can see from above table that provinces are becoming autonomous on fiscal side and their revenue bases are increased many times in couples of years. It was also agreed in seventh national finance commission awards that provinces will effectively increase the tax base by

taxing the real estate, agriculture sector and tax collecting system to achieve the 15 percent of gross domestic product (GDP) in coming years.

Table1.2; Comparative analysis of share of provinces in divisible pool

Province	% share on the basis of 7 th NFC award	War on terror grant	Grant for compensation on the account of OZ & T	Total percentage share
Punjab	51.74			51.74
Sindh	24.55		0.66%	25.21
Khyber Pakhtunkhwa	14.62	1.80 %		16.62
Balochistan	09.09			09.09
Total	100			
Source: Report of the National Finance Commission 2009.				

Again above table shows provinces are become more autonomous on fiscal side.

Similarly after 18th amendment in constitution of Pakistan 17 federal ministries are dissolved and transferred to provinces. These ministries includes food and agriculture, women development, sports, education, minorities' affairs, social welfare and special education, special initiative, local government and rural development, labor and manpower, Zakat and Usher, population planning, youth affairs, culture, livestock and dairy development, tourism and environment and health.

Hence provinces revenue base has increased many times. There are four financial entities which can make their own independent fiscal policy. There are also vast geographical and

economic disparities across provinces in Pakistan. It has become of utmost importance to study monetary policy effects at provincial level in Pakistan.

Idea that policy shocks affect regions differently is given by the heterogeneity of provincial economies, their financial networks and their fiscal policies. We can deduce variation in province response to central bank action from traditional and credit theories of monetary policy transmission mechanism.

These theories give different ways through which monetary policy can affect provinces differently. Interest rate channel can affect differently due to varying interest elasticities of industries combined with differing geographical and economic concentration of industries. So called credit channel of monetary policy also imply different effects due to policy innovations. Also the degree by which firms and individuals are dependent on credit from and the ease with which bank can change their balance sheet can precisely notify the impact of monetary policy shocks. Effects of central bank monetary policy may vary across Provinces; monetary policy is more effective where small firms or bank dependent borrowers are concentrated.

1.1 Research Gap

We have done a detailed survey on literature of monetary policy effects at regional, state or provincial level. But we could not find even a single study for the case of Pakistan despite the fact the issue has become important after 18th constitution amendment. Not only this, even monetary policy effects at sectoral level there is only a single study in 2003. So there is a huge gap in literature about monetary policy effects at sectoral level and provincial level.

1.2 Objectives of the study

The objectives of the study are as follows

- To analyze the monetary policy effects at national level
- To check the monetary policy effects at provincial level.

Our core objective is to study monetary policy effects at provincial level.

1.3 Motivation

As mentioned earlier that after 7th national finance commission awards share of provinces in divisible pool has increased many times. Also after the 18th constitution amendment 17 important federal ministries have been dissolved and transferred to provinces. Hence planning at provincial level has become important and key to stimulate the growth process and attain prosperity. So in this regard evolution of monetary policy effects at provincial level in Pakistan has become necessary and need of the time.

1.4 Significance of the Study

If we look in case of Pakistan, focus of the researchers mainly remained on the response of aggregate variables or on the effectiveness of different monetary transmission mechanisms. This study adds to the literature by testing the monetary policy effects at the provincial level in Pakistan.

1.5 Organization of the study

Study starts from the introduction, research gap, objective and motivation of study. Second chapter deals with the current state of national and provincial economies. Third chapter consists of literature review. Fourth chapter describes variables and estimation technique. Estimated results and conclusion are given in the fifth and sixth chapter respectively.

Chapter 2

National and Provincial Economies

To simulate growth at provincial level it has become vital to formulate provincial growth strategies. The growth strategies should form the basis for the allocation of funds among different sectors in annual development programs (ADPs). Through 18th amendment in constitution of Pakistan many powers are transferred to provinces. Now it's provincial matter to set level playing field policies to promote growth and upgrade the living standards of citizens of provinces and nation as a whole.

Table 2.1: Growth Rate of Pakistan and Provincial Economies in different Eras

	Bhutto ERA 1973- 1977	Zia Era 1977-1988	PPP+ PML(N) 1988-1999	Average 1973-1999
Pakistan	2.52	6.38	4.51	4.89
Punjab	3.16	5.97	4.50	5.09
Sindh	1.95	7.06	3.92	4.94
Khyber Pakhtunkhwa	1.18	7.03	4.33	4.99
Balochistan	2.68	5.02	4.63	4.49

Data is obtained from Bengali and Sadaqat (2001), growth rate are calculated by the author of this study. All above values are in percentage form.

Table 2.1 is showing remarkable differences in growth rate of provincial economies. If we look in the long run we come to know that all four provincial economies are growing at rate of 5 percent on average from 1973-1999. If further look in different regimes, we see that in Zia regime when country was growing at the rate of more than 6 percent, at that time Sindh and Khyber Pakhtunkhwa showed tremendous growth of more than 7 percent.

Table 2.2 Growth Rate of Pakistan and Provincial Economies in after 1999-00

	Musharaf Era 1999-00 to 2007-08	PPP Era 2008-2013	PML(N) 2013-2015	Average 1999-2015
Punjab	5.35	3.42	3.85	4.51
Sindh	5.55	2.37	4.62	4.36
Khyber Pakhtunkhwa	4.92	3.20	2.36	4.01
Balochistan	5.25	2.29	2.44	3.89
Pakistan	5.32	3.00	3.78	4.34

Source: Pakistan Punjab Social Sector Public Expenditure Review 2013.

Pakistan economy attained faster growth rate during the regime of Musharaf. Sindh achieved the highest growth rate of 5.5percent among all provinces. Punjab and Balochistan also achieved the growth rate of more than 5 percent. While Khyber Pakhtunkhwa growth rate remained below 5 percent. During the period of PPP government country faced the slow growth pattern of average 3 percent. Punjab and Sindh could show only 3.42 and 2.37 percent growth rate. While the Khyber Pakhtunkhwa and Balochistan economies achieved the growth rate of 3.20 and 2.29 respectively. On average Pakistan's growth rate from 1999-00 to 2014-2015 remained 4.34%. On provincial level in Punjab and Sindh, average growth rate was 4.51 and 4.36 percent. While Khyber Pakhtunkhwa and Baluchistan's average growth rates were 4.01 and 3.89 respectively during the period of 1999-00 to 2014-2015.

Size of provincial economies

Size of respective provincial economies is given in the table 2.3. Punjab is the largest provincial economy with its share of more than 50 percent in national economy. Then there is

Sindh with the share of 28 percent. Share of Khyber Pakhtunkhwa and Balochistan economies has fallen from 1999-00 to 2014-15. War on terror is one of the reasons of decline in share of these provincial economies. Data shows that Balochistan is the smallest province with respect to its share in the national economy.

Table 2.3 Size of Provincial Economies and National Economy

	1999-00 (millions)	Percentage Share	2014-15 (millions)	Percentage share
Punjab	1837299	51.58	721816.53	52.79
Sindh	1009674	28.34	1906929.10	28.36
Khyber Pakhtunkhwa	103181	11.34	721816.53	10.73
Balochistan	311864	8.75	545019.97	8.10
Pakistan	3562018	100	6723292.72	100

Source: Pakistan Punjab Social Sector Public Expenditure Review 2013. Data is in constant factor cost. From 2013 and onward data is extrapolated

Sector wise share of Provinces in the National Economy

Table 2.4 shows the sectoral share of provinces to the national economy. Punjab dominates in below given sectors. Agriculture sector from Punjab contributes more than 58 percent to total domestic agriculture output. Then Sindh, KPK and Balochistan agriculture sector share in national value added is 21.4, 7.4 and 12.3 percent respectively.

Table 2.4 sector wise share of province to national value added

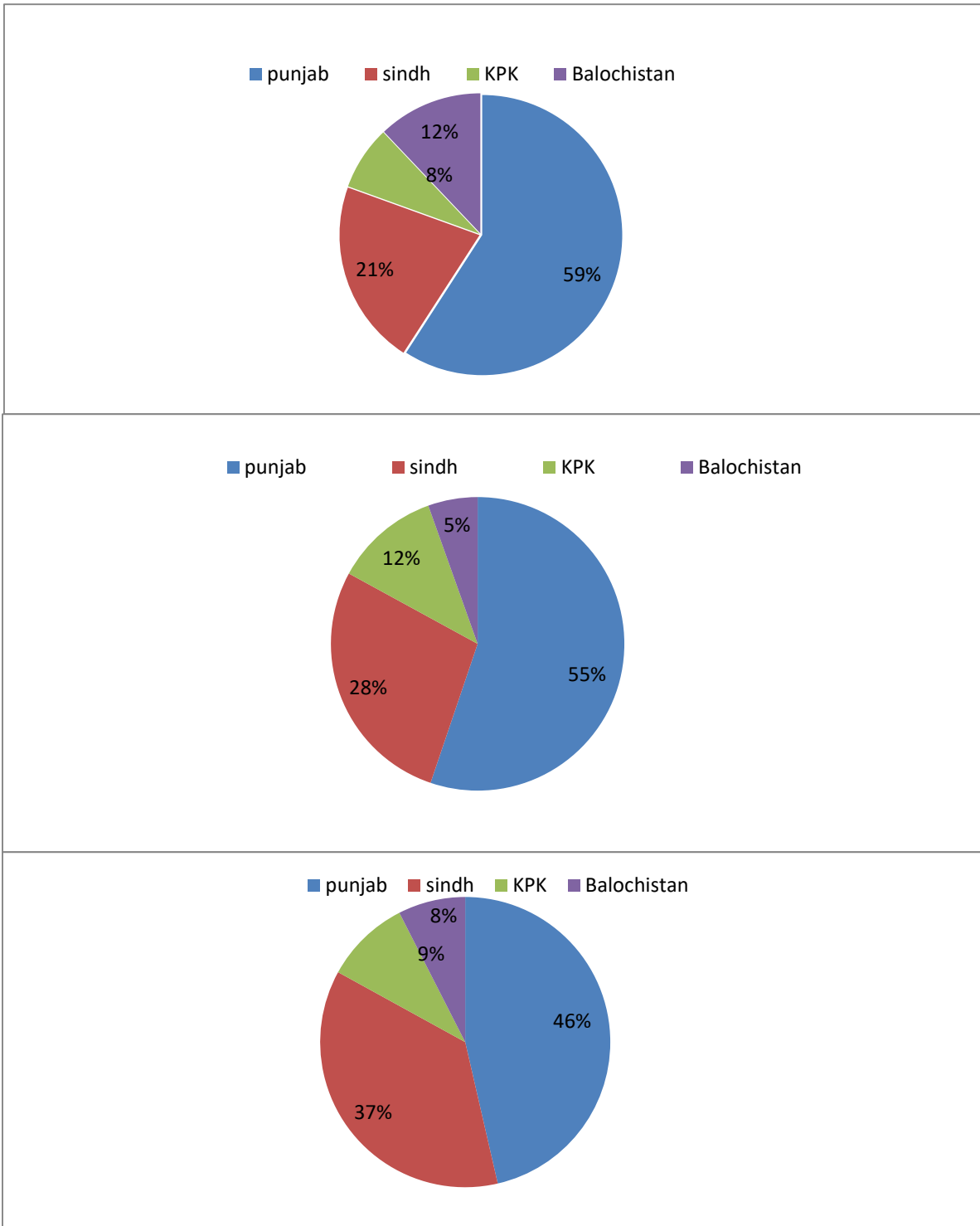
Province	Agriculture		Manufacturing		Services	
	1999-00	2010-11	1999-00	2010-11	1999-00	2010-11
Punjab	58.2	59.2	45.9	46.4	43.28	55.18
Sindh	22.3	21.4	39.2	36.6	30.1	27.74
KPK	8.2	7.4	10.5	9.5	11.73	11.58
Balochistan	11.3	12.1	4.4	7.5	6.38	5.46

Source: Pakistan Punjab Social Sector Public Expenditure Review 2013. Data is in % form

Manufacturing sector share from Punjab, Sindh, KPK and Balochistan is 46.4, 36.6, 9.5 and 7.5 percent respectively to domestic value added in manufacturing. Highest share of service sector is from Punjab. Then there come Sindh, KPK and Balochistan.

Figure 2.1 sector wise share of province to national value added

Agriculture, manufacturing and services sector share respectively shown in following figure.



2.2 Growth Performance at disaggregated level

Punjab

Table 2.5 shows the sectoral value added to Punjab economy. Agriculture sector share in Punjab is higher than in any other province. However its share to provincial value added has fallen from 29.26 percent to 24.24 percent. Agriculture sector plays a vital in growth of Punjab economy. Manufacturing sector experienced good growth during 1999-00 to 2007-08. In 1999-00 share of manufacturing to provincial value added was only 13.07percent. But it increased to 17.88 percent of total Punjab value added in 2007-08. Biggest contributor to Punjab value added is services sector. Its share has increased from 51 percent to 54.8 percent from 1999-00 to 2010-11.

Table 2.5 Sectoral Value added to Punjab Economy (current prices, Rs. Millions)

Sectors	1999-00	2007-08	2010-11
Agriculture	53766	1154764	2187030
Manufacturing	240191	909086	1477034
Services	937651	2755268	4942380

Source: Data is taken from Pakistan Punjab Social Sector Public Expenditure Review2013.

Sindh

Manufacturing sector has highest share in the value added of the Sindh. Its share has increased from 20.30percent to 24.34 percent from 1999-00 to 2010-2011. In the same period share of agriculture to Sindh value added has fallen 20.18 percent to 16.53 percent. Services sector share has increased from 1999-00 to 2010-11. In year in 2010-11 services sector share to Sindh value added is more than 51 percent of the total value added of the Sindh.

Table 2.6 Sectoral Value added to Sindh Economy (current prices, Rs. Millions)

Sectors	1999-00	2007-08	2010-11
Agriculture	205784	447940	791335
Manufacturing	204982	715932	1165407
Services	502487	1170991	2446602

Source: Pakistan Punjab Social Sector Public Expenditure Review2013.

Khyber Pakhtunkhwa

Sectoral value added to KPK's economy is given in the table no 2.7. Services sector is highest contributor to KPK economy with its share of 60 percent in year 2010-11. While manufacturing sector share has increased from 7.2 percent to 16.22 percent in year 2010-11. Agriculture sector displayed a downward trend in its share to provincial economy. Its share is contracted to 14.68 percent from 18.79 percent in year 2010-11. Although Khyber Pakhtunkhwa is the front line in war on terror but maintained a good growth rate.

