Interest Rate, Broad Credit Channel and Firm Investment in Pakistan: Evidence from the Manufacturing Sector

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Dedicated to my Brother

Umer Majeed Awan

(*Who is source of my success*)

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ABSTRACT

This study explores the effects of monetary policy on firms' business fixed investment spending through the interest rate and broad credit channel of monetary policy transmission in Pakistan by using disaggregated firm level data of manufacturing sector during 1974-2010. Neo-classical investment model is used to identify the interest rate and broad credit channel. User cost of capital indicates the presence of interest rate channel while cash flow to capital stock ratio is used as a proxy to identify the broad credit channel. Firm specific user cost of capital is constructed by using firm level information related to debt, equity, and apparent interest rate. Sales as well as cash flow are also constructed by using firm level data taken from financial statements analysis of companies. Due to the problem of endogeneity, Generalized Method of Moments (GMM) one step and two step estimation technique is applied.

This study divides the firms into small and large to identify the broad credit channel and to explore the heterogeneous effects of monetary policy. This study also splits the data into pre (*1974-1989*) *and post* (*1990-2010*) *financial sector reforms periods to test the hypothesis that whether firms' behavior after denationalization in terms of monetary policy effects has changed or not as well as into three other different time frames ranging from 1974-1985, 1986-1997 and 1998-2010 to gauge the relative strength of the monetary policy effects on investment spending through the interest rate channel during these time frames.*

To explore the possibility that effects of monetary policy on firms' investment may be different for different sectors, textile cotton, textile synthetic and chemical sectors are analyzed. Results indicate the presence of the strong interest rate and broad credit channel of monetary policy transmission in Pakistan. Firms' investment found to be affected by the monetary policy. Small firms explored to be more responsive to the monetary tightening as compared with large firms due to greater informational asymmetries proving that monetary policy exerts heterogeneous effects.

Effect of monetary policy on firms' business fixed investment spending through the interest rate channel are greater after the financial sector reforms than the pre reform era giving strong indication of strengthening of monetary management after the reforms. During different time frames, effect of monetary policy through the interest rate channel has been different, greatest during the 1986-1997. Different sectors explored to be sensitive to monetary tightening to varying degrees and chemical sector investment discovered to be most sensitive to the monetary tightening due to capital intensive nature of its operations while the interest rate channel explored not to be operative for the textile synthetic sector.

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Chapter 1

INTRODUCTION

There is consensus among the economists that monetary policy affects the real economic activity but how the effects of monetary policy are transmitted to the real economic activity is still debatable. Especially after the financial crisis of 2008, researchers and policy makers have shifted their attention towards the monetary actions and their impact on behavior of economic agents. A large strand of the literature all over the world has attempted to find out the mechanism through which the monetary policy affects the economic agents: consumers, banks and firms. Monetary policy affects the real economic activity by various transmission channels. These transmission channels include interest rate channel, exchange rate channel, equity price channel and broad credit channel[1]. By using disaggregated firm level data, literature identifies two most important channels through which monetary policy affects the business fixed investment spending of the firms (Kalckreuth, 2001; Chatelain *et al.*, 2001; Bryson, 2009; Karim, 2010). One is traditional interest rate channel. It implies that changes in the market interest rate leads to the changes in the user cost of capital which in turn affects the capital formation by the firms. Second is the broad credit channel which is composed of balance sheet channel and bank lending channel. Monetary policy shock leads to the decline in the net cash flow, due to rise in interest expenses, and deteriorates the value of collateral. It negatively affects the firms' net worth and directs to the increase in the external finance premium, which is the difference between the cost of external and internal generated funds, due to the increase in the agency cost as explained by Bernanke and Gertler (1995). In other words, firms' balance sheet conditions worsen that causes the

[1]For an overview of these channels see Mishkin (1996)

external finance premium to rise due to the higher agency cost. Firms that are subject to severe informational problems like small firms are affected more strongly by monetary contraction. Monetary contraction also affects the firms' revenue due to the decline in consumers' demand thus negatively affecting the firms' balance sheet conditions. This channel is known as the balance sheet channel. Monetary contraction also affects the banks' ability to supply loans identified as the bank lending channel. Tight monetary policy leads to the fall in bank deposits and bank reserves leading to the contraction in loan supply. Resultantly, aggregate demand declines and inflation comes down. Small firms are affected more strongly by the loan supply contraction as discussed by Mishkin (1996).

1.1 GAP IN THE LITERATURE

There are bundle of studies who have investigated the transmission channels of monetary policy in Pakistan but most of these studies relies on the aggregated data that cannot be used to find out the role of credit market frictions in the transmission of monetary policy process. It is necessary to find out the role of credit market frictions in the monetary policy transmission because it is stated by the Agha *et al.* (2005) that in Pakistan a strong bank lending channel exists because the capital market is under the process of development and most of the borrowers are bank dependent for their working capital and investment financing needs.

Most of the studies investigating the monetary policy transmission channels in Pakistan have not focused on the role that financial position of the borrower plays in the monetary policy effects. The relevance of monetary policy in affecting the business fixed investment spending is absent in all the studies exploring the monetary transmission channels in Pakistan despite of its importance in the macroeconomic

fluctuations. So, it is of immense importance to investigate the effects of monetary policy on firms' fixed investment spending.

1.2 OBJECTIVES

The main aim of this study is to explore the interest rate and broad credit channel with a particular focus on firms' fixed investment spending in Pakistan by using dynamic neo-classical investment model. In a recession, half or more of the total decline in spending is attributable to the reduction in investment spending and investment plays a critical role in determining the long term productive capacity of the economy as explained by Abel *et al.* (2011). It makes investment an ideal candidate to gauge the impact of monetary policy on firms' fixed investment and to find out the interest rate and broad credit channels of monetary policy transmission. The objectives of this study are defined below:

1. *To explore whether the interest rate channel is operative in Pakistan?*

   This study explores the effects of monetary policy on firms' fixed investment spending in Pakistan. Interest rate channel is identified through the user cost of capital. User cost of capital is calculated by using firm level information related to debt, equity and apparent interest rate. Neo-classical investment model is estimated to explore the effects of monetary policy on firms' fixed investment spending by taking into account 498 firms of the manufacturing sector of Pakistan for the period 1974-2010.

2. *To investigate whether the broad credit channel is operative in Pakistan?*

   This study is particularly interested to investigate the significance of broad credit channel in Pakistan. This study explores the relevance of the broad credit channel

by using cash flow to capital stock ratio as an indicator of broad credit channel. For this purpose, neo-classical investment model is augmented with the cash flow to capital stock ratio. Greater effect of cash flow to capital stock ratio on firms' fixed investment spending in case of small firms as compared with large firms point out towards the relevance of broad credit channel.

3. *To explore whether the sales positively and significantly accelerate the firms' fixed investment spending in Pakistan?*

   Role of sales in accelerating the firms' business fixed investment spending is analyzed by this paper. This study examines whether the sales positively and significantly accelerate the firms' fixed investment spending in case of manufacturing sector of Pakistan as advocated by the accelerator theory of investment. Differential effect of sales on firms' fixed investment in case of different sectors and firms of different sizes is also explored.

4. *To analyze whether the response of firms to monetary policy have changed after the financial sector reforms in Pakistan?*

   Effect of monetary policy on firms' fixed investment spending before and after the financial sector reforms is explored by this study. For this purpose, data is divided into pre (1974-1989) and post (1990-2010) financial sector reform periods. The effect of user cost of capital on firms' fixed investment spending is analyzed before and after the financial sector reforms in order to examine the response of firms' fixed investment spending to monetary policy during these different economic regimes.

5. *To investigate whether the response of firms is heterogeneous to monetary policy in Pakistan?*

   By splitting the sample according to firm size, heterogeneous response of firms' fixed investment spending to monetary policy is explored in case of manufacturing sector of Pakistan. Differential effects of firms' fixed investment to the sales, cash flow and user cost of capital is investigated in case of small and large firms.

6. *To investigate whether effects of monetary policy are different for different sectors in Pakistan?*

   This study explores the effects of monetary policy on business fixed investment spending in case of different sectors in order to discover the differential impact of monetary policy in case of different sectors. This study analyzes the textile cotton, textile synthetic and chemical sectors and examines the response of fixed investment spending to monetary tightening in case of these sectors.

1.3 SIGNIFICANCE OF THE STUDY

Most of the literature in Pakistan has made an effort to find out the monetary transmission channels by using aggregated data (Agha *et al*., 2005; Alam and Waheed, 2006; Hussain, 2009; Hussein *et al*., 2011; Munir and Qayyum, 2012). Most of these studies have relied on the aggregated data that leads to the insignificant relationship between user cost of capital and firms' business fixed investment due to the firms' heterogeneous response and frictions in capital market that can't be exploited with the aggregated data (Chirinko *et al*. 1999; Karim 2010, 2012). Disaggregated data is considered more suitable to figure out interest rate channel

through user cost of capital. According to best of author knowledge, the impact of monetary policy on firms' fixed investment spending using firm level data has not been figured out in Pakistan. Due to this drawback, this study has attempted to explore the interest rate and broad credit channel with emphasize on effects of monetary policy upon firms' fixed investment spending by using firm level data. Firstly, interest rate channel is recognized by using the firm level user cost of capital as Mojon *et al*., (2001), Kalckreuth (2001), Chatelain and Tiomo (2001), Karim (2010, 2012) and Chatelain *et al*. (2001) have explored the interest rate channel by using user cost of capital. Secondly, broad credit channel is explored by using cash flow to capital stock ratio as a proxy for the broad credit channel. Thirdly, this study explores the effects of monetary policy on firms' business fixed investment spending through the user cost of capital before (1974-1989) and after (1990-2010) financial sector reforms. Fourthly, behavior of firms is analyzed with respect to monetary policy effects in different time frames ranging from 1974-1985, 1986-1997 and 1998-2010. Fifthly, an attempt is carried out to investigate that whether different sectors comprising on textile-cotton, textile-synthetic and chemical are affected by the same magnitude by the monetary policy or not. Lastly, heterogeneity of firms' response to the monetary policy is identified by using the firms' assets as size criterion.

1.4 ORGANIZATION OF THE STUDY

Chapter 2 is about the brief history of monetary policy in Pakistan. Chapter 3 deals with the literature review; chapter 4 explores the theoretical model, chapter 5 deals with the data, variables' construction and estimation technique while chapter 6 is about the data tests, full sample results and small and large firms' analysis. Chapter 7 is about the effect of monetary policy on firms' investment under different time

frames, chapter 8 deals with the sectoral analysis while chapter 9 discusses conclusion and policy implications.

Chapter 2

MONETARY POLICY OF PAKISTAN- AN OVERVIEW[2]

The prime objective of monetary policy is to maintain price stability and facilitating the growth process in the country. Monetary policy and monetary management has undergone many changes in Pakistan. History of monetary policy in Pakistan can be divided into two regimes namely pre 1990's era and post 1990's regime, in other words, pre reforms era and post reforms era.

The period of 1960's is characterized by the malpractices in the banking sector[3]. Credit provision was concentrated in the hands of big borrowers. Small firms had to rely on internal generated funds for their investment and working capital needs. Banks were owned by the large enterprises and these businesses used the savings of peoples to finance their own ventures. Only a small portion of population was enjoying growth. In order to achieve the objective of better income distribution, the new government of Pakistan People's Party decided to nationalize the banking and insurance sector in 1970's. Era of 1970's is characterized by the role of government in monetary management.

Prior to financial sector reforms in 1990's, conduct of monetary policy had direct controls. After the banking sector reforms in 1972, a National Credit Consultative Council was formed that was responsible for managing the monetary policy. Under an annual credit plan, credit was allocated to the different sectors of the economy by the government and the amount of monetary expansion was determined for the year. National Credit Consultative Council was also responsible for the provision of credit to those sectors that were not given attention before the nationalization of the banks.