Table 2.7 Sectoral Value added to KPK Economy (current prices, Rs. Millions)

Sectors	1999-00	2007-08	2010-11
Agriculture	75759	145097	272455
Manufacturing	54859	185162	300960
Services	227731	664216	1109769

Source: Pakistan Punjab Social Sector Public Expenditure Review2013.

Balochistan

Table 2.8 Sectoral Value added to Balochistan Economy (current prices, Rs. Million)

Sectors	1999-00	2007-08	2010-11
Agriculture	104406	269380	446248
Manufacturing	22770	140342	238579
Services	139676	374833	632790

Source: Pakistan Punjab Social Sector Public Expenditure Review 2013.

Military actions and insurgency in the Balochistan has severely affected the economic activity and investment. Services and agriculture sectors are highest contributors to provincial economy with their share of 44.23 and 31.24 percent. Although economic environment is not as good as in other provinces but the manufacturing sector share has increased from 7 percent to 16.62 percent. Share of Balochistan in 7th national Finance commission has been increased. Similarly aghaz e haqooq Balochistan package has positive impact on growth process of Balochistan.

2.3 Provincial Ranking on the Basis of Per Capita Income

Table 2.9 is about the per capita income based ranking of the provinces. Per Capita Income data is obtained from different Household Integrated Expenditure Surveys. Data shows that per capita income is gradually increasing in Khyber Pakhtunkhwa. From fourth position it has attained 2nd position in year 2013-14. While Sindh and Balochistan could not maintained their

rankings and slipped to lower rankings. Punjab's ranking also improved from 2nd to 1st in 2013-14.

Table 2.9 per capita income based ranking of provinces.

Provinces	2001-02	2007-08	2013-14
Punjab	2 nd	1 st	1 st
Sindh	1 st	2 nd	3 rd
Khyber Pakhtunkhwa	4 th	3 rd	2 nd
Balochistan	3 rd	4 th	4 th

Source: Different Household Integrated Expenditure Surveys

2.4 Employment Statistics

Punjab

Punjab is the highest employment provider province. Number of employed individual has increased from 27 million to 33.43 million in 2013-14. Most striking fact is that non agriculture sector is providing more employment than agriculture sector. Similarly informal sector is providing more employment than formal sector.

Table 2.10 Sectoral employment level in Punjab (Millions)

Sectors	2001-02	2007-08	2013-14
Employed individual	27.03	28.97	33.43
Agriculture	11.58	12.58	14.93
Non agriculture	15.45	16.39	18.5
Formal	4.58	3.8	4.3
Informal	10.87	12.59	14.2

Source : labor Force Survey by Pakistan Bureau of Statistics

Sindh

Sindh is second most employment provider province. Number of individuals employed increased from 9.50 million to 14 million. Like Punjab non agriculture sector is providing more employment than agriculture sector. Formal sector is proving more employment than the informal sector.

Table 2.11 Sectoral employment level in Sindh (Million)

Sectors	2001-02	2007-08	2013-14
Employed individual	9.50	12.26	14.00
Agriculture	3.55	5.66	6.00
Non agriculture	5.90	6.60	8.00
Formal	2.82	2.29	2.70
Informal	3.08	4.31	2.43

Source : labor Force Survey by Pakistan Bureau of Statistics

Khyber Pakhtunkhwa

Table 2.13 shows the employment situation in Khyber Pakhtunkhwa. Number of employment has increased from 5 million to 6.14 million in KPK. All sectors KPK economy maintained a modest increase in employment.

Table 2.12 Sectoral employment level in KPK (Million)

Sectors	2001-02	2007-08	2013-14
Employed individual	4.95	5.73	6.14

Agriculture	2.19	2.56	2.26
Non agriculture	2.76	3.17	3.88
Formal	0.95	0.85	0.90
Informal	1.78	2.32	2.95
Source : labor Force Survey by Pakistan Bureau of Statistics			

Balochistan

Employment situation is not very good in Balochistan. Number of employed persons is only 2.5 million. Agriculture is the most employment provider province.

Table 2.12 Sectoral employment level in Balochistan (Million)

Sectors	2001-02	2007-08	2013-14
Employed individual	1.74	2.13	2.48
Agriculture	0.81	1.12	1.30
Non agriculture	0.87	1.01	1.18
Formal	0.44	0.45	0.40
Informal	0.43	0.56	0.78
Source : labor Force Survey by Pakistan Bureau of Statistics			

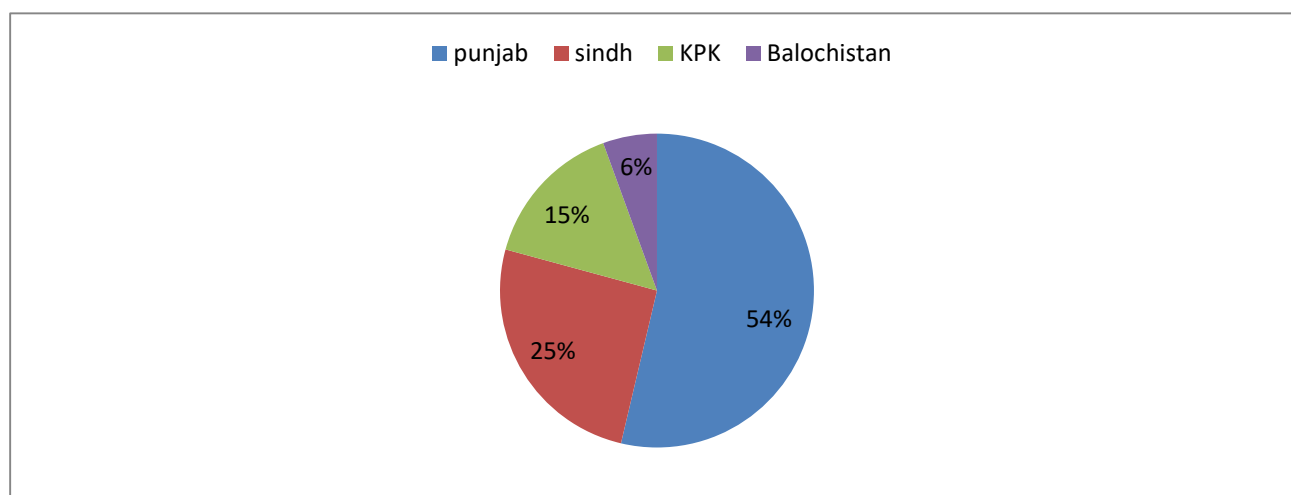
2.5 Land, Population and Population Density

Total area of Pakistan is 796095 square kilometers. Balochistan is biggest province area wise with 347190 square kilometers. Then there is Punjab with the area of 205344 square kilometers. Sindh total area is 140914 square kilometers. Khyber Pakhtunkhwa is small province with the

area of 74521 square kilometers. Federally Administered Tribal Area is 27220 square kilometers.

Pakistan’s capital Islamabad area is 906 square kilo meters.

Figure 2.2 Share of Provinces in total Population



Punjab is highly populated province with 101391 thousand peoples. 54 Percents of total population is based in Punjab. 25 percent of total population is based in Sindh. So Sindh is the second highly populated province. 15 percent of total population lives in KPK. Less populated province is the Balochistan, where only 6 percent of total population lives.

Table 2.13 Population growth rates in Different Periods

Province	2000	2007	2015
Punjab	2.39 (%)	1.69	1.60
Sindh	1.2	2.81	2.45
KPk	2.75	2.82	2.82
Balochistan	2.05	2.5	1.38
Pakistan	2.11	2.37	1.96

Source : Different Development Statistics of Provinces

Currently KPK population growth is highest among all provinces. KPK population is growing at the rate of 2.82 percent. Balochistan population growth rate is 1.38 percent. This is the lowest growth rate of population among all provinces. Punjab’s population growth rate has fallen from 2.39 percent to 1.60 percent. Pakistan population growth rate is 1.96 percent in year 2015.

2.6 Education

Literacy rate in Punjab has increased from 47.23 percent to 63 percent in 2014-15. Punjab is leading province in literacy rate. Then there come Sindh with the literacy rate of 62 percent. Although KPK literacy rate has increased but still it is lagging behind the Punjab and Sindh. War on terror had severe effects on schools, college level education. Many schools were burnt by Terrorists. Baluchistan’s literacy rate has increased from 30percent o 54.31percent in 2014-15.

Table 2.14 literacy rates in provinces in different periods.

Province	1999-00 (Musharaf)	2007-08(PPP era)	2014-15 (PMLn Era)
Punjab	47.23%	57.71	62.93
Sindh	52.97	57.61	61.98
KPk	37.39	49.85	54.17
Balochistan	29.65	48.82	54.31

Source : Different Development Statistics of Provinces

2.7 Infrastructure

From infrastructure we are just taking roads and irrigations networks. Infrastructure is very important for development of a country. Motor ways and Pak China Economic Corridor are the projects that will not only increase infrastructure but also will economic prosperity in Pakistan.

2.7.1 Roads

Road length is given in table 2.15. Length of roads is increased almost in all provinces over the time.

In Punjab roads length has increased from 42307 kilo meters to 77231km. In Sindh road size is 18243km while in KPK road size is 15983km. In Balochistan road length is 37542.

Table 2.15 Roads links in Provinces in different Periods.

Province	1999-00 (Musharaf)	2007-08(PPP era)	2014-15 (PMLn Era)
Punjab	42307	72240	77231
Sindh	25015	10574	18243
KPk	10906	12035	15983
Balochistan	23450	30630	37542

Source : Different Development Statistics of Provinces (unit is km)

2.7.2 Irrigation

Data in table 2.16 is showing that in Punjab irrigation system is narrowly expanded in last decade. It irrigates 14874 thousand hectors land. While in Sindh situation is reverse, irrigation system is contracted. Now it irrigates only 1823thousand hectors land. Situation in KPK is the same, it irrigation system irrigates only 932 thousand hectors land. Irrigation system is enhanced in Balochistan. After the completion of Kachhi Canal Project 713000 acres barren land will be irrigated.

Table 2.16 Irrigation system in different Periods

Province	1999-00 (Musharaf)	2007-08(PPP era)	2014-15 (PMLn Era)
Punjab	13371	14219	14874
Sindh	2520	2375	1823
KPk	920	900	932

Balochistan	825	1301	1167
Source : Different Development Statistics of Provinces (000 hectors)			

2.8 Some stylized facts

Increase in the annual income tax revenue is good indicator of the growth of the underlying economy. Year book of Federal Board of Revenue shows that from 2008-09 to 2012-13; Khyber Pakhtunkhwa attained the highest growth rate of 19 percent in annual income tax revenue. With the 15 percent growth rate Sindh is on the 2nd number. On the other hand Punjab and Balochistan attained the rate of 12 to 13 percent only during this period. Household Integrated Expenditure survey shows that KPK achieved the 20 percent annual growth in the value owner occupied houses.

2.9 Conclusion

As we have seen from above given data and discussion that there is vast and huge difference between provinces. Their contribution to national value added is different even their sectoral value added share to provincial economies are different. In some province manufacturing has huge contribution to provincial and national value added but in some province its contributions is minor. Pakistan is diverse in nature and geographically there are vast differences among the provinces. Alam and Waheed (2006) highlighted that manufacturing, wholesale and retail trade and finance & insurance sectors are the most sensitive to monetary policy shocks. These three sectors are the main contributors to Punjab and Sindh value added while their share to KPK and Balochistan value added is low as compared to Punjab and Sindh. High interest sensitive sectors are concentrated in mainly to provinces. Also after the 18th constitution amendment 17 important

federal ministries have been dissolved and transferred to provinces. So in this regard evolution of monetary policy effects at provincial level in Pakistan has become necessary and need of the time. If we come to know which provinces are high sensitive to monetary policy shocks and which are less sensitive, we can make proper and accurate police.

Chapter 3

Literature Review

If we look back in literature we come to know that Beare (1976), Toal (1977), Garrison and Chang (1979), Mathur and Stein (1990) and Garrison and Kort (1983) initiated the work at regional level. Beare (1976) used the data of agrarian provinces of Canada for period of 1956-71 and found that different provinces react differently to money supply fluctuations. Also Toal (1977) documented the differences in regional responses to monetary policy shocks during the period of 1956-1975 in USA. Author revealed that regional differences in Mideast, Great Lakes and Southeast regions were relatively large while in Rocky Mountains and New England regions responses were small.

3.1 State level studies

Garrison and Chang (1979) studied the effects of monetary and fiscal policy on regional business cycle in USA. Authors constructed Keynesian reduced form model for regional income determination. Quarterly data of eight regions for the period of 1961-1976 was used for analysis. They suggested that monetary and fiscal policy have prominent regional differences. Further that the monetary and fiscal policy strokes persuade economic activity in different regions. Garrison and Kort (1983) examined the monetary policy fluctuation on the state level employment. They reported that Great lakes region is most vulnerable to money supply shocks, while Rocky Mountain region is less vulnerable during the 1960-78. Gerlach and Smets (1995) concluded in their study there are no vast differences in the effects of monetary policy shocks across the countries. Standard monetary policy effects were somehow greater in Canada, Germany and United States than France and Italy.

Britton and Whitely (1997) documented some issues and results by comparing monetary transmission mechanism in the U.K, Germany and France. Authors found that variations in policy rate are quickly and entirely reflected in changes in market interest rates in the U.K, then in Germany and slowly and partially in France. Also that financial liberalization has condensed the level of liquidity constraints in the United Kingdom, So corporate and household indebtedness are notably higher in U.K than in France or Germany. Nominal stickiness has fallen due to labor market reforms in U.K than in other two countries. With these arguments they concluded that effects of policy changes will implausible to be identical in the above mentioned three countries. Ganley and Salmon (1997) shed light on the industrial impacts of monetary policy in England. They took 24 sectors of UK economy and estimated VAR's to check the speed and enormity of reactions of each sector to unanticipated monetary policy shock. The results showed that unexpected monetary policy shocks have asymmetrical effects across different sectors. Some sectors like construction are highly sensitive to monetary policy and some sectors like services showed soft reaction to monetary policy contraction. Manufacturing sector showed diverse results because within manufacturing sector there is wide variation in reactions of different manufacturing firms. Electrical utensils and rubber products firms demonstrated huge changes while tobacco, drinks and food firms illustrated meek reaction.

Carlino and Defina (1998) analyzed whether across the region monetary policy has uniform effects in U.S or not. Authors through impulse response which were estimated from structural auto-regression disclosed the following results. Core regions (New England, Plains, Far West, Mideast and Southeast) reacted approximately in similar fashion as U.S. average response. These regions accounted for 70 percent of U.S. population and two third of GSP in 1980. Southwest and Rocky Mountains were less sensitive to monetary policy changes while

Great lakes was more sensitive. Carlino and Defina (1999) used an indirect approach to study the impact of common monetary policy on European Monetary union economies. First they study state level effects of monetary policy in United States. Then using the EMU economies data they constructed an index that indicates the relative sensitivity of EMU economies to monetary policy shock. Study suggested that France, Italy, and Netherland will be less sensitive while Finland, Ireland and Spain will be most responsive to monetary policy adjustments. Austria, Belgium, Germany and Luxembourg will exhibit quite moderate response.

Dedola and Lippi (2000) examined the 21 manufacturing industries output response to monetary policy shocks by structural VAR using the data of five OECD countries. Study documented the following results. There are large cross industry differences of monetary policy effects but similarities across countries of cross industry allocation of policy effects. Motor vehicle industry was high responsive while food industry was less responsive to monetary policy innovations. Differences in effects are related to industry output durability, firm borrowing capacity, firm size and investment intensity. Arnold (2001) tried to assess the regional impacts of monetary policy in Europe. Analysis consists on data of 58 regions of 8 European countries for the period of 1979 to 1995. Author presented panel and cross sectional evidence. He concluded that in monetary transmission mechanism there are significant regional differences. Also there is significant link between the regional impact of monetary policy and the proportion of labor force working in industry.

Nachane et.al (2002) examined the state level effects of monetary policy in India. Researchers used structural vector auto regression method on the data of 14 states. They divided the states into two groups, states which were more vulnerable to monetary policy shocks and the states which were relatively less vulnerable to monetary policy shocks. Results revealed that the

states which were enriched in manufacturing and financial deepening were more exposed to monetary policy and vice-versa. Arnold and Vrugt (2002) measured the impacts of monetary policy shocks on regional and sectoral level in Netherlands. Using VAR model to data of 11 regions covering 12 sectors, total 132 region sector combinations for the period of 1973 to 1993 authors documented the following results. Regional effects of monetary policy are notably associated to industrial composition. Sectoral effects of monetary policy account for the variation in interest coefficients. Works are given high wage in sectors which are more vulnerable to monetary policy shocks. Fuentes and Dow (2003) exemplified the regional impacts of monetary policy in Europe. Authors made a point that debate on the economic consequences of economic and monetary union is based on two fronts, the efforts needed for member countries to take part in this process and its economic consequences. Regional impacts of monetary policy are elucidated on the base of differences in regional economic structure (size of firms, sectoral mix and size of banks) and financial structure (concentration of banks, bank size, bank's health and availability of informal source of finance). Authors used post Keynesian theory of regional finance and found that uniform European monetary policy may produce instability in pattern of credit availability. Serju (2003) conducted a research on the monetary policy effects at sectoral level in Jamaican economy. Structural Vector Autoregression model was estimated on the quarterly data from 1990 to 2002. Study established the following results. Different sectors respond differently to monetary policy innovations. Agriculture, construction, manufacturing and insurance & financial sectors are those sectors which are highly sensitive to monetary policy shocks. Transportation and communication, utilities and distribution services are those which are not responsive to monetary policy innovations. Analysis also discovered that output is determined by nonmonetary shocks.

Raddatz and Rigobon (2003) evaluated the monetary policy and sectoral shocks in United States. They employed structural vector autoregressive technique on the quarterly data from 1955 to 2002 and documented the following results. Policy aimed to stabilize the output produces large differences across sectors. Thus monetary policy is the source of sectoral transfer. Residential investment, consumption of durables and consumption of nondurables are the most responsive while software and equipment investment are less responsive. Investment in structures does not show any response to monetary policy. Owyang and Wall (2005) conducted a study about the structural breaks and regional disparities in the transmission of monetary policy. Authors studied the regional effects of monetary policy pre-Volcker and Volcker Greenspan period. They found huge difference in the monetary policy effects across U.S states. To check the relative importance of various channels of monetary policy authors used the sub regional VAR's. Study found that the cost of recession is related to money channel while intensity of recession is connected to bank lending channel. Fielding and Shields (2005) examined the asymmetries in effects of monetary policy in South Africa. Purchasing power parity does not hold instantaneously across the different regions of monetary area, so it is possible that monetary policy adjustments will have different effects in different regions. Author estimated the asymmetries across the nine provinces in South Africa for the period of 1997 to 2005. They found that there are vast and significant differences in response of price to monetary policy changes. Monetary policy based exclusively on the targets for the national macroeconomic aggregates is not likely to be most advantageous. Hanson et.al (2006) conducted a study to check whether monetary policy helps least those who need it most. In USA monetary policy is set at national level in consequences of national events but it is not necessary to have homogeneous effects throughout the countryside. Using the data of 50 states for the period of 1970- 2003,

authors checked how monetary policy affects the distribution of economic activity across the U.S states. Study revealed that contractionary monetary policy reduces the economic activity in states experiencing worse economic situations as compared to average states. Study suggested that monetary policy helps least those states who need it most.

Kortes and Kong (2007) working on Chinese economy investigated the impact of monetary policy on real output and in its provinces. They employed vector error correction method on the data for the period of 1980-2004. Study found that coastal provinces are more affected by monetary policy than landlocked provinces. Study also found that differential provincial effects of monetary policy are positively to the GDP share of primary sector and to share of loans account by industrial firms. Georgopoulos (2009) investigated the regional impacts of monetary policy in Canada. Study identified three possible reasons for regional differences (difference in share of interest sensitive industries, differences in share of small to large firms and differences in contribution of exports to output). First they conducted impulse responses of industry output through VAR, which showed that primary and manufacturing industries are high interest sensitive. Then they estimated impulse responses of employment at provincial level from monetary policy contraction. The results revealed that primary industry based provinces (Prince Edward Island and Newfoundland) are adversely affected by tightening of monetary policy. While New Brunswick, British Columbia, Quebec and Nova Scotia showed statistically insignificant responses. Ribon (2009) examined the industry effects of monetary policy in Israel. Researcher used system of VAR equations on monthly data of 16 industries for the period of 1997 to 2006. It was found that contractionary monetary policy reduces the quantity produced and also reduces the price. Both reduction in price and quantity produced effects demand. Depreciation in exchange increases the price of all industries output and enhance

the quantity produced. Study also found that industries concentrated in production and at a higher technological level are less responsive to interest rate shocks. Study concluded that demand side effect is greater than that of supply side. Ghosh (2009) analyzed the industry effects of monetary policy in India. Author used 2 digit level industry data from 1981 to 2004 and employed Vector Auto Regression model to estimate the magnitude of monetary policy shock on industrial value added. It was found that high interest cost industries are hardly affected by monetary contraction. Also industries with high investment intensity are negatively affected by the monetary policy contraction. Industries with high leverage and overage are less sensitive to contractionary monetary policy.

Bremmer (2010) analyzed the impacts of monetary policy in US states. Author used monthly data for the period of 1976 to 2010 to study the impact of monetary policy on state employment and unemployment. Granger causality test and vector auto regressive model were estimated for each state. Granger causality test showed that in 24 states there is unidirectional causality from federal fund rate to state employment. But VAR model represented robust effects. Inverse relationship between federal fund rate and state employment was found. In 48 states higher federal fund rate caused lower employment. Francis et.al (2011) investigated the local effects of monetary policy. Authors employed Bayesian VAR on the data of 105 metropolitan areas. Study revealed that there are noteworthy and critical cross metropolitan variation in employment in response of monetary policy fluctuation. Also found those traditional channels of monetary policy (interest rate and equity channel) are less important in explaining business cycle variation across metro areas.

Table 3.1 categorization of literature on the regional impacts of monetary policy

Nature of regional effect	Hypothesis	Key explanatory Variables
Economic structure	<ul style="list-style-type: none"> Asymmetric shocks due to differences in economic structure Regional differences in response to variation in interest rate 	<ul style="list-style-type: none"> Size of firm Sectoral mix Size of banks
Financial Structure	<ul style="list-style-type: none"> Market failure and Asymmetric information produce high dependence on local banks 	<ul style="list-style-type: none"> Concentration of banks Size of banks Availability of sources of finance other than banks. Health of the banks

3.2 Sectoral level Studies

Dhal (2011) studied industrial effects of monetary transmission mechanism in India. Researcher used monthly data from 1993 to 2011 of used based industries (basic goods, consumer durables, consumer nondurables, intermediate goods and capital goods) and employed VAR model for analysis. Results showed that consumer durables and capital goods industries are more responsive than that of other three used based industries. Moreover study found that monetary policy could have differential because of fluctuation in exchange rate. Anagnostou and Papadamou (2012) assessed the monetary policy effects across the Greek regions. Authors used employment, investment and gross domestic product data of 13 peripheries in Greece for the period of 1980- 2009 for analysis. VAR and Panel VAR models estimates showed that monetary policy don't have uniform effects across the different regions. Study confirmed that there is no size effect monetary policy for Greek regions Vespignani (2014) conducted a research about differential impacts of monetary policy among regions and its determinants in Australia. He used a mix of non- stationary and stationary variables to construct structural vector error correction model for estimation. Author came up with the results that monetary policy has great affect on

economic activity in Western Australia. In Victoria, South Australia and New South Wales monetary policy upsets create contraction while in Queensland economic activity is less affected. Xiaohui and Masron (2014) analyzed the regional effects of monetary policy in China. The authors used structural auto regressive model on annual data for the period of 1978 to 2011. Results revealed that three regions behave differently to monetary policy innovations. The east region showed highest response while middle region showed the second highest response and the western region showed the smallest response. Study also showed that economic gap between three regions is widening due to different regional effects of monetary policy. Engin and Umut (2014) tried to assess the regional effects of monetary policy in Turkey. They checked in role of spatial spillovers and geographical factors in regional effects of monetary policy. To check the response of provinces authors used reduced form VAR model using the date for the period of 1975 to 2000. They found that provinces respond differently to monetary policy shocks. Ege and Marmara regions provinces are less vulnerable while provinces in East and Northern Anatolian regions highly sensitive to monetary policy shock. Also Provinces with small size banks and closed economies are highly sensitive. Neighboring provinces exhibit spatial spillover through financial linkage and trade. Singh and Rao (2014) analyzed the sectoral effects of monetary policy innovations in India. Authors used reduced form VAR model on the time series data of 8 sectors for period of 1996 -2013. Study found that at sectoral level monetary policy has diverse effects. As compared to aggregate output construction and trade, transportation and communications, manufacturing, mining and quarrying, and hotel are more sensitive to contractionary monetary policy. Study also found that different transmission channels are responsible for differential effects of monetary policy. Sector specific monetary policy recommended by the researchers in this study. Beckworth (2016) examined the regional effects

of monetary policy innovations in American South during and after spectacular economic transformation in the twentieth century. Author used impulse response functions estimated from vector auto regressions of 11 states of American South before and after 1980 for analysis. Study established that many states of South behaved in significantly different and more severe manner than that of US as whole. Study also found that during the post convergence period state responses are closer to and less severe in some case than that of nation level response.

Alam and Waheed (2006) studied the sectoral effects of monetary policy in Pakistan. Authors used quarterly data from 1973 to 2003 to analyze policy effects at aggregate as well as sectoral level. Standard VAR model and impulse response functions were generated to check the dynamic reaction of aggregate as well as sectoral output to policy shocks. It was found that finance and insurance, manufacturing and wholesale and retail trade are sensitive to interest rate variations while construction, mining and quarrying, agriculture and ownership of dwellings were insensitive. Study concluded that above mentioned three sectors are the driving force behind the aggregate fluctuations.

Conclusion

After the detailed survey of monetary policy effects, we found that monetary policy has differential impact at regional level. These different effects are because of industrial concentration, firm size in different locations, bank dependency, banks size etc. In most of the studies authors used vector autoregressive model to check these effects. One thing is clear from above survey that no work in this regard is initiated earlier for the case of Pakistan. In this study we will analyze the monetary policy effects at provincial level as well as national level. This will be our contribution to the literature.

Chapter 4

Data and Methodology

This chapter consists of theoretical background, model, data description & sources and estimation procedure. First we describe theoretical ground on which we mention different sources of differential effects of monetary policy. Then we will specify our model and define variables and their sources. Finally we will explain the estimation procedure.

4.1 Theoretical background

Sources of differential effects of monetary policy

The process by which monetary policy shocks are spread to the economic growth and inflation is known as monetary transmission mechanism [Taylor (1995)]. If we look in pragmatic studies, we come to know that monetary policy innovations are modeled by the change in short term interest rate which is set by the central bank of a country [Leeper, Sims and Zha (1996)]. Innovation in short term interest rate affects aggregate demand through many ways which includes real cost of capital, exchange rate, income, wealth and credit availability in the economy. Work by Bernanke and Gertler (1995) and Mishkin (1996) give details of all types of transmission mechanism.

Different firms depending on their products and leverage will have different interest rate sensitivities (elasticity) to monetary policy innovation. Increase in interest rate may decrease the demand for investment goods and consumer durable goods by increasing the cost of firms and individuals. Taylor (1995) has done a survey on the interest rate channel of monetary transmission mechanism. Regional effects of monetary policy will arise due to concentration of

different interest rate sensitive industries across the regions. Regions in which share of interest rate sensitive industries is high will be more affected by monetary policy tightening.

Second channel of monetary transmission mechanism is other asset prices like exchange rate and equity prices. Through exchange rate channel monetary policy affects net exports. As increase in money supply decrease the interest rate, which depreciates the domestic currency and make domestic goods cheaper, thus increasing net exports. Regional effects may arise due to competitiveness and proportional share in net exports. Domobusch, Favero and Giavazzi (1998) viewed that due to cross regional variation in openness; regional effects of monetary policy may arise. Equity price channel works through Tobin q theory of investment. Regional differences in the distribution of wealth and differences in Tobin's q lead to regional effects of monetary policy.

Third channel of monetary transmission is credit channel. Credit channel further consists of two channels (a) bank lending channel and (b) bank balance sheet channel. Central bank affects economy by affecting banks ability to provide loan. Lending channel is viewed as the bank willingness and capacity to lend. Smaller firms and individuals lack substitute of bank credit. Regional difference will arise due to lack of credit. Regions where proportion of smaller firms is high will be more vulnerable to monetary policy shocks. In tight monetary policy information asymmetries between borrower and lender may increase the cost of borrowing. So financing of all form (trade credit, bank loans and commercial paper, etc) may shift from small firms to large firms.