[2] For a comprehensive history of monetary policy of Pakistan see Zaidi (1999)
[3] See Husain (1994)

Treasury bills were issued on demand by the government and on ad hoc basis and were redeemable at any time that made the debt management complex. Under this regime, all types of rates of returns were controlled by the government and market forces had no role in their determination. All the players in the economy and money market had to accept these rates. It was mandatory for the commercial banks to invest 30 % of their time and demand deposits in government securities at a very low rate of return. Credit ceilings and interest rate control was also imposed by the government. In pre 1990's regime, financial markets were segmented due to the high rates of return on saving schemes causing the movement of funds to the national saving schemes from the banks.

These directed policies affected the financial sector adversely. Due to the credit ceiling, banks had to face excess liquidity problem. The amount that was lent was provided to the prioritize sectors at the very low interest rates. The policies of credit ceiling and the low rate of return on the government securities and loans hampered the banks' profitability. The credit given on the political pressure turned into the non-performing loans and affected banks' profitability. Higher interest rate on government saving instruments as compared with that paid on deposits by the commercial banks lead to the segmentation of the financial market. In response of the financial market segmentation, focus of savers was shifted towards the national saving schemes. The effects of financial sector nationalization were catastrophic not only for the banking sector but also for the growth of industries. The nationalization stopped the pace of industrial growth that was set up in the era of president Ayub Khan and thus take off of Pakistan's economy was halted.

Regime of Zia-ul-Haq is marked with various policy changes. During 1977-1988, the process of nationalization began to end. In 1985, a Deregulation Commission was

established that recommended the deregulation of the economy[4]. Due to the problems caused by the direct controls, IMF (International Monetary Fund) and World Bank advised of financial sector reforms under the umbrella of financial sector adjustment loan. Under this regime, State Bank of Pakistan (hereafter SBP) started conducting monetary policy by indirect instruments. In 1991, auctioning of the treasury bills started at the higher interest rate of 13% that SBP was auctioning at low interest rate before. Credit ceiling was removed in 1992 and bank credit was regulated by credit to deposit ratio and liquidity ratio. Removal of credit ceiling resulted in the deposit creation by the banks. Government banks were privatized and establishment of new banks in the private sector was allowed.

Unlike the previous regime, government started the auctioning of treasury bills and federal investment bonds. Open market operation was adopted as market based monetary policy instrument. SBP removed the limit of maximum lending rate in 1995, thus allowing banks to charge interest rate of their demand. In 1995, the credit to deposit ratio was also abolished completely to further enhance the credit availability to the private sector. Removal of credit to deposit ratio was considered a milestone towards financial liberalization and market based monetary management. Banks were allowed to invest their entire portfolio after meeting the cash reserve and liquidity ratio requirement set by the SBP.

The reforms have been fruitful in case of Pakistan. Banks' profitability has increased substantially after the financial sector reforms. Financial deepening has also strengthened after the financial sector reforms as well as increase in the banks is also visible in Pakistan.

[4] See Janjua (2003)

Fiscal years 2005-2009 represents an excellent case study showing that how monetary policy is formulated and implemented as well as brief history of recent activities of monetary authorities. In the beginning of 2005, consumer price index (hereafter CPI) inflation was on average 3.8% and was accelerating. It is evident in the monetary economics literature that the accelerating inflation is alarming situation for an economy. Gross domestic product (hereafter GDP) growth rate was also accelerating during this time. At the end of 2004, GDP growth rate reached 7.5%, unemployment rate was decreasing, fiscal deficit had declined and current account was in surplus. Monetary authorities exclusively watch the macroeconomic indicators like GDP growth rate, unemployment rate, fiscal and current account deficit because these indicators depict a picture of economic conditions, especially demand pressures. At the time of 2005, the macroeconomic indicators were giving a mixed picture so monetary authorities maintained the policy rate at 7.5% from 2002 to the beginning of 2005. The loose monetary policy resulted in money supply exceeding the GDP growth rate. Resultantly, inflation increased from 3.5% in 2002 to 9.3% till the mid of 2005.

To cope with the alarming situation, monetary authorities of Pakistan shifted their focus from loose to tight monetary policy in order to curb inflation since the main function of any central bank is to control inflation in order to stabilize the economy. Hence in April 11th, 2005, policy rate was increased from 7.5% to 9% that helped in bringing down inflation to the target range of 8% for the fiscal year 2006. For 2007, SBP decided its inflation target to maintain at 6.5%. To achieve this target, policy rate was further increased from 9% to 9.5%. It helped in bringing down the inflation. However, the target inflation of 6.5% set for the year 2007 could not be achieved due to high food inflation. Food items have 40.3% share in the basket of CPI in case of

Pakistan. Due to such large share of food items in CPI calculation, CPI inflation rose drastically. Government borrowings, foreign exchange inflows and broad money (M2) growth were also the causes of inflation in 2007 due to which inflation target could not be achieved.

In fiscal years 2008-2009, macroeconomic situation worsened. Financial crisis resulted in the decline of foreign direct investment and portfolio investment sharply, leading to the fall in foreign exchange reserves. High oil prices resulted in the sharp rise in import bill since one third of Pakistan's imports are oil related. To compensate the fall in foreign reserves, borrowing was taken from SBP that resulted in inflation. Thus fiscal deficit increased due to the military expenditures, high oil prices, less revenue generation and subsidy on wheat.

Fiscal as well as current account deficit resulted in twin deficit. Fiscal borrowing hampered the availability of credit to private sector. Liquidity squeezed in the economy that resulted in the interest rate rise. In 2008, current account deficit rose to 8.4% while fiscal deficit increased to 7.7%. In 2009, large scale manufacturing sector activity declined by 7.7%. Inflation on average stood at 25.3% in 2008 while 20.8% in 2009. To cope with these issues, SBP required the government to finance its budget deficit from long term financing and imposed a quarterly ceiling on the borrowing. Government was advised by the SBP to retire its debt. In fiscal year 2008, 60% fiscal deficit was financed by the SBP and commercial banks that lead to the liquidity management problem. To deal with so high inflation, policy rate was increased from 9.5% in 2005 to 15% in 2008. Due to the measures taken, from 2009, situation has improved and SBP has lowered the policy rate.

The evolution of monetary policy is linked with the macroeconomic developments. Economic developments lead to the creation of new theories. These new theories reshaped the conduct of monetary policy[5]. Important shifts in macroeconomic thoughts are classical economics, Keynesian school of thought, Neo-Keynesian and Monetarist. Therefore various approaches are adopted by the monetary authorities all over the world to achieve their goals. These approaches are termed as monetary policy frameworks. The prime objective of any central bank is to control inflation for sustainability of financial system. Every central bank use different approaches to achieve this target. There are three monetary policy frameworks adopted by central banks namely monetary aggregate targeting (MAT), exchange rate targeting (ERT) and inflation targeting (IT), adopted in combinations or only one.

In exchange rate targeting, the value of domestic currency is pegged against the value of any other foreign currency. Exchange rate targeting is easy to understand by the public and is less prone to the fiscal dominance.

In monetary aggregate targeting, monetary base is targeted. Money supply is determined by the central bank and then market determines the short term interest rate. There are two conditions for the successful implementation of monetary aggregate targeting. First, the relationship or link between the targeted aggregates and inflation/output should be strong. Second, monetary aggregates should be well controlled by the central bank.

In some countries the relationship between monetary aggregates and output explored to be weak that resulted in adaptation of inflation targeting. In inflation targeting, a

[5] See Qamar *et al*. (2009)

target for the inflation rate is set and attempts are carried out to achieve the target level of inflation.

Currently Pakistan is following monetary aggregate targeting. Due to minimal financial integration with the countries, low diversified exports, non-healthy financial system and highly fluctuating inflation; exchange rate targeting and inflation targeting are not best monetary policy frameworks in Pakistan. The current monetary policy framework adopted by SBP is monetary aggregate targeting but the operational focus has been moved from targeting monetary base to the policy rate leading to the determination of reserve money growth endogenous (Qamar *et al.*, 2009).

It is of immense importance to communicate the monetary policy to the public and businesses.[6] In Pakistan, SBP issues the monetary policy statement to communicate its intended objective. SBP started issuance of monetary policy statement in 2003 at the biannual frequency. These days, monetary policy statement is issued after every two months. SBP issues brief statements in the months of April, June, October and December while detailed statements in February and August.

Monetary management has many challenges for the monetary authorities in Pakistan. The most important one is of fiscal dominance. It is argued by the Mahmood (2010) that monetary and fiscal policy coordination leads to the better economic performance and lack of coordination can lead to financial instability. To better coordinate the fiscal and monetary policy, Monetary and Fiscal Co-ordination board was formed in 1994 but still there is lack of coordination between fiscal and monetary authorities in terms of macroeconomic policies formulation.

[6] Hashmi (1997) highlighted the need of disciplined monetary policy in Pakistan by analyzing the impact of unexpected and anticipated changes in money supply on stock market and concluded that unexpected changes in money supply had adverse impact on monetary policy.

To minimize the fiscal dominance, in 2005, Fiscal Responsibility and Debt Limitation Act was formulated by the government with the aim of increasing revenue, decreasing the public debt and maintain the public debt within the defined limits of less than 60% of gross domestic product (GDP).

Monetary policy stance is expressed in different ways in different countries. In other words, operational frameworks to achieve the policy objectives (mainly price stability and economic growth) differ country to country. In Japan, Australia, Malaysia, New Zealand and Korea, monetary policy stance is conveyed through uncollateralized short term money market rate, in India, Philippines and Sri Lanka through official repo and reserve repo rate while in Indonesia through Bank of Indonesia Rate. In Pakistan, monetary policy stance is signaled through changing of the policy rate (Qamar *et al*., 2009). However, Hassan (2011) by using reserve equation shows that SBP manages the exchange rate and to achieve this target uses the t- bill rate that also helps SBP in determination of discount rate.

Transparency of central banks has gained much importance in recent years. Transparency refers to the provision of all available information to the public about policy decisions by the central bank, operations and assessment in a timely manner. Transparency is important because it strengthen the credibility of central bank that in turn helps in anchoring of inflation expectations. Malik and Din (2008) conducted a study to figure out the degree of transparency of SBP. The results of their study imply that SBP is least transparent in terms of policy transparency, completely opaque in its procedural matters, partially transparent regarding political and economic matters while quite transparent in terms of operational transparency. Qamar (2010) emphasize the formulation of strong long run communication strategy in order to effectively manage public expectations about inflation and induce transparency.

To conclude, over the time period monetary policy has strengthened in Pakistan but it is still under the process of development. SBP has taken many revolutionary steps in monetary management and it is expected that monetary management will improve in Pakistan.

In the next chapter this study analyzes the literature in detail on monetary transmission channels and monetary policy to explore the theoretical underpinnings and empirical evidences on the transmission channels.

Chapter 3

LITERATURE REVIEW

Monetary policy plays a vital role in affecting the firms' business fixed investment spending. Investment is not only one component that is influenced by the monetary policy. Monetary contraction also affects the other parts of firms' balance sheets like sales, debt and inventories. Thus this study divides its literature review into studies focusing on the effects of monetary policy on composition of external finance, literature gauging the impact of monetary policy on sales, debt and inventories, studies analyzing the monetary transmission channels and firms' investment, literature investigating the role of trade credit in nullifying the impact of monetary policy, literature investigating the role of leverage in magnifying the effects of monetary policy and studies investigating the monetary transmission channels in Pakistan.