In tight monetary policy when reserves of banks are confined, some large banks can discover alternatives of backing for loans and deposits by issuing large cash deposits which are

cheaper. So the regions where large banks provide more share of loan will be less affected than the region where small firm provide more of loans.

4.2 Model, Variable Description and Data Sources

Following the work of Carlino and Defina (1998) we will use Vector Autoregression framework to check our hypothesis that monetary policy shocks have differential effects in different provinces of Pakistan. To establish the frame work we have taken national and provincial data of value added, exchange rate, consumer price index, call money rate and credit to private sector. Monetary policy is transmitted through various transmission channels, so have included most of the variables of monetary transmission mechanism.

VAR model for Punjab is based on the following equations

$$Pog_t^1 = \alpha_0 + \alpha_1 \Sigma Pog_{t-i} + \alpha_2 \Sigma CPI_{t-i} + \alpha_3 \Sigma CPS_{t-i} + \alpha_4 \Sigma ER_{t-i} + \alpha_5 \Sigma CMR_{t-i} + \varepsilon_1 \dots \mathbf{1}$$

$$CPI_t = \beta_0 + \beta_1 \Sigma Pog_{t-i} + \beta_2 \Sigma CPI_{t-i} + \beta_3 \Sigma CPS_{t-i} + \beta_4 \Sigma ER_{t-i} + \beta_5 \Sigma CMR_{t-i} + \varepsilon_2 \dots \mathbf{2}$$

$$CPS_t = \gamma_0 + \gamma_1 \Sigma Pog_{t-i} + \gamma_2 \Sigma CPI_{t-i} + \gamma_3 \Sigma CPS_{t-i} + \gamma_4 \Sigma ER_{t-i} + \gamma_5 \Sigma CMR_{t-i} + \varepsilon_3 \dots \mathbf{3}$$

$$ER_t = \delta_0 + \delta_1 \Sigma P_{t-i} + \delta_2 \Sigma MPV_{t-i} + \delta_3 \Sigma PGDP_{t-i} + \delta_4 \Sigma SGDP_{t-i} + \delta_5 \Sigma KGDP_{t-i} + \varepsilon_4 \dots \mathbf{4}$$

$$CMR_t = \sigma_0 + \sigma_1 \Sigma P_{t-i} + \sigma_2 \Sigma MPV_{t-i} + \sigma_3 \Sigma PGDP_{t-i} + \sigma_4 \Sigma SGDP_{t-i} + \sigma_5 \Sigma KGDP_{t-i} + \varepsilon_5 \dots \mathbf{5}$$

Similarly VAR model is developed for other provinces. Pog is the Punjab Output gap. CPI is the consumer price index (in natural log form), CPS is the credit to private sector, ER is the exchange rate (in natural log form) and CMR is the call money rate.

We will use Gross Domestic Product of four provinces of Pakistan which is sum of output produced in certain province in the period of one year (from GDP we find output gap). Interest

¹ Pog (Punjab output Gap). Provincial GDP (lnpgdp) is regressed on time, actual and fitted values are found. Then difference between actual and fitted value is divided by fitted value than multiplied by 100

rate is the cost of borrowing money. Usually interest rate is expressed in percentages. We will also use inflation rate and exchange rate as confounding variables. Annual percentage change in consumer prices compared with the previous year's consumer price is termed as the inflation rate. Exchange rate is the value of one currency for the purpose of conversion to the other currency. Credit to private sector is the amount of credit which is provided to the private sector during a year.

Table 4.1 Variables, unit of measurement and sources

Variable	Unit of measurement	Source
National and Provincial GDP	Million Rupee	Bengali and Sadaqat (2005) World Bank Report (2013)
Consumer price index		World development indicator
Exchange Rate	Rupees per Dollar	World development indicator
Credit to Private Sector	Percent of GDP	World development indicator
Call money Rate	Percentage	International Financial Statistics

4.3 Estimation Procedure

To estimate our model we will use Vector autoregression (VAR). All details relating to VAR are given below.

Vector Autoregression (VAR)

Three decades before a new macro econometric framework: Vector Autoregression (VAR) was presented by [Christopher Sims \(1980\)](#). VAR is n-equation n- variable linear model, in which every variable is elucidated by its own lagged value and remaining n-1 variables present and past values. If we are dealing with simple uni-variate autoregression, this will be a single variable linear model, whose current value will be explained by its own lagged values. Using this simple

framework we get a systematic way to incorporate the dynamics of multiple time series data. Also it is easy to use and interpret the statistical toolkit that came along with the VARs. Sims (1980) and many other macro econometricians explained that VAR provides sound and plausible approach to data description, structural inference, forecasting and policy analysis.²In this study we will use reduced form Vector Autoregression.

Reduced Form Vector Autoregression

In reduced form vector autoregression model each variable is taken as the linear function of its own lagged value, lagged values of remaining (n-1) variable and serially uncorrelated error term. Thus in our Model for each province there will be five equations. Provincial gdp as a function of lagged value of provincial gdp, lagged value of consumer price index, credit to private sector, exchange rate and call money rate. Just like this there will be four other equations to make model endogenous. It is the beauty of VAR that it makes every variable endogenous. Another beauty of VAR model is that it can be easily estimated through OLS method. It is important to know how the number of lags to be included in equation of VAR. For this purpose we can use different lag selection criteria's. Error terms in the VAR regression are the shock travels in the variables after considering its lagged value. Error terms in the reduced form VAR will be correlated across the equations if variables are correlated.

² There are three different types of vector autoregression. Reduced form VAR, Recursive VAR & Structural VAR

General VAR Model

For simplicity and understanding we are taking two time series say Y & X case here. Assume Y is output and X is interest rate. Then with only one lag VAR model would be as

$$Y_t = \alpha_{11}Y_{t-1} + \alpha_{12}X_{t-1} + \varepsilon_{1t} \dots\dots\dots (1)$$

$$X_t = \alpha_{21}Y_{t-1} + \alpha_{22}X_{t-1} + \varepsilon_{2t} \dots\dots\dots (2)$$

But there can be more than two endogenous variables and more than one lag. With k endogenous variables and p lags VAR model can be written in matrix form as

$$Y_t = A_1Y_{t-1} + \dots\dots\dots + A_pY_{t-p} + \varepsilon_t \dots\dots\dots 3$$

In above equation no 3, Y_t , Y_{t-1} and ε_t are $k \times 1$ vector and $A_1, \dots\dots\dots, A_p$ are $k \times k$ matrices of constants which will be estimated.

In terms of lag operator (L) system can be written as

$$\begin{bmatrix} 1 - \alpha_{11}L & -\alpha_{12}L \\ -\alpha_{21}L & 1 - \alpha_{22}L \end{bmatrix} \begin{bmatrix} Y_t \\ X_t \end{bmatrix} = \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

This gives the solution

$$\begin{bmatrix} Y_t \\ X_t \end{bmatrix} = \begin{bmatrix} 1 - \alpha_{11}L & -\alpha_{12}L \\ -\alpha_{21}L & 1 - \alpha_{22}L \end{bmatrix}^{-1} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

$$\begin{bmatrix} Y_t \\ X_t \end{bmatrix} = 1/\Delta \begin{bmatrix} 1 - \alpha_{22}L & -\alpha_{12}L \\ -\alpha_{21}L & 1 - \alpha_{11}L \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \dots\dots\dots 4$$

Where

$$\Delta = (1 - \alpha_{11}L)(1 - \alpha_{22}L) - (\alpha_{12}L)(\alpha_{21}L)$$

$$\Delta = 1 - (\alpha_{11} + \alpha_{22})L + (\alpha_{11}\alpha_{22} - \alpha_{12}\alpha_{21})L^2$$

$$\Delta = (1 - \lambda_1L)(1 - \lambda_2L)$$

λ_1 & λ_2 are the roots of the equations.

$$\lambda^2 - (\alpha_{11} + \alpha_{22})\lambda + (\alpha_{11}\alpha_{22} - \alpha_{12}\alpha_{21}) = 0$$

To have convergent expansion for Y_t and X_t in terms of ε_{1t} & ε_{2t} , we must have $|\lambda_1| < 1$ and $|\lambda_2| < 1$. The roots of $|A - \lambda I| = 0$ in absolute term are less than 1. A is the matrix of the lag coefficients.

After the fulfillment of stability condition we can write Y_t and X_t as the function of present and lagged values of ε_{1t} & ε_{2t} . These are called the **Impulse Response Functions**. IRF represent present and lagged effects over time of shock in ε_{1t} & ε_{2t} on Y_t and X_t .

From equation 4

$$Y_t = \Delta^{-1} [(1 - \alpha_{22}L)\varepsilon_{1t} + \alpha_{12}L\varepsilon_{2t}]$$

And expanding Δ^{-1} in the power of L and congregating the expression with the same power of L. We will get

$$Y_t = \varepsilon_{1t} + \alpha_{11}\varepsilon_{1,t-1} + (\alpha_{11}^2 + \alpha_{12}\alpha_{21})\varepsilon_{1,t-2} + \alpha_{12}\varepsilon_{2,t-1} + \alpha_{12}(\alpha_{11} + \alpha_{22})\varepsilon_{2,t-2} + \dots$$

Similarly expression for X_t . A shock in X_t in period t has no effect on Y_t until the period (t+1)

Chapter 5

Results and Discussion

5.1: Unit Root Test

Unit root test results are shown in Table 5.1. All variables are stationary at the first difference. As shown in the table only at the 1st difference Augmented Dickey Fuller test statistics is greater than the critical value. So the null hypothesis that the “series is not stationary” is rejected. Thus all variables are integrated of order one.

Table 5.1: Augmented Dickey Fuller Test Results

Variables	Test for Unit Root	Included in Test Equation	P- Statistics		Results
			ADF Test Statistics	Critical value	
LnPKGDP	Level	Intercept	-1.48	-3.60*	I(1)
		Trend and intercept	-0.88	-4.19	
	1 st Difference	intercept	-4.42	-3.60	
LnPGDP	Level	Intercept	-1.28	-3.60	I(1)
		Trend and intercept	-0.55	-4.19	
	1 st Difference	Intercept	-4.70	-3.60	
LnSGDP	Level	intercept	-0.84	-4.19	I(1)
		Trend and Intercept	-1.27	-4.19	
	1 st Difference	Intercept	-5.40	-3.60	
LnKPKGDP	Level	Intercept	-0.05	-3.60	I(1)
		Trend and intercept	-2.79	-4.19	
	1 st Difference	Intercept	-5.85	-3.60	
LnBGDP	Level	Intercept	-1.16	-3.60	I(1)
		Trend and intercept	-1.30	-4.19	
	1stDifference	Intercept	-6.98	-3.60	
CMR	Level	Intercept	-2.67	-3.60	I(1)
		Trend and intercept	-2.59	-4.19	
	1 st Difference	Intercept	-5.70	-3.60	
LnCPI	Level	Intercept	-0.07	-3.60	I(1)
		Trend and intercept	-3.52	-4.19	
	1 st Difference	intercept	-3.34	-3.60	
CPS	Level	Intercept	-2.65	-3.60	I(1)
		Trend and intercept	-2.55	-4.19	
	1 st Difference	Intercept	-4.83	-3.60	
LnER	Level	Intercept	0.50	-3.60	I(1)
		Trend and intercept	-1.93	-4.19	
	1 st Difference	Intercept	-4.67	-3.60	

Note: *, **, *** indicate the critical value at 1%, 5% and 10% significance level respectively.

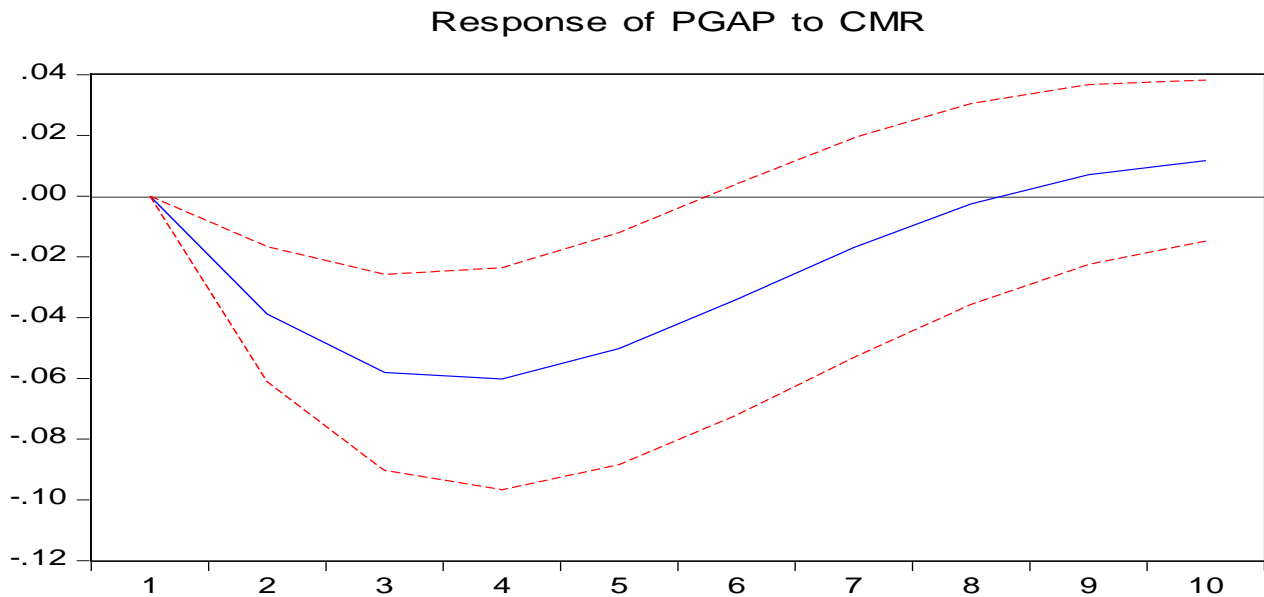
5.2: Impulse Response Function

Impulse response function shows that shock to one variable under consideration is not constrained to that variable but is conveyed to all variables to capture the dynamic interaction among these variable. Impulse response function not only shows the current value of response but also the future value of response of all variables under consideration. In this study shock of one standard deviation is given and responses are given below.

5.2.1 Punjab

To check monetary policy effects, we have estimated the impulse response function and variance decomposition of Punjab's output gap. Detail is as follows.