3.1 MONETARY POLICY AND SOURCES OF EXTERNAL FINANCE

Monetary policy affects the firms' sources of finance. Monetary tightening hampers the availability of external finance and deteriorates the internal generated funds. Firms can raise external finance by various means like through banks and by issuance of commercial paper. Kashyap *et al.* (1993) explored that monetary contraction reduce the loan demand by the firms due to the increased cost of debt while commercial paper issuance by the firms rise to acquire funds due to the lesser cost associated with the commercial paper issuance. Results indicated that change in the external finance composition affects the firms' investment and real output substantially. Oliner and Rudebusch (1996) expressed their disagreement regarding the result of Kashyap *et al.* (1993) and commented that the results are misleading due to the aggregation of firms of different sizes. They explored that the monetary contraction doesn't reduce the

supply of bank loans relative to the other non-bank sources of finance and bank behavior regarding the supply of loans is substantially different for small and large firms. They explored a strong credit channel and concluded that all the lenders face information asymmetries, banks are not unique in this regard as shown by Kashyap *et al.* (1993). Kashyap *et al.* (1996) replied to the objections of Oliner and Rudebusch (1996) and proved that their results hold even if firms are divided into small and large. Their results discovered that large firms' substitution of bank loans with commercial paper is on higher side as compared with the aggregated data set.

3.2 MONETARY POLICY AND LOAN SUPPLY

Monetary policy operates through various channels. Monetary policy affects the loan supply by the banks that plays the key role in the transmission of monetary policy. Romer and Romer (1990) concluded that bank lending channel has weakened because of ability of banks to raise funds through other sources. Christiano *et al.* (1996) discovered that monetary tightening leads to the fall in commodity prices. It was found that net funds raised by business sector increases up to one year and then eventually declines.

It is argued that firms having loan commitments with the banks are affected less by monetary contraction. Morgan (1998) analyzed the bank lending channel through the loan commitments. He explored that in the wake of tight monetary policy, loans not under any loan commitment declines substantially while loans made under contract commitment increases or remains unchanged. Results indicate that firms not having any loan commitment with the banks get more hit in the wake of monetary tightening. Kashyap and Stein (2000) figured out that banks with less liquidity as well as smaller banks get more hit in case of monetary tightening and explored a strong bank lending

channel of monetary policy transmission. Brissimis *et al.* (2001) discovered bank lending channel in Greece by using bank level data. It was concluded that monetary tightening reduces the supply of bank loans while large and healthy banks loan supply is insulated from the adverse impact of monetary policy to some extent. Their results confirm the results of Kashyap and Stein (2000).

After the financial crisis of 2008, researchers and monetary economists have emphasized on the risk taking channel of monetary policy transmission. Jimenez *et al.* (2008) by using a comprehensive credit data set identified the risk taking channel of monetary policy in Spain. The results concluded that lower interest rates before the disbursement of loans results in lending to the customers having high probability of default and bad credit history thus leading to risky lending by the banks[7].

The results of above mentioned studies were criticized by Bohacek and Mendizabal (2007) on the basis that these studies introduce the adjustment cost under which agents change their choices slowly that leads to the effects of monetary policy propagating over time. They presented a new phenomenon by considering that agents have assets, make choices and banks intermediate the agents. Their results concluded that in the wake of tight monetary policy funds flow from low productivity agents to high productivity agents that set a propagation scheme. Ashcraft (2006) discovered the aggregate elasticity of output to the bank lending very minimal, indicating that bank lending channel is not of immense importance, at least for analysis in case of America. It seems due to the developed capital market in the case of America due to which businesses can arrange finance from non-bank sources as well.

[7] See Jimenez *et al.* (2008) for the risk taking channel of monetary policy transmission.

3.3 MONETARY POLICY AND CREDIT MARKET IMPERFECTIONS

Monetary policy effects are propagated through the credit market imperfections. Bernanke and Blinder (1988) emphasized on the role of both the interest rate and credit channel in transmitting the effects of monetary policy on output. Bernanke and Gertler (1989) figured out that the agency cost declines with increase in the net worth and improvement in net worth leads to increased investment spending. Bernanke and Gertler (1995) discovered that monetary tightening lead to the increase in the external finance premium. It was explored that tight monetary policy leads to the decline in the net cash flow, due to the increased interest payments, thus deteriorate balance sheets of firms as well as of households. Up to 40% decline in the profit explored to be attributable to the rise in interest payments due to monetary contraction with reference to America. Results stress that cash flow is an important factor affecting the inventory accumulation and investment spending. Bernanke *et al*. (1996) confirmed the results of Bernanke and Gertler (1995) and concluded that firms facing higher agency cost get larger reduction in loans by the lenders as compared with the borrowers having strong net worth.

3.4 MONETARY POLICY AND ITS IMPACT ON SALES, DEBT AND INVENTORIES

Monetary policy affects the firms in different ways. Monetary policy affects inventories, debt and the sales due to the decreased demand and high cost of financing. Gertler and Gilchrist (1994) concluded that small firms' sales, inventories and short term debt behave differently from the large firms and this differential response can be attributed to the capital market access, in other words access to the external finance. In the wake of tight monetary policy, small firms' sales decline at

the faster pace and the gap between large and small firms' sales enlarge much. After tight monetary policy, small firms' inventories declines sharply while large firms' inventories keep rising up to the considerable time and then after declining, again reach on the trend. Small firms' short term debt declines sharply while large firms' short term debt first increases then reaches on the trend. The sharp asymmetric response is observed in recession and booms when tight monetary policy is conducted. In booms, small firms accumulate inventories as sales decline after monetary tightening while small firms shed inventories quickly after the tight monetary policy in recession. Benito (2005) analyzed the impact of monetary policy on firms' inventories in United Kingdom and Spain and found that firms' inventories are more sensitive to monetary policy in United Kingdom then in Spain.

It is evident in the studies of most of the researchers that firms' inventories declines due to monetary tightening but Zhang (2012) by assuming the sticky price model presented contradictory results relative to other studies on this issue. He concluded that in the wake of monetary tightening, firms' sales decline while their inventory of finished goods increases to earn more money from the sale of their finished goods.

3.5 INTEREST RATE, CREDIT CHANNEL AND FIRMS' INVESTMENT

A large strand of literature has identified the interest and broad credit channels by using user cost of capital and cash flow respectively. The work on user cost of capital was pioneered by the Jorgenson (1963). Eisner and Nadari (1968) conducted a pioneer study on the determinants of corporate investment. They explored the elasticity of capital to output near to one and concluded that the constant elasticity of substitution production function is more relevant then the Cobb-Douglas production functions as contradicted to the assumptions of Jorgenson (1963). Results explored

the elasticity of substitution near to zero and exhibited increasing returns to scale. Audretsch and Elston (1994) explored the effect of liquidity constraints on firms' investment for the small, medium and large sized firms thus indirectly supporting the balance sheet channel in Germany. Their results implies that medium sized firms base investment decisions on liquidity as compared with small and large firms and small firms explored to be less financial constraints due to the Housebank[8] phenomena. The effect of competition in German financial markets explored to increase the access to external finance.

Credit availability is of enormous importance for the financing needs of the firms and borrowing cost is an important determinant affecting the financing decision of the businesses. Brigden and Mizen (1999) explored the credit channel of monetary policy transmission in United Kingdom and indicated that credit availability affects the gross fixed capital formation. Chirinko *et al*. (1999) explored the user cost of capital elasticity with respect to corporate investment in America. The user cost of capital elasticity turned out to be -0.25. It was argued that low user cost elasticity with respect to investment indicates the weakening of the traditional interest rate channel of monetary transmission mechanism which seems plausible in the light of America's developed capital market. The study of Mairesse *et al.* (1999) indicated that cash flow doesn't have any significant impact on investment in the France and USA. Wesche (2000) found that firms having asymmetric information are affected more by monetary contraction. Agung (2000) indirectly supported the broad credit channel in Indonesia by finding out the financial constraints and agency cost phenomena in Indonesia.

[8] Bank- borrower relationship through which businesses process transactions.

Collateral plays an important role in the determination of cost of borrowing and firms having good credit rating are affected less by monetary contraction. Gaiotti and Generale (2001) discovered that the small sized firms and the firms having more intangible assets that are not considered as collateral by the lending institutions are affected more by monetary contraction as compared to the large sized firms and firms having tangible collateral. Mojon *et al*. (2001) found that the user cost of capital in Germany, France, Italy and Spain has significant negative effect on firms' investment spending. The long run effect of user cost of capital and sales figured out to be close to one. Valderrama (2001) figured out the interest rate and broad credit channel in Austria and explored that a strong credit channel is operative in Austria. Results indicated that young firms rely heavily on sales to finance their investment while the effect of interest rate channel found insignificant for young firms. It was discovered that firms having high trade credit and having close association with lender called "Housebank" are affected less by monetary contraction. The results of this study are supported by the findings of Kalckreuth (2001). Kalckreuth (2001) explored that poor rated firms' investment spending is more sensitive to the cash flow as compared to firms with good overall rating ratio and the user cost of capital sensitivity decrease for poor rated firms. No significant difference between the cash flow sensitivity of small and large firms was found in Germany implying possible less information asymmetries between the lenders and firms. In Germany, less information asymmetries seems attributable to the firms' close relationship with a bank called "Hausbank" as suggested by Ehrmann (2004).

The studies reasoning that low sensitivity of investment to cash flow is attributable to the close relationship of borrower with the lender in Germany are criticized by Engel and Middendorf (2009). They explored that there is no particular difference in terms

of sensitivity of investment to internal generated funds between the firms linked to banks and the firms that don't have close links with the lender.

Taking into account different subsectors of the manufacturing, Butzen *et al.* (2001) explored the broad credit and interest rate channel in Belgium. It was explored that the manufacturing firms' investment responds negatively to the user cost of capital growth while positively to the cash flow, similar to the results of other studies. Small firms' investment discovered to be more responsive to the internal generated funds then large firms while large and small firms explored to be insignificantly influenced by the user cost of capital growth. This study also found that large firms are sensitive to the growth of value added but not to the cash flow thus implying that large firms have better access to external finance. This study also analyzed the different subsectors of manufacturing and discovered that capital intensive subsectors are affected more by monetary contraction as compared with labor intensive subsectors. Lunnemann and Matha (2001) found younger firms' investment to be more responsive to the user cost of capital growth, sales growth and cash flow to capital stock ratio then older firms. Results implies that younger firms face financial constraints and with time information asymmetries declines and agency problem moderates. Small firms explored to be more sensitive to the liquidity then large firms. Results confirmed that the interest rate and broad credit channels are operative. Chatelain and Tiomo (2001) explored that firms with high risk of bankruptcy are more sensitive to the internal generated funds since they have to bear high risk premium in case of external finance. Results verified the existence of broad credit channel.

The strength of interest rate and broad credit channel varies country to country. Chatelain *et al.* (2001) discovered interest rate channel in four countries of euro-area

comprising on France, Germany, Spain and Italy while broad credit channel was explored only in Italy. Chatelain *et al.* (2003) pointed out that user cost of capital has significant negative effect on firms' investment in Germany, Italy, Belgium and Luxembourg while insignificant in France, Spain and Austria. It was also explored that poorly rated firms in France and Germany, small services firms in Belgium and French equipment manufacturers exhibit higher liquidity to investment sensitivity.

The ability to arrange finance from the non-bank sources can alleviate the pressure of monetary contraction. Nagahata and Sekine (2005) explored a strong interest rate channel but credit channel was not discovered operative in Japan. Their study highlighted that non-bond issuing firms are affected more by the monetary policy through the interest rate channel then the bond issuing firms[9]. Rungsoboon (2005) found out the strong balance sheet channel in Thailand. Results figured out that small and non-bond issuing firms are affected more by the financial crisis then the large sized and bond issuing firms, indicating the presence of balance sheet channel. The study of Rungsoboon (2005) lacks in the respect that it did not focus to find out the relevance of the interest rate channel.

It is explored by the Gonzalez and Acevedo (2009) that monetary contraction leads to the decline in bank loans of the firms. Results support the notion that monetary contraction leads to the decline in loans more severely for small firms then the large firms. Bryson (2009) explored the substantial interest rate and credit channel in Jamaica by using neo-classical investment model. Karim (2010) explored that small firms are more affected by the cash flow then large firms thus confirming the broad credit channel in Malaysia.

[9] Bond issuing firms can raise the capital from capital market due to which such firms are not significantly affected by monetary contraction.