Figure 5.1: Impulse Response Function of Punjab output Gap to call money Rate³



In the above figure solid line in blue color shows the point estimates of the response and red dotted lines show the upper and lower error bands. To calculate these error bands we add and

³ Because of the nature of the study we have plotted here the response of output gap. Remaining IRF's are given in appendix.

subtract two times standard error from point estimates. At vertical axis maximum and minimum lengths of the response is given while on horizontal axis annual time period is given. From the occurrence of shock response is plotted for the period of ten years.

Response of Punjab's output gap to one standard deviation positive unanticipated shock in call money rate is given in figure 5.1. Due to one standard deviation positive shock in call money rate output gap decreases upto 6 percent. Decrease in output gap bottoms out within the four years of shock occurrence. So the monetary policy shock is significant in Punjab.

Variance Decomposition of output Gap in Punjab

Variance decomposition of Punjab's output gap is given in the following table.

Table 5.1: Variance Decomposition of Punjab's output Gap⁴

Period	S.E.	PGAP	LNCPI	CPS	LNER	CMR
1	0.10	100.00	0.00	0.00	0.00	0.00
2	0.12	86.42	3.30	0.71	0.32	9.23
3	0.14	68.38	7.64	1.08	0.56	22.32
4	0.16	56.00	10.58	1.01	0.56	31.82
5	0.17	50.16	11.94	0.90	0.50	36.48
6	0.17	48.41	12.30	0.92	0.55	37.79
7	0.18	48.35	12.24	1.06	0.78	37.55
8	0.18	48.49	12.08	1.20	1.15	37.05
9	0.18	48.32	11.99	1.28	1.53	36.85
10	0.18	47.95	11.95	1.30	1.83	36.95

Variance decomposition shows the relative importance of call money rate in explaining the variation in the output gap. Output gap itself is highest important variable in explaining the variation in output gap. Upto 2years 86percent variations in output gap are explained by itself. Even in the long run 48 percent variations in output gap are explained by own. Above table shows that upto four years of shock 32 percent variations in output in Punjab are explained by

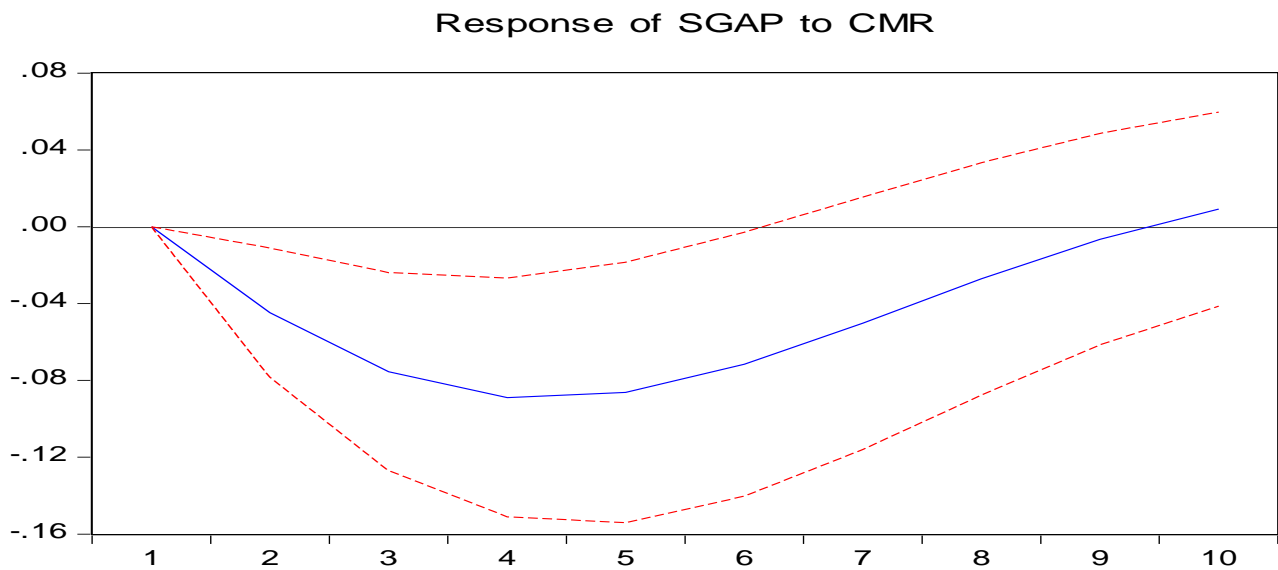
⁴ Because of nature of the study here we are representing the variance decomposition of output gap only. Remaining variables variance decomposition is given in the appendix.

the call money rate. If we look in long run 37 percent of variations in output gap are explained by the call money rate.

5.2.2 Sindh

Figure 5.2 shows the response of Sindh’s output gap to one standard deviation positive unanticipated shock in call money rate. A decline of 8percent in output gap in Sindh can be observed from the following figure. Monetary policy has significant effects in Sindh. This decline bottoms out after 5 years of the occurrence of the shock in call money rate. When output is greater than the potential output, means there is positive output gap, with the increase in the interest rate, it will decrease. If we follow the interest rate channel, with the increase in interest rate, investment will decrease so output will also decline. Similarly cost of borrowing will increase. So firms and individuals will hesitate to borrow and prefer to save more. Ultimately output will decline.

Figure 5.2: Impulse Response Function of Sindh’s output Gap to call money Rate



Variance decomposition of Sindh output gap is given in table 5.2. Similar to Punjab, output gap itself is important variable in explaining the variation in output gap in Sindh. Upto 3years 76 percent variation in output gap is explained by itself. In the long run case upto 10years of occurrence of shock more than 50 percent variation is explained by output gap itself. After the occurrence of monetary policy shock in short run 11 percent variations in output gap are explained by call money rate. While in long run more than 25percent variation in output gap is explained by the call money rate. Call money rate is important variable in explaining the variation in output gap.

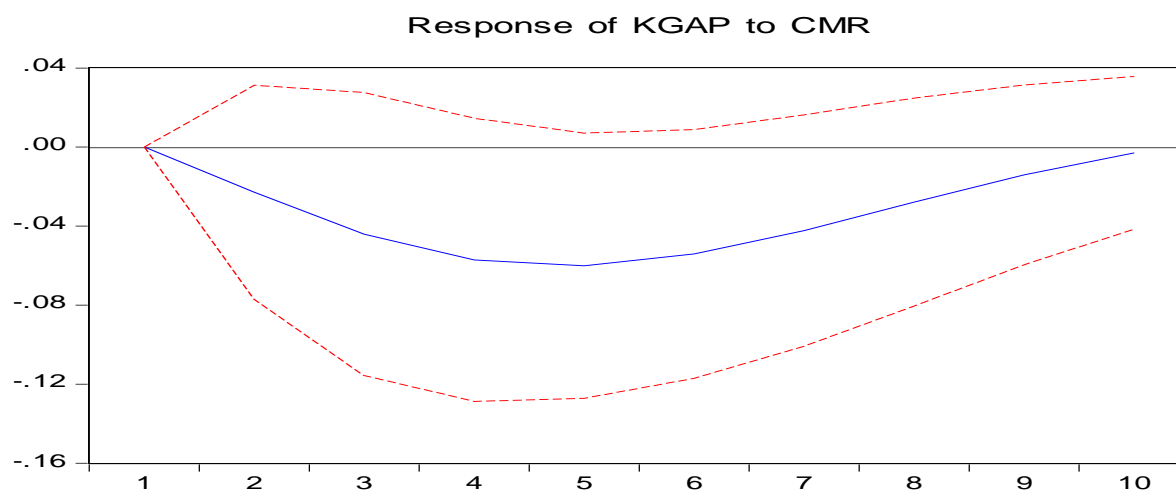
Table 5.2: Variance decomposition of Sindh's output gap

Period	S.E.	SGAP	LNCPI	CPS	LNER	CMR
1	0.17	100.00	0.00	0.00	0.00	0.00
2	0.22	89.75	1.31	2.87	2.04	4.01
3	0.26	76.35	2.88	4.61	5.08	11.06
4	0.29	66.05	3.79	4.53	7.68	17.92
5	0.31	59.56	4.02	3.95	9.42	23.02
6	0.32	55.83	3.89	3.96	10.33	25.97
7	0.33	53.70	3.72	4.89	10.62	27.04
8	0.34	52.34	3.72	6.45	10.54	26.93
9	0.34	51.27	3.93	8.04	10.34	26.39
10	0.34	50.35	4.26	9.22	10.16	25.98

5.2.3: Khyber Pakhtunkhwa

Figure 5.3 shows the response of Khyber Pakhtunkhwa output gap to one standard deviation positive unanticipated shock in call money rate. Positive shock of one standard deviation decreases the output gap by 5percent but monetary policy has insignificant effects in KPK. If we look on the duration of shock, decline in output gap bottoms out after 4.5 years of occurrence of this shock. Channels are the same as mentioned in Sindh and Punjab case.

Figure 5.3: Impulse Response Function of KPK's output Gap to call money Rate



Variance Decomposition of KPK's Output Gap

Variance decomposition of output gap in Khyber Pakhtunkhwa shows interesting result. Monetary policy variable has little importance in explaining the variation in the output gap in the short run. In long run 10 percent variations in output gap is explained by call money rate. More than 14 percent are explained by credit to private sector.

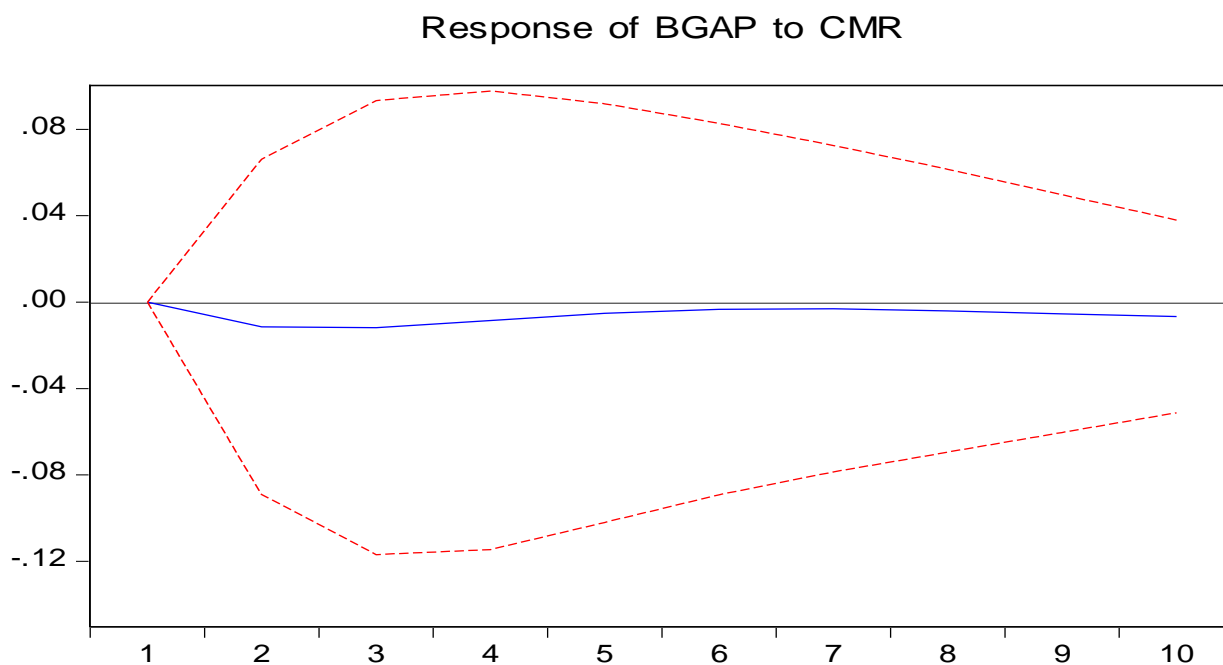
Table 5.3: Variance decomposition of KPK's output gap

Period	S.E.	KGAP	LNCPI	CPS	LNER	CMR
1	0.25	100.00	0.00	0.00	0.00	0.00
2	0.30	93.52	0.49	4.28	1.120	0.58
3	0.32	82.90	1.41	9.79	3.54	2.35
4	0.34	73.99	2.22	12.68	6.22	4.86
5	0.35	68.89	2.65	12.89	8.28	7.27
6	0.36	66.51	2.74	12.22	9.51	9.00
7	0.37	65.25	2.69	12.03	10.04	9.96
8	0.37	64.21	2.64	12.68	10.16	10.29
9	0.38	63.21	2.64	13.79	10.07	10.27
10	0.38	62.40	2.70	14.81	9.93	10.13

5.2.4 Balochistan

Impulse response function in figure 5.4 shows that monetary policy has minute negative but insignificant effects in Balochistan. Military operation and insurgency in Balochistan discouraged the investor to invest in Balochistan.

5.4: Impulse Response Function of Balochistan's output Gap to call money Rate



Variance Decomposition

Variance decomposition shows the same results as shown in the figure 5.4. Output gap itself accounts for more than 95percent variance.

Table 5.4: Variance decomposition of Balochistan's output gap

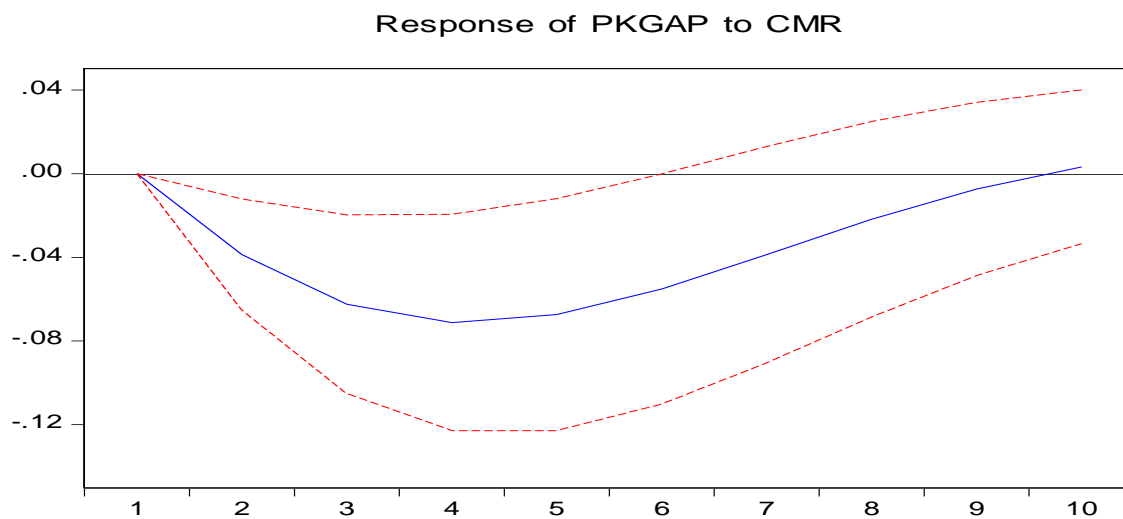
Period	S.E.	KGAP	LNCPPI	CPS	LNER	CMR
1	0.38	100.00	0.00	0.00	0.00	0.00
2	0.46	99.47	0.16	0.05	0.24	0.06
3	0.49	98.66	0.41	0.12	0.68	0.11
4	0.50	97.86	0.66	0.14	1.19	0.13
5	0.51	97.18	0.87	0.15	1.65	0.13
6	0.52	96.66	1.04	0.14	2.00	0.13
7	0.52	96.25	1.18	0.16	2.25	0.14
8	0.52	95.93	1.29	0.19	2.42	0.14

9	0.52	95.69	1.37	0.23	2.53	0.15
10	0.53	95.50	1.43	0.28	2.60	0.169

5.2.5 Pakistan

Figure 5.2 shows the response of Pakistan’s overall output gap to one standard deviation positive unanticipated shock in call money rate. One standard deviation of interest rate contracts the output gap by 7percent. This contraction bottoms out in period of less than four years. From the previous results of Punjab and Sindh, we can say that these two provinces are the driving force behind the aggregate variation in output gap.

Figure 5.5: Impulse Response Function of Pakistan Output Gap to call money Rate



Variance Decomposition

Table 5.5 shows the variance decomposition of output gap of Pakistan. Table shows that call money rate is important variable for explaining variation in aggregate output gap. In short run it accounts for more than 20percent variance and in the long run it accounts for 31percent variance.

Table 5.5: Variance decomposition of Pakistan’s output gap

Period	S.E.	PKGAP	LNCPPI	CPS	LNER	CMR
1	0.12	100.00	0.00	0.00	0.00	0.00
2	0.16	91.96	0.93	0.22	1.40	5.46
3	0.19	80.47	1.99	0.22	3.48	13.80
4	0.22	70.40	2.63	0.20	5.34	21.40

5	0.23	63.26	2.82	0.49	6.62	26.78
6	0.24	58.86	2.75	1.23	7.34	29.79
7	0.25	56.43	2.64	2.36	7.61	30.93
8	0.25	55.15	2.63	3.62	7.62	30.95
9	0.25	54.37	2.77	4.73	7.53	30.58
10	0.25	53.75	3.00	5.54	7.45	30.24

5.3 Discussion

It is clear from impulse response functions that monetary policy has negative effect on the output gap of provinces and also at the national level. But the question is how we can measure the effectiveness of monetary policy in a particular province? Monetary policy is assumed to be more effective where monetary policy shock explains the larger proportion of the variance in the output gap. Using the time series data we found the 10years ahead variance decomposition of provinces and compared the proportion of variance decomposition of four provincial output gap that is explained by the monetary policy. It is clear that provinces do not respond by same strength to the common monetary policy shock. Punjab and Sindh are most sensitive to monetary policy shocks. In short run effects are small while in long run 36 percent and 25percent variance in output gap are explained by the monetary policy shock. Khyber Pakhtunkhwa is less responsive to monetary policy shocks while Balochistan is not affect by the monetary policy shocks.

Alam and Waheed (2006) highlighted that manufacturing, wholesale and retail trade and finance & insurance sectors are the most sensitive to monetary policy shocks. If we check the share of these sectors in provincial value added we come to know that share of these three sectors is higher in Punjab and Sindh. So these two provinces are most sensitive to monetary policy.

Table 5.6 percentage share of different sectors to provincial value added in 2010-11

Province	Manufacturing	Wholesale and Retail	Finance & Insurance
Punjab	17%	17.31	5.26
Sindh	23	17.20	4.71
KPK	16.23	13.22	4.55
Balochistan	15	20.97	0.78

Source: Data is taken from Pakistan Punjab Social Sector Public Expenditure Review2013.

KPK is less sensitive as compared to Punjab and Sindh. Concentration of manufacturing units is the important factor in determining the effects of monetary policy. We can check the concentration of industrial units from the following table

Table 5.7: Number of industrial units by Provinces (2005-06)

Punjab	3590
Sindh	1825
Khyber Pakhtunkhwa	673
Balochistan	212
Pakistan	6417

Source: Pakistan Bureau of Statistics

Above table shows that concentration of industrial units is higher in Punjab and Sindh than that of KPK and Balochistan. Banks concentration in the province is also the important factor in determining the effects of monetary policy. Branches of top 5 banks are mostly concentrated in Sindh and Punjab. Microfinance banks are also mostly concentrated in Punjab and Sindh. Special rural areas where there is no other source of finance. Microfinance banks charge more 25percent of interest.

Table 5.8: Number of branches of top 3 banks in provinces

	Punjab	Sindh	KPK	Balochistan

National Bank	691	264	221	78
MCB	730	282	116	44
ABL	501	208	151	32
Sources: relevant bank website				

From above table it is clear that branch network of banks is concentrated in Punjab and Sindh.

Number of branches in KPK and Balochistan is not much wide.

Conclusion

Impulse response functions and variance decomposition shows that Punjab and Sindh are most affected by monetary policy shocks. Khyber Pakhtunkhwa and Balochistan are less sensitive to monetary policy shocks. Reason behind the high response to monetary policy shock can be the concentration of industrial units, banks concentration, and firm size.

Chapter 6

Conclusion

In this study we used time series data of period 1973-74 to 2014-15 to check whether monetary policy has differential effects in four provinces of Pakistan. Using VAR framework we found impulse response functions and variance decomposition of variables of the interest. Study found that two provinces Punjab and Sindh are most sensitive to monetary policy shocks while Khyber Pakhtunkhwa and Balochistan are less sensitive to such shocks. Provinces where the share of sectors which are more sensitive to monetary policy shocks and intensively banked are more responsive to monetary policy shock and vice versa.

Policy Recommendations

Under current institutional setup it is not possible to make monetary policy a provincial matter. On the fiscal side provinces are autonomous to much extent. Province can setup fiscal policy at their end. They should set fiscal policy in such a way that the coordination of monetary and fiscal policy minimizes these differences in effects of monetary policy among the provinces

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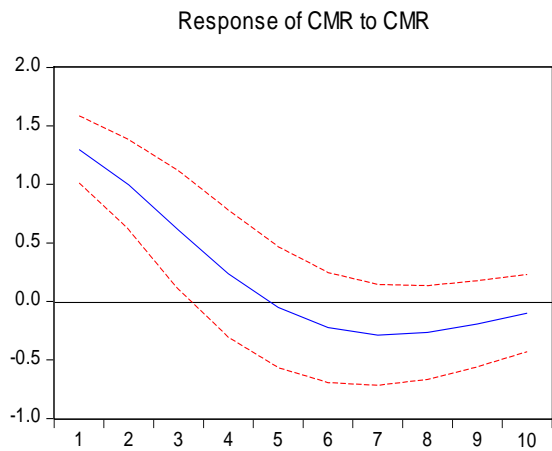
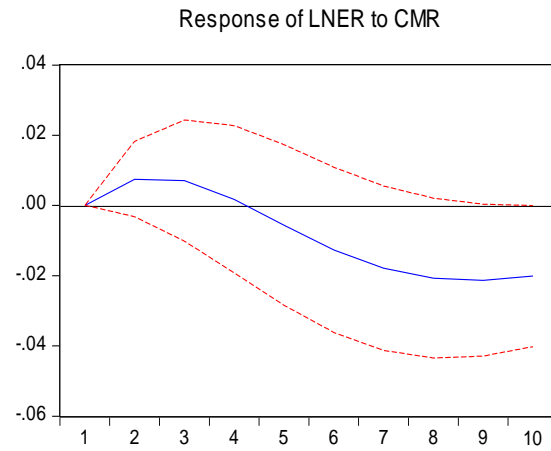
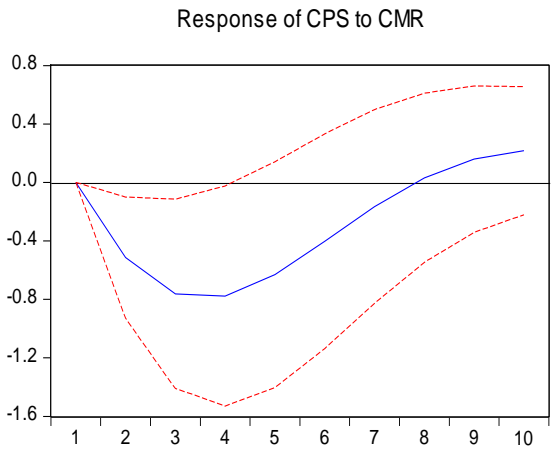
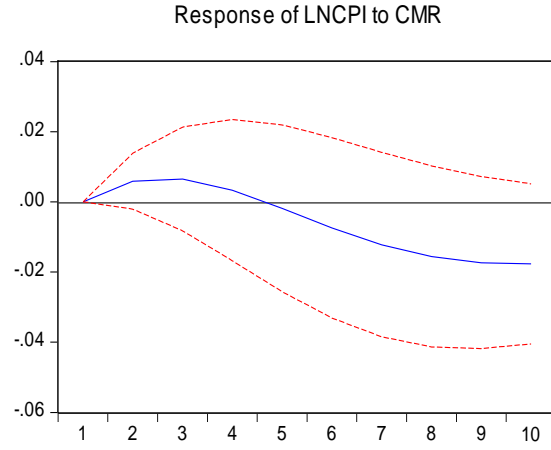
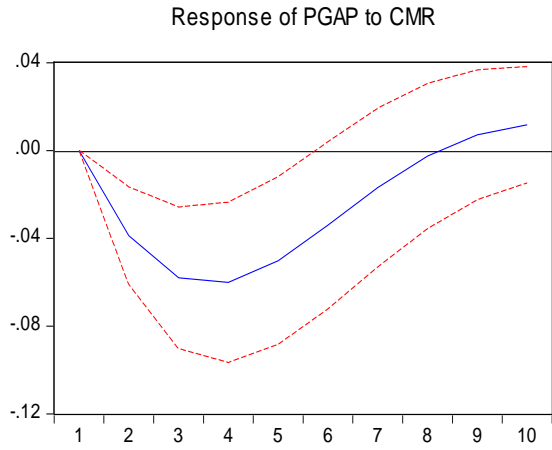
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Appendix

Impulse Responses to Call Money Rate in Punjab

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



Punjab Variables Variance Decomposition

Variance Decomposition of CPI

Period	S.E.	PGAP	LNCPI	CPS	LNER	CMR
1	0.03	1.15	98.84	0.00	0.00	0.00
2	0.05	8.08	90.56	0.16	0.20	0.97
3	0.07	15.89	82.27	0.17	0.35	1.30
4	0.09	23.00	75.38	0.12	0.42	1.05
5	0.10	28.78	69.79	0.10	0.44	0.86
6	0.11	33.03	65.22	0.12	0.45	1.15
7	0.12	35.84	61.49	0.15	0.48	2.02
8	0.12	37.52	58.47	0.18	0.53	3.29
9	0.13	38.42	56.08	0.19	0.62	4.67
10	0.13	38.87	54.23	0.19	0.76	5.93

Variance Decomposition of CPS

Period	S.E.	PGAP	LNCPI	CPS	LNER	CMR
1	1.95	0.15	17.76	82.07	0.00	0.00
2	2.57	0.12	20.54	74.80	0.54	3.98
3	2.96	0.75	21.95	66.56	1.11	9.60
4	3.21	2.22	22.35	59.98	1.43	14.00
5	3.36	4.16	22.20	55.77	1.51	16.33
6	3.43	6.05	21.87	53.54	1.49	17.01
7	3.46	7.44	21.57	52.56	1.47	16.93
8	3.48	8.20	21.39	52.14	1.47	16.79
9	3.49	8.45	21.30	51.85	1.49	16.89
10	3.50	8.460	21.26	51.58	1.50	17.18

Variance Decomposition of CMR

Period	S.E.	PGAP	LNCPI	CPS	LNER	CMR
1	1.55	0.93	29.01	0.25	0.00	69.79
2	2.01	5.46	27.95	0.18	0.31	66.07
3	2.22	10.42	26.68	0.42	1.12	61.33
4	2.32	14.11	25.48	0.78	2.37	57.23
5	2.38	15.89	24.50	1.03	3.75	54.80
6	2.41	16.19	23.77	1.10	4.91	54.01
7	2.44	15.90	23.24	1.07	5.65	54.11
8	2.46	15.64	22.87	1.09	6.02	54.35
9	2.48	15.60	22.64	1.19	6.16	54.39
10	2.48	15.67	22.52	1.37	6.183	54.24