The existing researches related to broad credit channel of monetary transmission mechanism has been criticized by Ehrmann (2004) on the base of data bias towards large firms and low data frequency. His study highlights the importance of using the unbiased and high frequency data. By using monthly German business survey data, he discovered that small firms' business and demand conditions deteriorate intensely as compared to large firms due to monetary policy shock. The effects of monetary policy found to be more profound in the recession then in boom thus supporting the results of Gertler and Gilchrist (1994**)**.

Another interpretation of balance sheet channel based on the quantity rather than the cost of borrowing is presented by Gallegati (2001). IS/LM fixed price model was modified and it was assumed that internal as well as external sources of funds can be used to finance the investment decisions. Results explored that changes in the interest rate propagate the business cycle by affecting the quantity of borrowing of the businesses rather than the cost of borrowing.

3.6 MONETARY POLICY, FIRMS AND LEVERAGE

Firms' external borrowing is composed on the equity and debt. Increase in leverage leads to the bankruptcy risk. Countries like Pakistan where capital market is underdeveloped, firms rely on debt for their financing needs. Due to high use of leverage, bankruptcy risk may arise.[10] Monetary policy affects the firms' business fixed investment spending and other components of firms' balance sheets through leverage as well, first documented by the Fisher (1933). Hu (1999) explored that firms with high leverage are affected more by monetary contraction as compared to the less

[10] Hashmi (2011) analyzed firm level data of manufacturing sector of Pakistan over the period 1974 to 2006. He explored firm level bankruptcy risk and observed that bankruptcy cost is associated with external finance in case of manufacturing sector of Pakistan.

indebted firms. Ghosh and Ghosh (2006) explored that highly indebted firms are extremely sensitive to the monetary contraction as compared to the low leveraged firms. Angelopoulou and Gibson (2007) highlighted that the firms having high leverage ratio, due to higher external finance premium, exhibit greater cash flow sensitivity and such firms have higher probability of default.

3.7 MONETARY POLICY AND TRADE CREDIT CHANNEL

It is evident in the literature that the firms having high trade credit are not affected much by the monetary contraction since such firms can arrange finance from their suppliers in the wake of tight monetary policy. Meltzer (1960) was the first one who suggested that the effects of credit channel can be offset by the trade credit which he termed as trade credit channel of monetary policy transmission.

Kohlar *et al.* (2000) discovered that trade credit channel has weakened the bank lending channel. Guariglia and Mateut (2001) explored that trade credit channel is offsetting the effects of credit channel in United Kingdom. It is found that in the wake of monetary contraction bank lending falls while trade credit increases, giving recognition to the trade credit channel. Similar results were found by the Mateut *et al.* (2002) who explored that in the wake of tight monetary policy bank lending falls while trade credit increases. Nilsen (2002) explored that in the wake of monetary contraction small firms as well as large firms having no bond rating increases their trade credit. It is argued by the study that trade credit act like a substitute of bank credit.

3.8 MONETARY TRANSMISSION CHANNELS IN PAKISTAN

Large numbers of studies have investigated the monetary policy transmission channels in Pakistan. Agha *et al.* (2005) figured out that in Pakistan monetary contraction leads to the fall in domestic demand and eventually results in reduction in overall price level. They explored that interest rate, credit channel, asset price channel and exchange rate channel simultaneously operates in Pakistan but the exchange rate channel explored to be of less importance. Their results are contradicted with the results of Hassan (2011), who by using reserve equation, explored that SBP actively manages the exchange rate. Alam and Waheed (2006) analyzed the sectoral effects of monetary policy and explored that manufacturing, wholesale trade, retail trade, financial and insurance sectors are affected more by monetary contraction while agriculture, mining and construction sector explored not to be significantly affected by monetary tightening. Khan and Qayyum (2007) explored that as compared to interest rate channel, exchange rate channel is more important in Pakistan, giving weight age to the results of Hassan (2011) who also found similar result. Hussain (2009) explored that in Pakistan inflation is not only caused by monetary expansion but also by the government spending and exchange rate. It was concluded that exchange rate channel has special importance in Pakistan and monetary authorities can control the inflation by targeting the exchange rate.

The role of credit market frictions in transmission of monetary policy in Pakistan is explored by Choudhary *et al*. (2012). It is explored that monetary tightening leads to the increase in the interest rate on loans. Shabbir (2012) found the strong balance sheet channel in Pakistan. Results revealed that monetary tightening negatively affects the firms' net worth and their cash flows. It is measured that 1% increase in the overnight interest rate deteriorates the small firms' net worth by 4.3% while net worth

of large firms decline by only 3.8%. Analysis shows that 1% increase in financial expenses reduces the cash flow in case of large firms by 1% but small firms' cash flow declines by 8.4%. Shabir (2013) explains that monetary tightening affects the net worth of the firms and deteriorates the cash flow position that resultantly affects the economic growth thus leading to the notion that monetary policy affects the economic growth through the firms' balance sheets. It is explored that monetary policy effects on firms' balance sheets remains for three years.

To conclude, it is evident that monetary policy affects the real economic activity by altering the different components of the firms' balance sheets. Monetary policy affects the sales, debt, inventories and investment of the firms. Monetary contraction also affects the banks' ability to supply loans.

How the interest rate and broad credit channel will be explored by this study is the topic of next chapter.

Chapter 4

THEORETICAL FRAMEWORK

There exists a large strand of literature discovering the interest rate and broad credit channels with emphasize on firm level fixed investment or capital formation as well as the role of sales in accelerating the business fixed investment spending. By using panel data, bulk of literature like, among others, Mojon *et al.* (2001), Kalckreuth (2001), Karim (2010), Chatelain and Tiomo (2001), Chirinko *et al.* (1999) and Chatelain *et al.* (2001) have investigated the impact of cash flow to capital stock ratio, sales growth and user cost of capital growth on firms' business fixed investment. The literature has accomplished this task by using neo-classical demand for capital model that is presented in detail in the section 4.1. This chapter also discusses the theoretical underpinnings of the interest rate and broad credit channels.

4.1 NEO-CLASSICAL INVESTMENT MODEL

This study similar to other empirical studies derives the investment model from the neo-classical demand for capital theory. Neo-classical theory of demand for capital states that firm chooses its production plan in such a way that the firm utility maximizes over time (Jorgenson, 1963). In other words, firm's objective is to maximize its net worth by optimally allocating the inputs; labor and capital.

Firm maximizes the net worth (present value of discounted net revenue) subject to a production function and net investment:

$$L = \left[e^{-rt} R(t) + \lambda_0(t) F(Q, L, K) + \lambda_1(t) \left(\dot{K} - I + \delta K \right) dt \right] \qquad (4.1)$$

Where rt is the interest rate, $\dot{K}$ is proportional to the net investment and $R(t)$ denotes the net revenue. Differentiating the equation (4.1) with respect to capital, the first order condition of maximization yields the following equality:

$$F_K(K_{it}, L_{it}) = UC_{it} \qquad (4.2)$$

Where i refer to the firm and t indicates time period. Equation (4.2) states that firm demand the capital until the marginal product of capital falls equal to user cost or real rental price of capital. Rental price of capital is defined as the user cost of capital (Jorgenson, 1963). Abel *et al.* (2011) define user cost of capital as the expected real cost of utilizing a capital unit for a specific time period. Firms will keep building up the capital up to the point where marginal product of capital gets equal to the user cost of capital. If firm chooses to acquire capital at the point where user cost of capital is greater than the marginal product of capital, firm will have to face the loss and vice versa.

In the footsteps of other studies (Eisner and Nadari, 1968; Karim, 2010; Chatelain *et al.*, 2001), this study parameterizes the production function as a constant elasticity of substitution production function of the form defined below:

$$F(K_{it}, L_{it}) = TFP_i A_t \left[\beta_i L_{it}^{\frac{\sigma-1}{\sigma}} + \alpha_i K_{it}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}\nu}, \quad \alpha_i + \beta_i = 1 \qquad (4.3)$$

Where in the equation (4.3) σ denotes the elasticity of substitution between the capital and labor, ν indicates returns to scale and $TFP_i A_t$ represents total factor productivity. It is assumed that total factor productivity has two components namely year specific component and firm specific component. Eisner and Nadari (1968) rejected the Cobb-Douglas production function assumed by Jorgenson (1967) by

utilizing data of American firms and concluded that constant elasticity of substitution production function is more relevant in explaining the investment behavior and its determinants. Differentiating the equation (4.3) with respect to capital, inserting the resultant (marginal productivity of capital) into equation (4.2) and simplifying the expression yields the equation (4.4):

$$\log K_{it} = \theta \log Y_{it} - \sigma \log UC_{it} + \log H_{it} \qquad (4.4)$$

Where $\theta = \left(\sigma + \frac{1-\sigma}{\nu} \right)$ and $H_{it} = \left(TFP_i A_t\right)^{\frac{\sigma-1}{\nu}} \cdot \left(\nu \alpha_i\right)^{\sigma}$

Y_{it}, UC_{it} and H_{it} represents sales, the user cost of capital and total factor productivity respectively. Total factor productivity represents all those factors that are not captured by the labor and capital. Equation (4.4) states that the capital stock is determined by sales, the user cost of capital and total factor productivity. Capital to sales elasticity is unity $(\theta = 1)$, if production function exhibit constant returns to scale $(\nu = 1)$ or if the elasticity of substitution is unity $(\sigma = 1)$ indicating the Cobb-Douglas production function (Chatelain *et al.*, 2001). Firm has aim to achieve the optimal capital stock and firm accumulate capital to achieve optimal capital stock defined as:

$$\log K_{it}^{*} = \theta \log Y_{it} - \sigma \log UC_{it} + \log H_{it} \qquad (4.5)$$

Since firm long run capital stock target value or optimal capital stock is unobservable, an adjustment process has to be formulated. In this way, one can identify the adjustment between optimal and current capital stock. Thus an autoregressive distributed lag model {ARDL (3, 3)} is specified as:

$$k_{it} = \omega_1 k_{it-1} + \omega_2 k_{it-2} + \omega_3 k_{it-3} + \theta_0 y_{it} + \theta_1 y_{it-1} + \theta_2 y_{it-2} + \theta_3 y_{it-3} - \sigma_0 uc_{it} - \sigma_1 uc_{it-1}$$
$$- \sigma_2 uc_{it-2} - \sigma_3 uc_{it-3} + \phi_0 h_{it} + \phi_1 h_{it-1} + \phi_2 h_{it-2} + \phi_3 h_{it-3} \quad (4.6)$$

Lower case letters indicate the level variables in logs. This study uses the autoregressive distributed lag (ARDL) model because of several reasons. Shocks in the economy stimulating the demand for capital goods has lag effects. Lag effects are due to the reason that the effects of change in explanatory variables on the dependent variable are distributed over time captured by distributed terms while adjustment can be observed by including the autoregressive terms in the model. Delivery lags and adjustment cost is introduced implicitly in the model[11]. Here autoregressive distributed lag (ARDL) model represents reduced form of unobservable model of capital stock adjustment. It is argued by Chatelain *et al.* (2001) that long run coefficients can include the expectational and technology parameters that can create econometric problems because these are unstable. Since firm specific effects are supposed to impact the level of factor productivity and its growth, Chirinko *et al.* (1999) suggests of first differencing the model to eradicate the firm specific effects to get consistent and efficient estimates. First differencing the equation (4.6), utilizing the approximation $\log K_t - \log K_{t-1} = I_t / K_{t-1} - \delta$ [12] and substituting the year specific productivity growth $(\Delta \log A_t)$ and firm specific effect productivity growth $(\Delta \log TFP_i)$ by time dummies λ_t and firm specific effects η_i respectively, including a random term ε_{it} and subsuming the depreciation rate δ into the firm specific effects yields the equation (4.8):

[11] See Kalckreuth (2001)

[12] $\Delta k_{it} = \log\left[\frac{K_{it}}{K_{it-1}}\right] = \log\left[1 + \frac{\Delta K_{it}}{K_{it-1}}\right] \cong \frac{\Delta K_{it}}{K_{it-1}} \cong \frac{I_{it}}{K_{it-1}} - \delta$

$$\Delta k_{it} = \omega_1 \Delta k_{it-1} + \omega_2 \Delta k_{it-2} + \omega_3 \Delta k_{it-3} + \theta_0 \Delta y_{it} + \theta_1 \Delta y_{it-1} + \theta_2 \Delta y_{it-2} + \theta_3 \Delta y_{it-3} - \sigma_0 \Delta uc_{it} - \sigma_1 \Delta uc_{it-1}$$
$$- \sigma_2 \Delta uc_{it-2} - \sigma_3 \Delta uc_{it-3} + \phi_0 \Delta h_{it} + \phi_1 \Delta h_{it-1} + \phi_2 \Delta h_{it-2} + \phi_3 \Delta h_{it-3} \quad (4.7)$$

Where Δk_{it} represents the net growth in capital stock

$$\frac{I_{it}}{K_{it-1}} = \omega_1 \frac{I_{it-1}}{K_{it-2}} + \omega_2 \frac{I_{it-2}}{K_{it-3}} + \omega_3 \frac{I_{it-3}}{K_{it-4}} + \theta_0 \Delta y_{it} + \theta_1 \Delta y_{it-1} + \theta_2 \Delta y_{it-2} + \theta_3 \Delta y_{it-3} - \sigma_0 \Delta uc_{it} - \sigma_1 \Delta uc_{it-1}$$
$$- \sigma_2 \Delta uc_{it-2} - \sigma_3 \Delta uc_{it-3} + \lambda_t + \eta_i + \varepsilon_{it} \quad (4.8)$$

Bernanke and Gertler (1989) stresses on the importance of cash flow in affecting the firms' investment. They state that macroeconomic shocks are propagated by affecting the cash flow of borrowers. Cash flow plays a vital role in affecting the firm's investment as a source of internal funds if firm is financially constrained. Thus considering the importance of cash flow for a firm, equation (4.8) is augmented with the cash flow to previous year capital stock ratio as:

$$\frac{I_{it}}{K_{it-1}} = \omega_1 \frac{I_{it-1}}{K_{it-2}} + \omega_2 \frac{I_{it-2}}{K_{it-3}} + \omega_3 \frac{I_{it-3}}{K_{it-4}} + \theta_0 \Delta y_{it} + \theta_1 \Delta y_{it-1} + \theta_2 \Delta y_{it-2} + \theta_3 \Delta y_{it-3} - \sigma_0 \Delta uc_{it} - \sigma_1 \Delta uc_{it-1}$$
$$- \sigma_2 \Delta uc_{it-2} - \sigma_3 \Delta uc_{it-3} + \phi_0 \frac{CF_{it}}{K_{it-1}} + \phi_1 \frac{CF_{it-1}}{K_{it-2}} + \phi_2 \frac{CF_{it-2}}{K_{it-3}} + \phi_3 \frac{CF_{it-3}}{K_{it-4}} + \lambda_t + \eta_i + \varepsilon_{it} \quad (4.9)$$

By using ARDL model, long run elasticity of investment to capital ratio with respect to user cost of capital growth $\sigma = (\sigma_0 + \sigma_1 + \sigma_2 + \sigma_3)/(1 - \omega_1 - \omega_2 - \omega_3)$, cash flow to capital stock ratio $\phi = (\phi_0 + \phi_1 + \phi_2 + \phi_3)/(1 - \omega_1 - \omega_2 - \omega_3)$ and sales growth $\theta = (\theta_0 + \theta_1 + \theta_2 + \theta_3)/(1 - \omega_1 - \omega_2 - \omega_3)$ are identified (Karim, 2010; Chatelain *et al.*, 2001). Short run effects are obtained from the coefficients of user cost of capital growth, cash flow to capital stock ratio and sales growth. Equation (4.9) states that investment ratio is positively affected by the sales growth and cash flow to capital stock ratio while negatively by the user cost of capital growth.

In the sections (4.2) and (4.3), this study briefly discuss that how the user cost of capital and cash flow can be used to identify the interest rate and broad credit channel respectively.

4.2 INTEREST RATE CHANNEL

In this section, this study discuss that how the user cost of capital, discussed in section (4.1), is used to identify the interest rate channel. Monetary policy alters the interest rate that in turn affects the user cost of capital. Contractionary monetary policy leads to the increase in the real long term interest rate. It in turn raises the cost of capital. The increased cost of capital discourages the investment and output (Mishkin, 1996). So, the traditional interest rate channel can be identified through the firm specific user cost of capital. There is heterogeneous response of small and large firms' investment to the user cost of capital since large firms have better access to external finance and have to bear low external finance premium then small firms. Thus, this study explores the differential response of firms' investment to the user cost of capital as well. In the next section an attempt is figured out to understand that how cash flow can be used to identify the broad credit channel.

4.3 BROAD CREDIT CHANNEL

This section relates the cash flow to identification of broad credit channel, discussed in section (4.1). Monetary policy affects the business fixed investment not only by the traditional interest rate channel but also by the broad credit channel identified by using cash flow.

The credit market imperfections are present in all the credit markets of the economy such as bank loans, equity and bond market (Mishkin, 1996). There exists asymmetric

information between lenders and borrowers that creates a wedge between the cost of external finance and opportunity cost of internal financing. In other words, lenders charge the borrowers interest rate depending upon borrowers risk. In the presence of information asymmetries the agency cost increases which in turn increases the external finance premium. Monetary contraction due to rise in the nominal interest rate reduces the cash flow and reduces the equity prices and value of collateral. Also, firms' sales declines as well and this decline is severe for the financially constrained firms (Karim, 2010; Bernanke and Gertler, 1995; Bernanke *et al.*, 1996). Decline in the borrower's net worth leads to the costly monitoring by the lender since borrower can default thus increasing the agency cost while agency cost increases due to the higher probability of auditing.

External finance premium incorporates the cost of valuation, monitoring and collection by the lenders (Bernanke and Gertler, 1995). The agency cost decreases as the internal generated funds increases since it reduces the moral hazard and adverse selection problem. This highlights the importance of cash flow and net worth in the determination of external finance premium and availability of external finance. Bernanke *et al.* (1996) state the inverse relationship between the net worth and external finance premium.

In the case of small firms, agency problem is considered more brutal then large firms since it is relatively easy to obtain the information about large firms. So, small sized firms are more influenced by monetary contraction then large sized firms (Chatelain *et al.*, 2001). Gertler and Gilchrist (1994) confirm the above notion that large firms have better access to the external finance due to the lesser information asymmetries then small firms. Likewise Bond and Meghir (1994) have stressed that firms face a

hierarchy of finance model[13] in which firms prefers the internal generated funds due to the low cost as compared to the external finance. Internal generated funds help in easing of the credit market frictions (Carpenter and Guariglia, 2008). Choudhary *et al.* (2011) figured out that in Pakistan prices are not sticky in short run and manufacturing businesses change their prices nearly four times in a year thus providing strong grounds to find out the broad credit channel of monetary policy transmission in Pakistan.

Broad credit channel of monetary transmission mechanism can be identified by using the cash flow. Since small firms face a greater wedge between the costs of external and internal generated funds due to the high agency cost arising from costly monitoring then large firms, small firms are expected to be more sensitive to the cash flow. Thus, this study has used cash flow to capital stock ratio as an indicator of broad credit channel[14]. Higher cash flow sensitivity in case of small firms will be regarded as an indication of broad credit channel.

To summarize, increase in the interest rate lead to the rise in the user cost of capital and deterioration of the firms' balance sheets and to identify the interest rate and broad credit channel, user cost of capital and cash flow can be used. Neo-classical investment model makes this task doable.

It is of practical importance to construct the variables and to estimate the model that is discussed in the next chapter.

[13] Hierarchy of finance model states that firms prefer internal generated funds over debt and equity.
[14] For details see (Karim, 2012; Chatelain *et al*. 2001)

Chapter 5

DATA AND METHODOLOGY

It is of immense importance to empirically test the theoretical underpinnings. Without empirical testing, one can't be sure that whether theory is correct or not. To estimate the model, one need data and has to specify an estimation technique. In this chapter such issues are discussed in detail.

5.1 DATA AND SAMPLE SELECTION

Data related to manufacturing sector has been obtained from the "Financial Statements Analysis of Companies (Non-Financial) listed at Karachi Stock Exchange" prepared by State Bank of Pakistan. Data period spans from 1974-2010 (37 Years). This study has utilized the data of 498 manufacturing firms of Pakistan. To find out the heterogeneous impact of monetary policy on firms' investment, the sample is divided into the small and large firms on the base of total assets.

5.2 VARIABLES' CONSTRUCTION AND DEFINITION

The variables used in this study are briefly discussed below:

5.2.1 Investment (*I*)

Business fixed investment spending for a specific firm i at a specific time period t broadly refers to the current period capital expenditures on property, plant, equipment and machinery (Karim, 2010). Investment is measured as the difference of current fixed assets at cost at time period t to previous year fixed assets at time period $t-1$ plus depreciation.

$$I_{it} = K_{it} - K_{it-1} + D_{it}$$

Where I_{it} indicates the investment, K_{it} is current period fixed assets, K_{it-1} represents previous year fixed assets and D_{it} represents the annual depreciation measured in Pakistani Rupees with unit of account in million. Higher the investment, higher will be the capital formation that will increase the net worth and production capacity of the firm. Investment today determines the future productive potential. It has been calculated by using fixed assets at cost taken from the financial statement analysis of the companies.

5.2.2 Capital (*K*)

Capital stock is defined as the firm fixed assets after excluding accumulated depreciation. Fixed assets include real estate, plant, equipment and machinery. Capital stock is calculated as the operating fixed assets at time period t excluding depreciation. Depreciation represents the wear and tear of the capital counted at annual basis.

$$K = Operating\ \ Fixed\ Assets\ at\ Cost - Depreciation$$

It is an important determinant of firms' production. Firm produce goods and services by using labor and capital. Hence capital is one of the most important factors determining the productive capacity of the firms. Building up of capital determines economic activity and significantly impact the business cycles (Baddeley, 2003).

5.2.3 Cash Flow (*CF*)

Cash flow is defined as the profit after tax plus depreciation. Cash flow is measured as retention in business plus depreciation where retention in business is defined as the net profit after tax less total amount of dividends. Cash flow is used here as an indicator of broad credit channel of monetary policy transmission mechanism. The

sensitivity of the firms to cash flow is likely to be heterogeneous depending upon the firms' financial position. Cash flow indicates firms' financial health and balance sheet conditions thus cash flow is an important factor to determine the borrowing capacity by the firms and external finance premium. Fazzari *et al*. (1988) argue that reduction in firms' cash flow reduces investment sharply. They explored the strong positive correlation between borrowing and cash flow thus indicating the importance of cash flow. They discovered cash flow as an important determinant of firms' investment spending and found the sensitivity of cash flow with investment spending present even for those firms that have high level of cash flow then investment needs. The cash flow positively affects the investment of the firms as documented by Chatelain *et al.* (2001), Karim (2010) and Angelopoulou and Gibson (2007).

$$CF = \text{Retantion in Business} + Depreciation$$

5.2.4 Sales (*Y*)

Sales represent the revenue generated from the sale of goods and services to the customers. As per Baddeley (2003), the accelerator theory of investment claims that there is positive association between sales growth and investment. Accelerator theory postulates that firms build up capital stock if they expect output to rise. Sales act as an indicator of expected demand for goods and services and future outlook of the firms. Thus increase in sales produce a signal of higher expected future demand which in turn stimulates firms to form capital. Sale is the main domain in which each manufacturing firm need to excel in order to be profitable. Sales also act a source of cash flow. It is found out by many studies like Karim (2010), Bryson (2009), Kalckreuth (2001) and Lunnemann and Matha (2001) that sales is an important determinant of firms' investment. Kalckreuth (2001) defines the sales as an

accelerator variable that accelerates the firms' investment. Credit channel indirectly operates via reducing the sales thus weakening the balance sheet of firms.