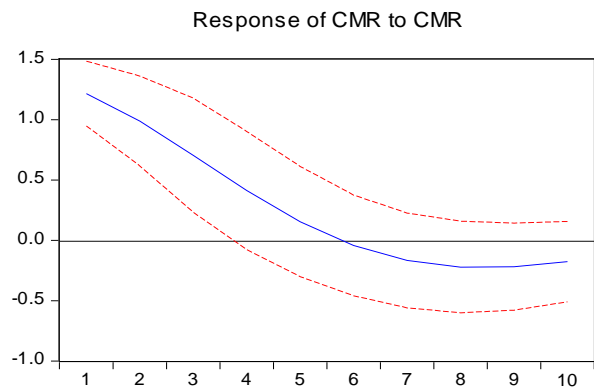
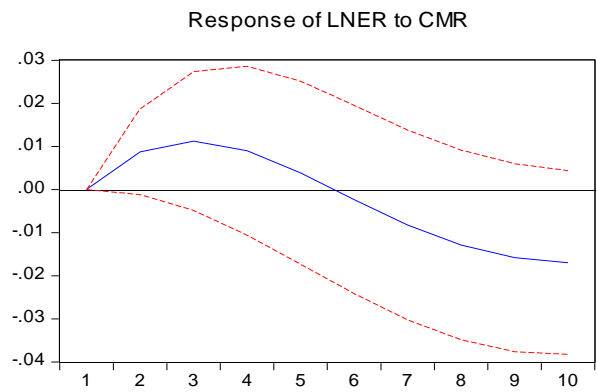
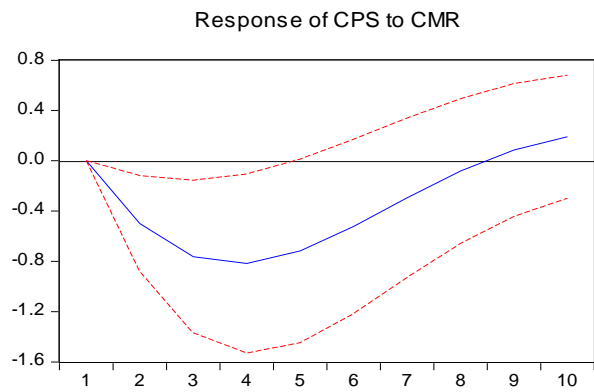
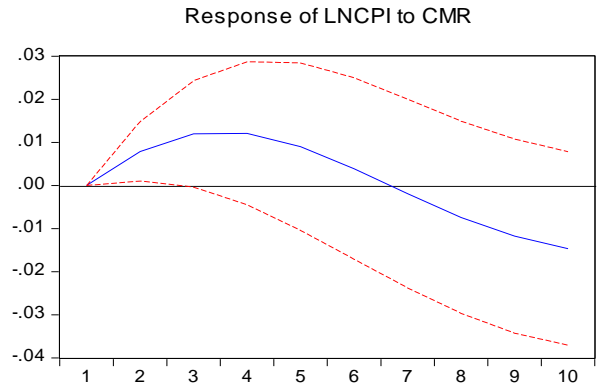
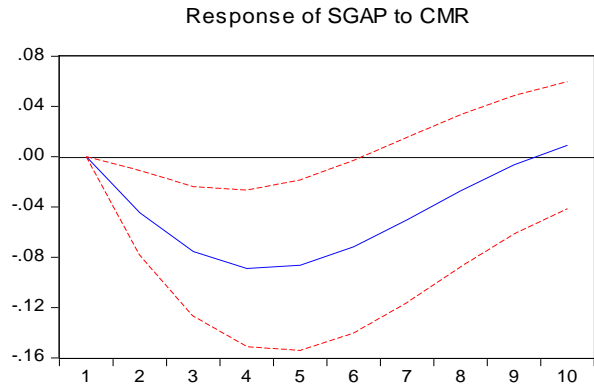
Variance Decomposition of CMR

Period	S.E.	PGAP	LNCPI	CPS	LNER	CMR
1	1.55	0.93	29.01	0.25	0.00	69.79
2	2.01	5.46	27.95	0.18	0.31	66.07

3	2.22	10.42	26.68	0.42	1.12	61.33
4	2.32	14.11	25.48	0.78	2.37	57.23
5	2.38	15.89	24.50	1.03	3.75	54.80
6	2.41	16.19	23.77	1.10	4.91	54.01
7	2.44	15.90	23.24	1.07	5.65	54.11
8	2.46	15.64	22.87	1.09	6.02	54.35
9	2.48	15.60	22.64	1.19	6.16	54.39
10	2.48	15.67	22.52	1.37	6.183	54.24

Impulse Responses to Call Money Rate in Sindh

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



Sindh Variables Variance Decomposition

Variance decomposition of SGOP

Period	S.E.	SGAP	LNCPI	CPS	LNER	CMR
1	0.17	100.00	0.00	0.00	0.00	0.00
2	0.22	89.75	1.31	2.87	2.04	4.01
3	0.26	76.35	2.88	4.61	5.08	11.06
4	0.29	66.05	3.79	4.53	7.68	17.92
5	0.31	59.56	4.02	3.95	9.42	23.02
6	0.32	55.83	3.89	3.96	10.33	25.97
7	0.33	53.70	3.72	4.89	10.62	27.04
8	0.34	52.34	3.72	6.45	10.54	26.93
9	0.34	51.27	3.93	8.04	10.34	26.39
10	0.34	50.35	4.26	9.22	10.16	25.98

Variance decomposition of CPI

Period	S.E.	SGAP	LNCPI	CPS	LNER	CMR
1	0.03	0.53	99.46	0.00	0.00	0.00
2	0.05	2.19	93.10	0.68	1.82	2.18
3	0.06	5.94	85.50	0.54	3.63	4.37
4	0.08	10.38	79.05	0.50	4.67	5.37
5	0.09	15.10	73.38	1.30	4.97	5.22
6	0.09	19.77	68.00	2.93	4.78	4.51
7	0.10	24.05	62.78	4.90	4.33	3.91
8	0.11	27.72	57.89	6.66	3.85	3.85
9	0.12	30.73	53.58	7.87	3.43	4.37
10	0.12	33.16	50.01	8.46	3.09	5.25

Variance decomposition of CPS

Period	S.E.	SGAP	LNCPI	CPS	LNER	CMR
1	1.93	2.86	14.79	82.34	0.00	0.00
2	2.60	2.17	17.97	75.43	0.73	3.67
3	3.01	1.85	19.81	67.48	1.69	9.14
4	3.25	1.75	20.66	61.01	2.43	14.12
5	3.38	1.80	20.88	56.92	2.80	17.57
6	3.44	1.93	20.78	55.09	2.88	19.29
7	3.46	2.10	20.55	54.75	2.84	19.72
8	3.48	2.27	20.33	54.96	2.85	19.56
9	3.50	2.40	20.15	55.06	2.97	19.39
10	3.52	2.49	20.00	54.86	3.17	19.46

Variance decomposition of ER

Period	S.E.	SGAP	LNCPI	CPS	LNER	CMR
1	0.05	5.98	1.17	0.00	92.83	0.000000

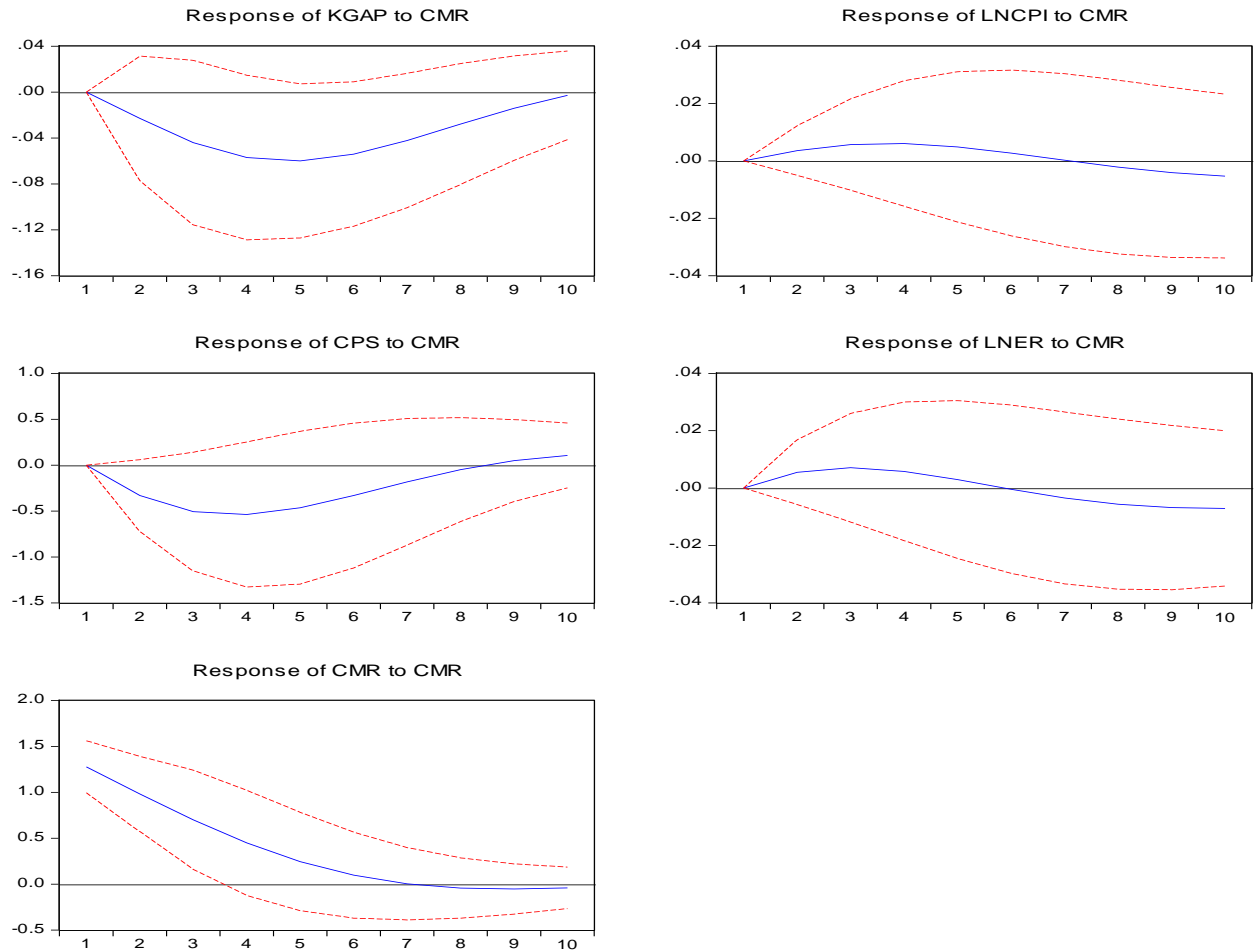
2	0.07	4.32	0.63	0.79	92.70	1.531150
3	0.08	3.14	0.58	3.43	89.94	2.892539
4	0.09	2.63	0.58	7.90	85.62	3.250439
5	0.10	2.79	0.55	13.45	80.28	2.921177
6	0.10	3.53	0.50	18.88	74.45	2.624251
7	0.11	4.69	0.46	23.21	68.74	2.892568
8	0.11	6.10	0.43	26.01	63.60	3.827670
9	0.12	7.66	0.46	27.39	59.28	5.194646
10	0.12	9.27	0.58	27.73	55.75	6.649023

Variance decomposition of CMR

Period	S.E.	SGAP	LNCPI	CPS	LNER	CMR
1	1.60	7.67	34.29	0.52	0.00	57.50
2	2.01	5.77	33.37	0.44	0.00	60.40
3	2.19	4.88	32.33	1.50	0.06	61.21
4	2.27	4.62	31.23	3.54	0.39	60.19
5	2.32	4.69	30.15	5.76	1.14	58.23
6	2.36	4.85	29.18	7.35	2.23	56.37
7	2.39	4.99	28.36	8.02	3.40	55.21
8	2.42	5.06	27.72	8.07	4.40	54.73
9	2.44	5.09	27.25	7.93	5.12	54.58
10	2.45	5.09	26.94	7.93	5.54	54.48

Impulse Responses to Call money Rate in KPK

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



Variance decomposition of KPK output gap

Period	S.E.	KGAP	LNCPI	CPS	LNER	CMR
1	0.25	100.00	0.00	0.00	0.00	0.00
2	0.30	93.52	0.49	4.28	1.120	0.58
3	0.32	82.90	1.41	9.79	3.54	2.35
4	0.34	73.99	2.22	12.68	6.22	4.86
5	0.35	68.89	2.65	12.89	8.28	7.27
6	0.36	66.51	2.74	12.22	9.51	9.00
7	0.37	65.25	2.69	12.03	10.04	9.96
8	0.37	64.21	2.64	12.68	10.16	10.29
9	0.38	63.21	2.64	13.79	10.07	10.27
10	0.38	62.40	2.70	14.81	9.93	10.13

Variance decomposition of CPI

Period	S.E.	KGAP	LNCPI	CPS	LNER	CMR
1	0.04	15.96	84.03	0.00	0.00	0.00
2	0.06	27.52	71.05	0.010	1.07	0.33
3	0.07	35.93	60.92	0.19	2.23	0.71
4	0.09	41.15	53.69	1.21	3.02	0.90
5	0.10	43.80	48.52	3.29	3.46	0.90
6	0.11	44.57	44.75	6.22	3.64	0.80
7	0.12	44.14	41.94	9.53	3.67	0.70
8	0.13	43.09	39.83	12.76	3.64	0.65
9	0.13	41.85	38.27	15.58	3.60	0.68
10	0.14	40.65	37.12	17.84	3.59	0.77

Variance decomposition of CPS

Period	S.E.	KGAP	LNCPI	CPS	LNER	CMR
1	1.79	0.11	10.32	89.55	0.00	0.00
2	2.52	5.34	11.37	80.62	0.93	1.72
3	3.01	13.08	11.51	69.49	1.89	4.01
4	3.32	19.73	11.27	60.62	2.45	5.91
5	3.49	24.12	10.93	55.19	2.62	7.11
6	3.57	26.24	10.64	52.86	2.59	7.65
7	3.61	26.75	10.43	52.51	2.54	7.75
8	3.64	26.54	10.30	52.91	2.56	7.66
9	3.66	26.26	10.22	53.22	2.67	7.60
10	3.67	26.19	10.16	53.20	2.81	7.61

Variance decomposition of ER

Period	S.E.	KGAP	LNCPI	CPS	LNER	CMR
1	0.05	0.17	0.16	2.56	97.10	0.00
2	0.07	2.51	0.74	5.38	90.79	0.55
3	0.09	5.52	1.14	10.30	82.02	0.98
4	0.10	7.33	1.33	16.76	73.50	1.06
5	0.11	7.86	1.39	23.68	66.11	0.93
6	0.12	7.67	1.42	30.01	60.09	0.79
7	0.13	7.22	1.47	35.11	55.40	0.77
8	0.13	6.78	1.58	38.84	51.90	0.87
9	0.14	6.46	1.77	41.35	49.36	1.05
10	0.14	6.26	2.07	42.91	47.51	1.23