5.2.5 User Cost of Capital (*UC*)

Following Bryson (2009) who used a slightly modified version of user cost of capital on the footsteps of Chatelain *et al.* (2003), and as discussed by Lunnemann and Matha (2001), the user cost of capital is measured as the weighted sum of the cost of debt and the equity. Both of which are weighted by their respective share of firms' total liabilities.

$$UC_{it} = AI_{it}\left(\frac{DB_{it}}{DB_{it}+E_{it}}\right)+LD_{t}\left(\frac{E_{it}}{DB_{it}+E_{it}}\right)$$

Where AI_{it} is the apparent interest rate calculated as the interest expenses over gross debt calculated from the financial statement analysis of companies. Here LD_t indicates the long term debt rate used as the proxy for the opportunity cost of equity. This study uses the government bond yield as the long term debt rate taken from the International Financial Statistics (IFS). Here E_{it} refers to the book value of equity measured as the total share holders' equity while DB_{it} indicates the book value of debt. This is a firm specific user cost of capital and firms base their investment decisions on the above discussed user cost. It is used as an indicator of interest rate channel of monetary transmission mechanism[15]. It is the most important factor determining the investment by firms. Firms' fixed investment decisions are based on user cost of capital. User cost of capital negatively affects the firms' investment as documented by Chatelain *et al.* (2003), Chirinko *et al*. (1999), Chatelain and Tiomo (2001) and Karim (2010).

[15] For details see Karim (2010, 2012)

5.2.6 Total Assets

Total assets include current assets plus non-current assets. This variable has been used to split the firms into small and large firms on the footsteps of, among others, Chatelain *et al.* (2001), Angelopoulou and Gibson (2007) and Shabbir (2012). The rationale behind splitting the sample into small and large firms is to find out the heterogeneous response of firms' investment to the user cost of capital growth, sales growth and cash flow to capital stock ratio. Small firms' investment is expected to be severely responsive to the sales growth, user cost of capital growth and cash flow as compared with the investment of large firms. Following Karim (2010), in order to divide the firms among small and large, the average of total assets for each firm is calculated. In the next step, the grand median of the averages is calculated to classify firms into large and small firms. A firm is classified as small if its mean assets are less than the grand median while large if its mean assets are greater than the grand median assets value.

5.3 METHODOLOGY

This study adopts the Generalized Method of Moments (hereafter GMM) one step and two step estimation procedures in dynamic panel data models. Inclusion of the lagged dependent variable among the regressors and individual effects results in the problem of endogeneity. These issues are addressed by using GMM one step and two step estimation methods that potentially removes the problem of endogeneity.

The econometric methodology and procedure is discussed below:

5.3.1 Panel Data Model

Panel data set is defined as the pool of observations on cross sections over several time periods. Panel data present a range of estimation methods and has widespread popularity because both cross sections and time dimensions can be taken into account for the analysis purpose.

A cross section dataset consists on observations of N individuals at the same point of time. There are many datasets that have N cross sections and T time series but can't be regarded as the panel data. The example includes households' survey data that is surveyed every year but each time data is collected from different households. A panel dataset always follow the same entity over time (Baltagi, 2002).

A panel dataset is considered as balanced panel if every variable has same time period while unbalanced panel refers to a dataset that have different time period for some of the variables. Panel dataset has many advantageous. By employing panel dataset, sample size can be increased significantly which reduces the problem of multicollinearity thus better results can be obtained.

5.3.2 Panel Unit Root

Due to the large cross sections N and time periods T, problem of unit root in panel data may emerge. Non stationary data leads to the spurious results. So, detection of unit root is important in panel dataset before conducting any analysis. To check unit root in the panel data, both Dickey-Fuller (hereafter DF) and Augmented Dickey-Fuller (hereafter ADF) unit root tests are extended to the panel data estimations. Panel unit root tests differ in terms of assumptions regarding panel structure and formulation of the null hypothesis. Some cross sections may have unit root while other may not,

that make the detection of panel unit root difficult. Unit root in panel data set can be detected by using following tests:

5.3.2.1 The Levin and Lin (LL) Test

Levin and Lin (hereafter LL) test can be regarded as an extension of the DF test. LL unit root test follows the following model to detect the unit root in panel dataset:

$$\Delta Y_{it} = \alpha_i + \rho Y_{it-1} + \sum_{k=1}^{n} \phi_k \Delta Y_{it-k} + \delta_i t + \theta_t + \mu_{it}$$

This test allows two way fixed effects namely unit specific fixed effects and unit specific time trends. LL unit root test assumes the coefficient of lagged Y_i homogenous across all units of the panel.

This method formulate null hypothesis as:

$$H_0 : \rho = 0$$

$$H_1 : \rho < 0$$

Where null hypothesis states that variable contains a unit root whereas the alternative hypothesis assumes that the underlying variable is stationary.

5.3.2.2 The Im, Pesaran and Shin (IPS) Test

LL test restricts the ρ to be homogenous across all the individuals which is not a valid assumption since each cross section may have different unit root. Considering this drawback, Im, Pesaran and Shin allowed heterogeneity on the coefficient of the Y_{it-1} variable by extending the test of LL. The IPS test is based on averaging the individual unit root test statistics.

Their test is given as:

$$\Delta Y_{it} = \alpha_i + \rho_i Y_{it-1} + \sum_{k=1}^{n} \phi_k \Delta Y_{it-k} + \delta_i t + \mu_{it}$$

They form null and alternative hypothesis as:

$H_0 : \rho_i = 0$ *for all i*

$H_1 : \rho < 0$ *for at least one i*

Here the null hypothesis is that all the series are non-stationary processes against the alternative that a fraction of the series in the panel are assumed to be stationary.

5.3.2.3 The Maddala and Wu (MW) Test

Maddala and Wu prepared a test to improve to some degree the drawbacks of all previous tests and proposed a test that could also evaluate stationarity in the unbalanced panel as opposed to other tests that were effective only in the case of balanced panel. MW test's equation is given below:

$$\prod = -2\sum_{i=1}^{N} \ln \pi_i$$

Where π_i denotes the probability limit values from the regular DF or ADF unit root tests for each cross section. This test follows the chi-square distribution with 2N degrees of freedom.

5.3.3 Correlation Matrix

Correlation of the independent variables with each other refers to the problem of the multicollinearity. Problem of multicollinearity causes the biased estimates. So, it is important to check the correlation of the explanatory variables. There are various

ways to detect the problem of multicollinearity like correlation coefficient and auxiliary regression.

5.3.4 Generalized Method of Moments (GMM) Estimation

This study uses the GMM one step and two step estimation methods developed by the Arellano and Bond. GMM estimation method is used because of the heterogeneity among the individuals caused by individual effects and endogeneity due to the inclusion of lagged dependent variable as regressors. For the large samples GMM two step is better option while for the small sample GMM one step should be used.

GMM estimation method works on the notion to choose the estimate of unknown parameters vector θ, the value of θ in such a way that estimated moments gets equal to their expected value. In the case of a moment condition like "explanatory variables should be uncorrelated with the error term", parameters estimates are chosen in such a way that estimated correlation between the regressors and error term gets equal to zero. If there are K unknown parameters and L moment conditions and $L = K$, then parameters that causes the estimated moment condition equal to zero can be found by solving this set of equations. This method is known as method of moments but in case of more moment conditions then parameters to be estimated $L > K$, it is not possible to find out parameters estimates that equates all moment conditions equal to zero due to more equations then unknowns. To solve this problem, the parameters are chosen in such a way that minimizes the violation of the moment conditions. So, GMM minimizes weighted sum of squares of all the estimated moments (Kennedy, 2008).

Following Baltagi (2002), an autoregressive model with no regressors is specified as below:

$$y_{it} = \delta y_{it-1} + \mu_{it} \qquad i = 1, \ldots, N; t = 1, \ldots, T \qquad 5.1$$

Where $\mu_{it} = \mu_i + \nu_{it}$. Both the terms μ_i and ν_{it} are assumed to have zero mean and constant variance. Here μ_i refers to the unobservable individual specific effect while ν_{it} indicates the remainder disturbance. Equation (5.1) is first differenced to eliminate individual specific effects (in our case firm specific effects).

$$y_{it} - y_{it-1} = \delta(y_{it-1} - y_{it-2}) + (\nu_{it} - \nu_{it-1}) \qquad 5.2$$

Where differenced disturbance $(\nu_{it} - \nu_{it-1})$ is moving average of order one $MA(1)$ process and have unit root. For the period $t = 3$, the relationship becomes:

$$y_{i3} - y_{i2} = \delta(y_{i2} - y_{i1}) + (\nu_{i3} - \nu_{i2})$$

In the above equation y_{i1} can be used as instrument since it has high correlation with $(y_{i2} - y_{i1})$ but uncorrelated with differenced disturbance $(\nu_{i3} - \nu_{i2})$. For the time period $t = 4$ the relation is given below:

$$y_{i4} - y_{i3} = \delta(y_{i3} - y_{i2}) + (\nu_{i4} - \nu_{i3})$$

In the above equation y_{i2} and y_{i1} can be used as instruments. By adding additional valid instrument each period, one gets a set of valid instruments. This instrumental variable procedure still does not account for the differenced error term in equation (5.2).

The variance-covariance matrix of the error takes the following form:

$$E\left(\Delta\nu_i \Delta\nu_i'\right) = \sigma^2{}_{\nu}(I_N \otimes G)$$

Where $\Delta\nu' = (\nu_{i3} - \nu_{i2}, \ldots, \nu_{iT} - \nu_{it-1})$ and G is $(T-2)\times(T-2)$ since $\Delta\nu_i$ is MA (1) with unit root:

$$G = \begin{pmatrix} 2 & -1 & 0 & \cdots & 0 & 0 & 0 \\ -1 & 2 & -1 & \cdots & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & \cdots & -1 & 2 & -1 \\ 0 & 0 & 0 & \cdots & 0 & -1 & 2 \end{pmatrix}$$

Matrix of the instruments is defined as:

$$W = \left[W_1', \ldots, W_N' \right]'$$

Since the instruments are orthogonal to the error by construction, the moments conditions are described as:

$$E\left(W_i' \Delta\nu_i \right) = 0$$

Premultiplying the equation (5.2) in vector form by the W' yields

$$W'\Delta y = W'(\Delta y_{-1})\delta + W'\Delta\nu$$

By applying the Generalized Least Square (GLS) on the above equation, Arellano and Bond one step consistent estimator is obtained:

$$\hat{\delta}_1 = \left[(\Delta y_{-1})' W (W'(I_N \otimes G)W)^{-1} W'(\Delta y_{-1}) \right]^{-1} \times \left[(\Delta y_{-1})' W (W'(I_N \otimes G)W)^{-1} W'(\Delta y) \right]$$

Where

$$W'(I_N \otimes G)W = \sum_{i=1}^{N} W_i' G W_i$$

is replaced by

$$V_N = \sum_{i=1}^{N} W_i'(\Delta v_i)(\Delta v_i)' W_i$$

This GMM estimator requires no knowledge concerning the initial conditions or the distributions of v_1 and μ_i. To operationalize this estimator, Δv is replaced by differenced residuals obtained from the one step GMM estimator that yield the GMM two step estimators.

$$\hat{\delta}_2 = \left[(\Delta y_{-1})' W \hat{V}_N^{-1} W' (\Delta y_{-1}) \right]^{-1} \left[(\Delta y_{-1})' W \hat{V}_N^{-1} W' (\Delta y) \right]$$

5.3.5 J-Statistics

J statistics also known as Sargan test or Hensen test is used to check the validity of the instrument used. In the case of more instruments then parameters, J statistics is used to test the validity of over identifying restrictions. J statistic follows chi-square distribution under the null that over identifying restrictions are satisfied.

5.3.6 Autoregressive Process (AR)

AR process is used to test that whether problem of serial correlation among the residuals has been removed by using instruments. Literature has used AR (1) and AR (2) process for this purpose.

If Y_t is a variable, suppose GDP and Y_t is represented as

$$(Y_t - \delta) = \alpha_1 (Y_{t-1} - \delta) + \mu_t \qquad 5.3$$

Here δ represents the mean of Y_t and μ_t indicates the error term having zero mean and constant variance. Equation (5.3) follows first order autoregressive or AR (1)

process. Equation (5.3) states that Y_t depends on its previous value Y_{t-1} and on a random component.

The second order autoregressive or AR (2) process can be defined as:

$$(Y_t - \delta) = \alpha_1(Y_{t-1} - \delta) + \alpha_2(Y_{t-2} - \delta) + \mu_t \qquad 5.4$$

pth order autoregressive process or AR (p) is depicted as below:

$$(Y_t - \delta) = \alpha_1(Y_{t-1} - \delta) + \alpha_2(Y_{t-2} - \delta) + \cdots + \alpha_p(Y_{t-p} - \delta) + \mu_t \qquad 5.5$$

To conclude, first of all data will be tested to check for the presence of unit root and multicollinearity. Then GMM will be used to estimate the model. J statistics will be employed to gauge the validity of instruments and serial correlation test will be applied as diagnostic test. The results of all tests and model are part of the next chapter.

Chapter 6

DATA TESTS AND EMPIRICAL RESULTS

Empirical testing is necessary to test the validity of the theory. In this chapter, this study empirically tests the neo-classical investment model. Firstly, data is tested for the detection of unit root and multicollinearity problem. Lastly, full sample is tested along with the small and large firms' sample.

6.1 DATA TESTS

Data needs a cautious attention before conducting any analysis. It is important to check that whether the data is unit root free and doesn't encounter with the problem of multicollinearity. Thus this study first of all tests for the detection of unit root and multicollinearity problem.

6.1.1 Panel Unit Root Test

Since panel data may have unit root problem due to its nature, it is necessary to evaluate the data for the detection of unit root before further analysis. There are many panel unit root tests like Levin, Lin and Chu, Breitung, Im, Pesaran and Shin, Fisher – ADF (Augmented Dickey Fuller), Fisher–PP (Philip- Perron) and Hadri. Each test can present different and contradictory results. Im, Pesaran and Shin, Fisher–ADF and Fisher–PP tests treat unit root heterogeneous across all cross sections. In other words, these tests suppose individual unit root for each cross sections while Levin, Lin and Chu, Breitung and Hadri panel unit root test consider the unit root homogenous across all cross sections.

The results of the unit root tests are presented in Table 6.1. All the variables used in this study don't encounter the problem of unit root as indicated by the p values of the

variables. Moreover, both the tests lead to the same results that weight to the conclusion that variables are stationary.

Table 6.1: Panel Unit Root Test

Variables	LLC Test Stat	p - value	IPS Test Stat	p – value	Conclusion
I_{it}/K_{it-1}	-483.809	0.0000	-91.2917	0.0000	Stationary
CF_{it}/K_{it-1}	-39.7299	0.0000	-37.3072	0.0000	Stationary
$\Delta \log UCC_{it}$	-74.1911	0.0000	-82.7688	0.0000	Stationary
$\Delta \log Sale_{it}$	-97.8950	0.0000	-88.0733	0.0000	Stationary

Note:

- LLC denotes the Levin, Lin and Chu panel unit root test while IPS represents the Im, Pesaran and Shin panel unit root test.
- LLC assumes the common unit root process while IPS assumes the individual unit root process with the null of unit root.
- Investment ratio, cash flow to capital ratio, user cost of capital growth and sales growth are denoted by the I_{it}/K_{it-1}, CF_{it}/K_{it-1}, $\Delta \log UCC_{it}$ and $\Delta \log Sale_{it}$ respectively.

6.1.2 Correlation Matrix

Before going further it is important to check the correlation among the explanatory variables since high correlation among the explanatory variables can lead to the misleading results. Correlation matrix is one approach widely used in the literature to detect the magnitude of correlation. Table 6.2 indicates that the variables used in this study don't face the problem of multicollinearity. All explanatory variables have expected signs.

Table 6.2: Correlation Matrix

Variables	I_{it}/K_{it-1}	CF_{it}/K_{it-1}	$\Delta \log Sale_{it}$	$\Delta \log UCC_{it}$
I_{it}/K_{it-1}	1	0.003214	0.072016	-0.063297
CF_{it}/K_{it-1}	0.003214	1	0.085235	-0.018728
$\Delta \log Sale_{it}$	0.072016	0.085235	1	0.109451
$\Delta \log UCC_{it}$	-0.063297	-0.018728	0.109451	1

6.2 EMPIRICAL RESULTS

In this section this study explores the interest rate and broad credit channel. Also, small and large firms' behavior to the monetary policy is analyzed. Firstly, model is estimated for all the firms without considering the sectors and sizes of the firms. In other words, neo-classical investment model is estimated for the full sample. Secondly, firms are divided into small and large to identify the broad credit channel of monetary policy transmission.

6.2.1 Full Sample Results (1974-2010)

Under the full sample results, all the firms are considered in the estimation process to gauge the impact of explanatory variables on the firms' investment without considering sectors and sizes. Full sample covers 498 firms of the manufacturing sector and data period spans from 1974-2010.

The results are presented in table 6.3:

Table 6.3: Full Sample Results, Dependent variable: $I_{i,t}/K_{i,t-1}$

Explanatory Variables	Coefficients	Explanatory Variables	Coefficients
$I_{i,t-1}/K_{i,t-2}$	-0.251 (0.007)***	$\Delta \log UC_{i,t}$	-1.741 (0.096)***
$I_{i,t-2}/K_{i,t-3}$	-0.333 (0.006)***	$\Delta \log UC_{i,t-1}$	-0.748 (0.119)***
$I_{i,t-3}/K_{i,t-4}$	-0.269 (0.005)***	$\Delta \log UC_{i,t-2}$	-1.727 (0.115)***
$\Sigma I_{i,t-n}/K_{i,t-n-1}$	-0.853***	$\Delta \log UC_{i,t-3}$	-1.243 (0.107)***
$\Delta \log S_{i,t}$	1.649 (0.061)***	$\Sigma \Delta \log UC_{i,t-n}$	-5.459***
$\Delta \log S_{i,t-1}$	0.479 (0.055)***	$CF_{i,t}/K_{i,t-1}$	3.075 (0.118)***
$\Delta \log S_{i,t-2}$	0.949 (0.060)***	$CF_{i,t-1}/K_{i,t-2}$	-0.476 (0.059)***
$\Delta \log S_{i,t-3}$	0.534 (0.061)***	$CF_{i,t-2}/K_{i,t-3}$	0.705 (0.056)***
$\Sigma \Delta \log S_{i,t-n}$	3.611***	$CF_{i,t-3}/K_{i,t-4}$	0.198 (0.043)***
Wald 1(p value)	0.0000	$\Sigma CF_{i,t-n}/K_{i,t-n-1}$	3.502***
Wald 2 (p value)	0.0000	*Long Term Sales*	1.949

		Elasticity	(0.116)***
m2 (Statistics Value)	0.505	*Long Term User Cost of Capital Elasticity*	-2.946 (0.200)***
Sargan (p value)	0.2888	*Long Term Cash Flow Elasticity*	1.890 (0.110)***

Note:

- GMM two step estimates
- Constant and Time dummies are included. (not reported).
- I/K is the investment to capital ratio, $\Delta \log S$ represents the sales growth, $\Delta \log UC$ denotes the user cost of capital growth while CF/K represents the cash flow to capital ratio.
- Instruments used are lags 2 to 5 of investment to capital ratio, lags 2 to 4 of sales growth, lags 1 to 5 of user cost of capital growth and lags 2 to 5 of cash flow to capital ratio.
- Standard errors in parenthesis.
- *P* value for the total effects and long term elasticity is computed using Wald Statistic.
- Wald 1 and Wald 2 are the tests for the joint significance of explanatory variables and time dummies respectively.
- m2 is the second order serial correlation tests based on residuals asymptotically distributed as N(0,1) under the null of no serial correlation.
- Sargan is the test of instruments' validity asymptotically distributed as χ^2 under the null that instrument is valid.
- Statistics significant at 1%, 5% and 10% is denoted by ***, ** and * respectively.

This study estimates the neo-classical investment model augmented with cash flow to capital ratio by using GMM estimation method. Table 6.3 carries the results of the 498 firms of manufacturing sector of Pakistan for the period 1974 to 2010 (full sample). Results found by this study are in line with the findings of the literature. The dynamics of the model are captured by the lagged dependent variable. All the lags of dependent variable are found highly significant at the 1% level. The lagged dependent variable have negative signs indicating that there is no spillover effect of investment spending (investment ratio) to the next year investment. In other words, investment of the previous years has no effect on the investment of the latter years. Negative signs on the lagged dependent variables are indicative of the less smooth investment process (Butzen *et al.* 2001). The result of this study regarding the lagged dependent variables is also consistent with the results of Chatelain *et al.* (2001) for Spain and Bryson (2009).

All the studies have found strong impact of sales growth on the investment (investment ratio) indicating it as the most important determinant affecting the investment decisions by the firms. Sales growth has revealed significant impact as far as the full sample results are concerned. Sales growth at the level as well as all its lags is found significant at the 1% level. The contemporaneous effect of sales growth on investment ratio is largest as compared with all its lags. Contemporaneously, 1% increase in the sales growth leads to the 1.649% rise in the investment. At lags one, two and three, sales growth leads to the rise in the investment by 0.479%, 0.949% and 0.534% respectively. In our case sales growth reveals sort of a cyclical pattern that can be observed by having a look at the coefficients of the level and all lags of sales growth. At lags one and three the magnitude of sales growth impacting the investment spending drops as compared with the level and lag two. Such cyclical behavior is indicative of the fact that impact of sales growth on investment is higher after the break of one year. Sales growth is found jointly significant at the 1% level. Total effect of sales growth on investment spending has been found striking by this study. Jointly, 1% increase in the sales growth direct to the 3.611% increase in the investment spending. It is important to figure out the long run coefficients of all the explanatory variables as well since investment is a long term process. Significant results are found in terms of long run sales coefficients by this study. Long run sales growth elasticity found by this study indicates that 1% permanent rise in the sales growth leads to the 1.949% increase in the investment spending by the firms. On the base of above discussion, it is concluded that a strong sales accelerator mechanism is operative in Pakistan. Thus the hypothesis that sales accelerate the firms' investment in Pakistan is accepted as far as the sample under study is concerned. It is due to the fact that the main function of every business is profit generation and sales plays

immense important role in profitability. Manufacturing firms of Pakistan have no exception to it. This study's results regarding sales growth and its impact on firms' investment is in line with the results of other studies on this subject. Karim (2010), Bryson (2009), Kalckreuth (2001) and Lunnemann and Matha (2001) also found the significant and strong positive impact of sales growth on firms' investment, thus giving merit to the results of this study.