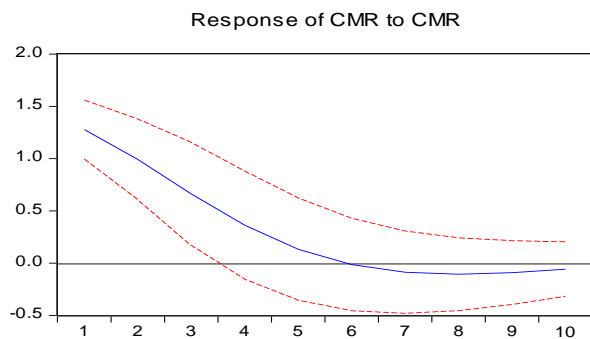
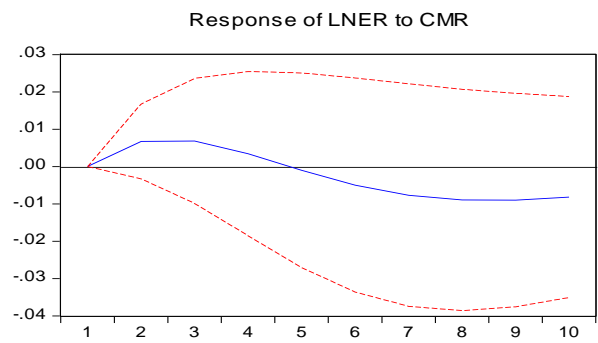
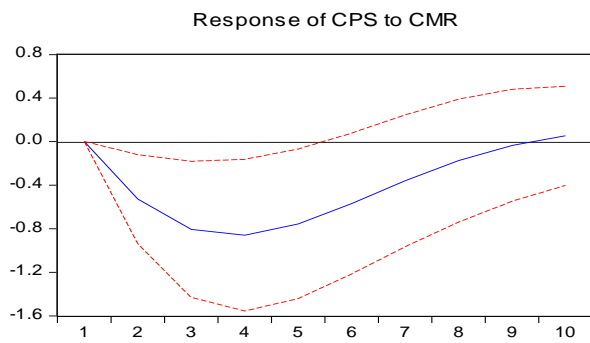
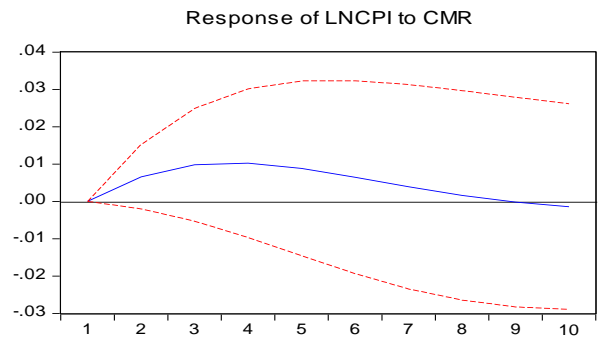
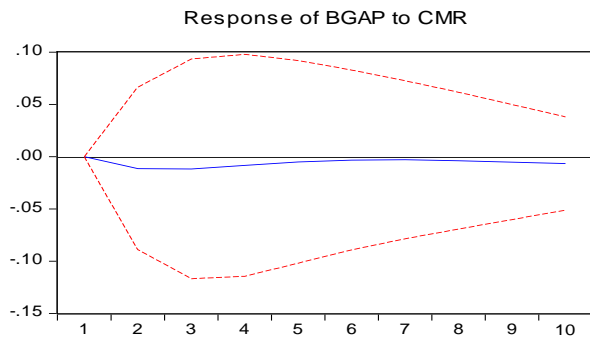
Variance decomposition of CMR

Period	S.E.	KGAP	LNCPI	CPS	LNER	CMR
1	1.63	7.21	30.61	0.67	0.25	61.23

2	2.07	10.21	28.32	0.65	0.20	60.60
3	2.27	11.44	26.55	2.17	0.18	59.64
4	2.37	11.36	25.24	4.75	0.37	58.26
5	2.43	10.88	24.27	7.37	0.82	56.65
6	2.46	10.69	23.56	9.17	1.42	55.13
7	2.49	10.95	23.07	9.97	2.01	53.97
8	2.51	11.41	22.74	10.11	2.47	53.23
9	2.52	11.81	22.55	10.03	2.76	52.82
10	2.52	12.02	22.44	10.02	2.91	52.58

Impulse Responses to call money Rate in Balochistan

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



Variance decomposition of Balochistan output gap

Period	S.E.	BGAP	LNCPI	CPS	LNER	CMR
1	0.38	100.00	0.00	0.00	0.00	0.00
2	0.46	99.47	0.16	0.05	0.24	0.06
3	0.49	98.66	0.41	0.12	0.68	0.11
4	0.50	97.86	0.66	0.14	1.19	0.13
5	0.51	97.18	0.87	0.15	1.65	0.13
6	0.52	96.66	1.04	0.14	2.00	0.13
7	0.52	96.25	1.18	0.16	2.25	0.14
8	0.52	95.93	1.29	0.19	2.42	0.14
9	0.52	95.69	1.37	0.23	2.53	0.15
10	0.53	95.50	1.43	0.28	2.60	0.169

Variance decomposition of CPI

Period	S.E.	BGAP	LNCPI	CPS	LNER	CMR
1	0.04	4.03	95.96	0.00	0.00	0.00
2	0.06	10.01	88.06	0.62	0.17	1.11
3	0.07	16.92	78.42	2.13	0.33	2.18
4	0.09	23.50	69.31	4.09	0.41	2.60
5	0.11	29.17	61.62	6.10	0.43	2.65
6	0.12	33.77	55.50	7.87	0.44	2.40
7	0.13	37.40	50.75	9.30	0.45	2.09
8	0.14	40.22	47.09	10.38	0.46	1.82
9	0.15	42.43	44.27	11.18	0.49	1.61
10	0.16	44.17	42.07	11.75	0.53	1.46

Variance decomposition of CPS

Period	S.E.	BGAP	LNCPI	CPS	LNER	CMR
1	1.95	0.02	18.70	81.26	0.00	0.00
2	2.57	0.05	21.30	73.66	0.74	4.22
3	2.92	0.16	22.90	64.65	1.43	10.83
4	3.15	1.06	23.37	57.05	1.73	16.76
5	3.30	2.83	22.98	51.93	1.75	20.48
6	3.40	4.95	22.22	49.11	1.67	22.03
7	3.47	6.78	21.50	47.84	1.61	22.25
8	3.51	8.03	21.01	47.37	1.59	21.98
9	3.53	8.70	20.76	47.20	1.61	21.72
10	3.55	8.96	20.66	47.11	1.63	21.61

Variance decomposition of ER

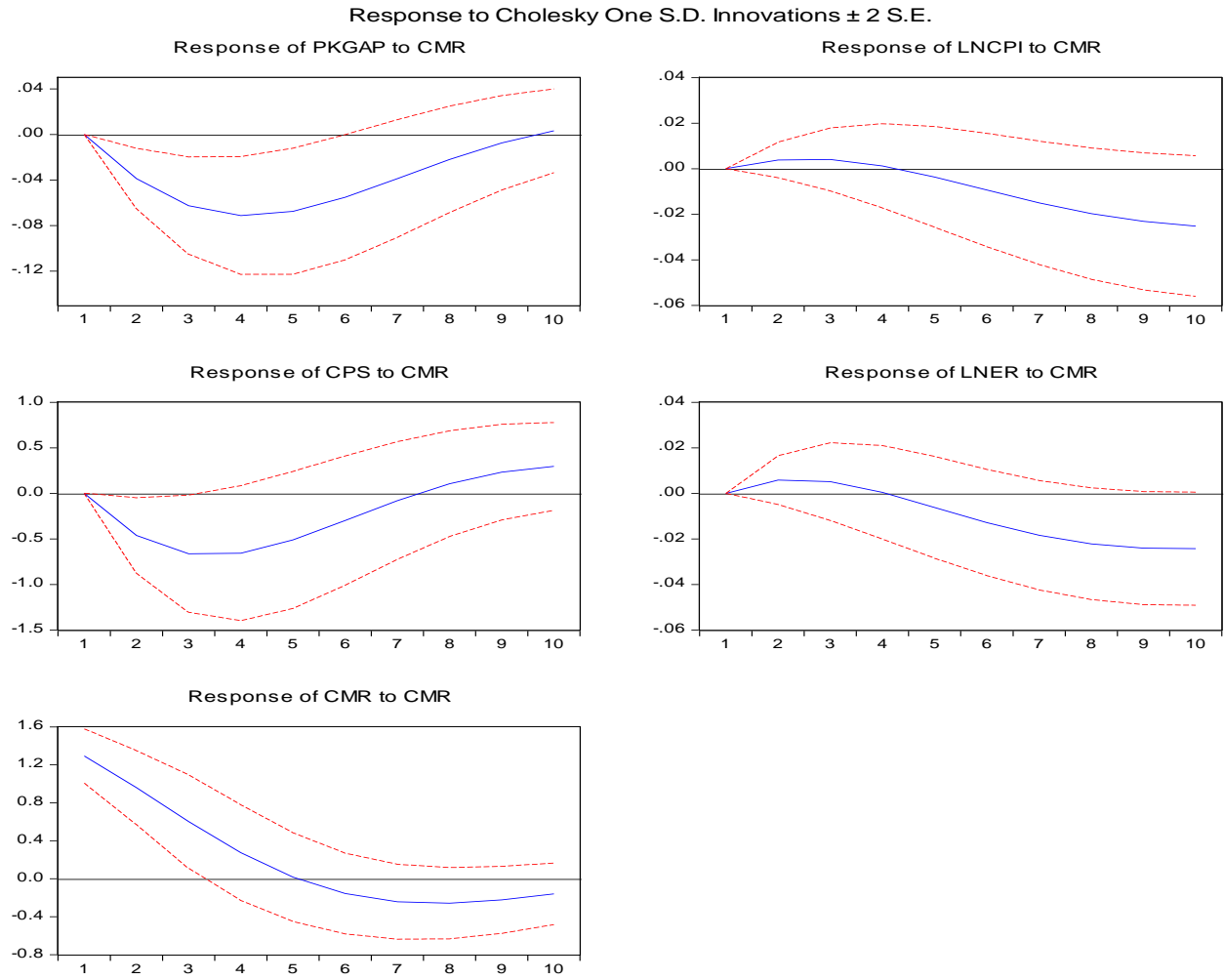
Period	S.E.	BGAP	LNCPI	CPS	LNER	CMR
1	0.04	10.04	0.23	0.09	89.62	0.00

2	0.07	25.21	0.33	3.24	70.31	0.88
3	0.09	37.33	0.59	8.13	52.84	1.10
4	0.10	45.22	0.74	12.24	40.91	0.87
5	0.12	50.10	0.84	15.05	33.32	0.68
6	0.13	53.09	0.95	16.75	28.49	0.69
7	0.14	54.98	1.10	17.68	25.34	0.88
8	0.15	56.20	1.32	18.11	23.21	1.13
9	0.16	57.04	1.64	18.25	21.70	1.35
10	0.16	57.64	2.05	18.23	20.55	1.50

Variance decomposition of CMR

Period	S.E.	BGAP	LNCPI	CPS	LNER	CMR
1	1.59	0.00	35.33	0.24	0.00	64.41
2	2.03	2.44	32.47	1.69	0.38	62.98
3	2.27	5.55	29.72	4.42	1.15	59.13
4	2.39	7.83	27.77	6.82	2.07	55.48
5	2.45	8.96	26.67	8.27	2.96	53.12
6	2.47	9.27	26.15	8.86	3.65	52.04
7	2.48	9.25	25.93	8.96	4.10	51.73
8	2.49	9.22	25.81	8.93	4.34	51.67
9	2.50	9.30	25.71	8.92	4.45	51.60
10	2.50	9.44	25.62	8.97	4.48	51.47

Impulse Responses to call money Rate in Pakistan



Variance decomposition of Pakistan output gap

Period	S.E.	PKGAP	LNCPI	CPS	LNER	CMR
1	0.12	100.00	0.00	0.00	0.00	0.00
2	0.16	91.96	0.93	0.22	1.40	5.46
3	0.19	80.47	1.99	0.22	3.48	13.80
4	0.22	70.40	2.63	0.20	5.34	21.40
5	0.23	63.26	2.82	0.49	6.62	26.78

6	0.24	58.86	2.75	1.23	7.34	29.79
7	0.25	56.43	2.64	2.36	7.61	30.93
8	0.25	55.15	2.63	3.62	7.62	30.95
9	0.25	54.37	2.77	4.73	7.53	30.58
10	0.25	53.75	3.00	5.54	7.45	30.24

Variance decomposition of CPI

Period	S.E.	PKGAP	LNCPI	CPS	LNER	CMR
1	0.03	2.13	97.86	0.00	0.00	0.00
2	0.05	8.51	89.90	0.25	0.83	0.48
3	0.07	17.12	80.28	0.32	1.62	0.62
4	0.08	26.42	70.86	0.27	1.98	0.45
5	0.09	35.09	62.24	0.21	1.96	0.48
6	0.11	42.27	54.70	0.16	1.74	1.10
7	0.12	47.61	48.36	0.13	1.48	2.39
8	0.13	51.24	43.20	0.11	1.25	4.16
9	0.14	53.52	39.15	0.13	1.07	6.11
10	0.15	54.86	36.03	0.18	0.93	7.97

Variance decomposition of CPS

Period	S.E.	PKGAP	LNCPI	CPS	LNER	CMR
1	1.92	0.31	13.49	86.19	0.00	0.00
2	2.55	0.18	16.36	79.61	0.56	3.26
3	2.94	0.68	17.94	72.54	1.26	7.55
4	3.17	2.14	18.55	66.83	1.72	10.74
5	3.31	4.46	18.55	62.85	1.88	12.24
6	3.39	7.22	18.23	60.24	1.84	12.44
7	3.45	9.82	17.80	58.45	1.79	12.12
8	3.49	11.82	17.38	57.03	1.83	11.91
9	3.53	13.07	17.01	55.82	1.98	12.09
10	3.56	13.69	16.72	54.83	2.18	12.56

Variance decomposition of ER

Period	S.E.	PKGAP	LNCPI	CPS	LNER	CMR
1	0.05	3.76	0.22	0.77	95.23	0.00
2	0.06	2.07	0.23	2.83	94.14	0.70
3	0.081	3.27	0.42	5.78	89.60	0.89
4	0.091	6.84	0.55	8.94	82.93	0.71
5	0.10	11.63	0.60	11.54	75.23	0.98
6	0.10	16.47	0.63	13.14	67.48	2.26
7	0.11	20.67	0.67	13.68	60.44	4.52
8	0.12	24.00	0.78	13.44	54.46	7.31
9	0.12	26.58	0.99	12.75	49.56	10.11
10	0.13	28.62	1.35	11.89	45.58	12.53

Variance decomposition of CMR

Period	S.E.	KGAP	LNCPI	CPS	LNER	CMR
1	1.57	0.03	32.07	0.06	7.27	67.82
2	1.96	1.49	30.90	0.24	0.03	67.33
3	2.13	4.56	29.61	0.82	0.27	64.72
4	2.22	8.08	28.28	1.50	0.92	61.19
5	2.28	10.91	27.01	1.97	1.99	58.10
6	2.33	12.54	25.91	2.11	3.26	56.15
7	2.37	13.15	25.02	2.07	4.46	55.28
8	2.40	13.18	24.37	2.03	5.39	55.00
9	2.42	13.03	23.94	2.14	5.99	54.87
10	2.44	12.89	23.69	2.40	6.32	54.67