This study is particularly interested in the user cost of capital to explore the interest rate channel. The user cost of capital used by this study is firm specific and varies with the apparent interest rate. In case of manufacturing firms of Pakistan, user cost of capital growth at level and its all lags turned out to be highly significant at the 1% level. Surprisingly, the coefficients of user cost of capital growth appeared to be large as compared with the results of other studies on this subject. Karim (2010), Kalckreuth (2001) and Butzen *et al*. (2001) found short run user cost of capital growth coefficients ranging from -0.016 to -0.191, -0.021 to -0.220 and 0.002 to 0.010, respectively. Effect of user cost of capital growth on firm investment ratio at level turned out to be -1.741 in case of this study. At the first, second and third year lag, 1% raise in the user cost of capital growth lead to the decline in investment by 0.748%, 1.727% and 1.243% respectively. It is evident from the results that user cost of capital growth depicts a cyclical pattern like sales growth. Coefficients of the first and third lags of user cost of capital growth have lesser negative effect on investment than the coefficients at level and the second lag, representing a cyclical pattern. Total effect of user cost of capital growth found to be significant in negatively impacting the firms' investment. Considering the effect of user cost of capital growth jointly, 1% increase in the user cost of capital growth leads to the 5.459% fall in the investment spending. Long term user cost of capital growth elasticity was also calculated by this study on

the pattern of vast literature. Long term user cost of capital growth elasticity also found to be significant at the 1% level indicating that 1% permanent increase in the user cost of capital growth leads to the decline in investment by 2.946%. Mojon *et al*. (2001) also explored the long term user cost of capital elasticity close to one, thus giving merit to our results. The above results regarding the impact of user cost of capital growth on firms' investment implies that a strong interest rate channel is operative in Pakistan. This highlights the importance of the interest rate channel in Pakistan and implies that interest rate is a quite influential factor affecting the investment decisions of the firms. This is due to the reason that manufacturing firms in Pakistan are bank dependent for their financing needs. Contractionary monetary policy increases the interest rate by the banks which in turn increases the cost of borrowing, negatively affecting the firms' investment decisions. Among others studies, Karm (2010), Kalckreuth (2001), Bryson (2009) and Chatelain *et al.* (2001) also found the similar results. In case of studies on Pakistan, Agha *et al*. (2005) and Munir and Qayyum (2012) found the strong interest rate channel.

The neo-classical model of investment is augmented with cash flow in order to gauge the impact of liquidity on firms' investment. Cash flow to capital ratio has been used as a proxy for broad credit channel by the studies like Karim (2010), Kalckreuth (2001), Chatelain and Tiomo (2001) and Chatelain *et al.* (2001). Consistent with the literature, this study also explore the significant impact of cash flow to capital stock ratio on firm investment. Cash flow to capital stock ratio at level and its lags explored to be highly significant at the 1% level. Contemporaneous effect of the cash flow to capital stock ratio discovered to be quite high. At the level, 1% rise in the cash flow to capital stock ratio leads to the 3.075% increase in the investment spending. The first lag of the cash flow to capital stock ratio explored to be negative. The first lag of cash

flow to capital stock ratio implies that 1% increase in the cash flow to capital stock ratio direct to the decline in investment by 0.476%. It indicates that the first year lag of cash flow to capital stock ratio doesn't positively influence the investment. Such pattern is attributable to some sort of cyclical pattern as indicated by studies like Butzen *et al*. (2001). Bhagat *et al.* (2005) presented another explanation of the negative cash flow sensitivity. Their study concludes that distressed firms facing operating losses but investing more than the previous year exhibit negative cash flow sensitivity to the investment. It is argued that negative cash flow sensitivity is attributable to those financially distressed firms that encounter operating losses but still invest more than the previous year. Negative cash flow to investment sensitivity arises in this case due to such firms because such firms arrange outside finance through equity. This study found that 1% increase in the cash flow to capital stock ratio results in increase in investment spending by 0.705% and 0.198% at the second and third lags respectively. Effect of total coefficients of cash flow also discovered to be highly significant. Jointly, 1% rise in the cash flow increases the investment spending by 3.502%. The long run sensitivity of cash flow also figured out to be highly significant at the 1% level by this study and the result revealed that 1% permanent increase in the cash flow increases investment by 1.890%. The positive effect of cash flow to capital stock ratio on firms' investment indicates that manufacturing firms are financially constrained due to which cash flow plays an important role in determination of manufacturing firms' investment. It highlights the importance of cash flow in affecting the firms' investment of the manufacturing sector of Pakistan.

GMM requires to check the validity of the instruments used and to test the presence of second order serial correlation among the transformed residuals. Results of the second

order serial correlation among the residuals represented by the *m2* are as expected. As per the requirement, null of no serial correlation is accepted in case of second order serial correlation test. Result of *m2* indicates that the results of this study don't suffer from the problem of second order serial correlation among the residuals. The instruments used by this study turned out to be highly valid as indicated by the p value of Sargan test. The null that instruments are valid is accepted. All the explanatory variables as well as time dummies found to be jointly significant at the 1% level, giving merit to our findings.

To summarize, results of full sample are as expected and in line with literature on the subject. A strong interest rate channel explored to be operative in Pakistan as indicated by strong impact of user cost of capital growth on firms' investment. Firms' investment is explored to be positively affected by sales and cash flow.

6.2.2 Firm Size and Monetary Transmission Channels

Each firm has different characteristics. Some firms are large while some firms are small. The tendency of small and large firms to respond to the shocks differs substantially. Some firms are "too big to fail" due to their capacity to absorb the shocks. Small firms as compared with large firms face greater informational asymmetries because getting information about the true financial position of large firms is relatively easy as compared to small firms. Thus it is important to divide the firms in terms of size to figure out that whether monetary policy has different effects on the firms.

The existence of broad credit channel is identified by analyzing the different role of cash flow for the small and large firms. Since the broad credit channel is based on the notion that monetary tightening leads to the greater hit to net worth of small firms,

due to higher interest expenses arising because of the higher risk premium, then large firms, small firms should respond strongly to the cash flow in order to finance their investment as compared with large firms. So, if the financially constrained firms (small firms) discover to be more responsive to the cash flow, it is considered as an indicator of existence of broad credit channel[16].

As this study has discussed the role of size in absorbing the effects of monetary policy, firms are divided into small and large on the base of total assets. Different division criteria's have been used to divide the firms into small and large. Karim (2010) and Bryson (2009) divided the firms on the base of median value of total assets, Shabbir (2012) on the base of 40th percentile of total assets while Angelopoulou and Gibson (2007) on the base of first quartile of total assets. This study follows the method of Karim (2010) and Bryson (2009) to divide the firms into small and large (other criterions were also checked but no difference in results was found). Out of total 498 firms, 248 firms are large while 250 firms are small. The result of large firms is presented in table 6.4:

Table 6.4: Large Firms, Dependent variable: $I_{i,t}/K_{i,t-1}$

Explanatory Variables	**Coefficients**	**Explanatory Variables**	**Coefficients**
$I_{i,t-1}/K_{i,t-2}$	-0.967 (0.002)***	$\Delta \log UC_{i,t}$	-0.697 (0.056)***
$I_{i,t-2}/K_{i,t-3}$	-0.990 (0.002)***	$\Delta \log UC_{i,t-1}$	-0.644 (0.051)***
$I_{i,t-3}/K_{i,t-4}$	-0.955 (0.003)***	$\Delta \log UC_{i,t-2}$	-0.672 (0.065)***
$\Sigma I_{i,t-n}/K_{i,t-n-1}$	-2.912***	$\Delta \log UC_{i,t-3}$	-0.170 (0.049)***
$\Delta \log S_{i,t}$	0.093 (0.015)***	$\Sigma \Delta \log UC_{i,t-n}$	-2.183***
$\Delta \log S_{i,t-1}$	0.074 (0.020)***	$CF_{i,t}/K_{i,t-1}$	0.388 (0.028)***
$\Delta \log S_{i,t-2}$	0.324 (0.019)***	$CF_{i,t-1}/K_{i,t-2}$	0.232 (0.023)***
$\Delta \log S_{i,t-3}$	0.313 (0.019)***	$CF_{i,t-2}/K_{i,t-3}$	0.514 (0.037)***

[16]See Chatelain *et al.* (2003) for reference

$\Sigma\Delta\log S_{i,t-n}$	0.804***	$CF_{i,t-3}/K_{i,t-4}$	0.233 (0.039)***
Wald 1(p value)	0.0000	$\Sigma CF_{i,t-n}/K_{i,t-n-1}$	1.367***
Wald 2 (p value)	0.0000	*Long Term Sales Elasticity*	0.205 (0.015)***
m2 (Statistics Value)	0.000	*Long Term User Cost of Capital Elasticity*	-0.558 (0.047)***
Sargan (p value)	0.2899	*Long Term Cash Flow Elasticity*	0.349 (0.029)***

Note:

- See table 6.3 for details of variables, estimation technique, computation methods, Wald 1, Wald 2, m2 and Sargan test.
- Instruments used are lags 2 to 3 of investment to capital ratio, lags 1 to 3 of sales growth, lags 1 to 3 of user cost of capital growth and lags 2 to 3 of cash flow to capital ratio.
- Statistics significant at 1%, 5% and 10% is denoted by ***, ** and * respectively.

Likewise, the result of small firms is presented in table 6.5. It is expected that behavior of small firms in terms of monetary policy effects will be different then the large size firms.

Table 6.5: Small Firms, Dependent variable: $I_{i,t}/K_{i,t-1}$

Explanatory Variables	**Coefficients**	**Explanatory Variables**	**Coefficients**
$I_{i,t-1}/K_{i,t-2}$	-0.508 (0.007)***	$\Delta\log UC_{i,t}$	-0.619 (0.073)***
$I_{i,t-2}/K_{i,t-3}$	-0.533 (0.008)***	$\Delta\log UC_{i,t-1}$	0.924 (0.112)***
$I_{i,t-3}/K_{i,t-4}$	-0.476 (0.009)***	$\Delta\log UC_{i,t-2}$	-0.590 (0.102)***
$\Sigma I_{i,t-n}/K_{i,t-n-1}$	-1.517***	$\Delta\log UC_{i,t-3}$	-0.063 (0.078)
$\Delta\log S_{i,t}$	1.622 (0.050)***	$\Sigma\Delta\log UC_{i,t-n}$	-0.348***
$\Delta\log S_{i,t-1}$	1.254 (0.074)***	$CF_{i,t}/K_{i,t-1}$	0.847 (0.078)***
$\Delta\log S_{i,t-2}$	1.342 (0.063)***	$CF_{i,t-1}/K_{i,t-2}$	-0.370 (0.041)***
$\Delta\log S_{i,t-3}$	1.033 (0.055)***	$CF_{i,t-2}/K_{i,t-3}$	0.860 (0.042)***
$\Sigma\Delta\log S_{i,t-n}$	5.251***	$CF_{i,t-3}/K_{i,t-4}$	0.147 (0.043)***
Wald 1(p value)	0.0000	$\Sigma CF_{i,t-n}/K_{i,t-n-1}$	1.484***
Wald 2 (p value)	0.0000	*Long Term Sales Elasticity*	2.086 (0.084)***
m2 (Statistics Value)	1.365	*Long Term User Cost of Capital Elasticity*	-0.138 (0.120)
Sargan (p value)	0.4607	*Long Term Cash Flow Elasticity*	0.589 (0.043)***

Note:

- See table 6.3 for details of variables, estimation technique, computation methods, Wald 1, Wald 2, m2 and Sargan test.
- Instruments used are lags 2 to 4 of investment to capital ratio, lags 2 to 3 of cash flow to capital ratio, lags 2 to 3 of sales growth and lags 1 to 4 of user cost of capital growth.
- Statistics significant at 1%, 5% and 10% is denoted by ***, ** and * respectively.

The dynamics of small and large firms indicates that for both type of the firms' investment is not a smooth mechanism. Butzen *et al.* (2001) argue that positive signs of lagged dependent variable represents smoother investment pattern and postulated that large firms exhibit smoother investment process as compared with small firms. The negative signs of the lagged dependent variables are indicative of the notion that for both small and large firms, investment is not a smooth process.

As it is evident in the studies like Karim (2010) and Lunnemann and Matha (2001), effect of sales growth on investment is more profound for small firms as compared to large firms. At the level, 1% rise in the sales growth leads to the 1.622% increase in the investment for small firms while only 0.093% in case of large firms. All the lags of sales growth are greater in magnitude for small firms as compared with large firms. For large firms, effects of sales growth ranges from 0.074-0.324 while for small firms the same effects ranges from 1.033-1.622. Evaluating the total effects, 1% increases in the sales growth results in 0.804% increase in the investment spending for large firms while 5.251% rise in investment for small firms. In the long run, 1% permanent rise in the sales growth contributes to the 0.205% increase in investment spending for large firms while 2.086% for small firms. The results confirm the existence of a strong sales accelerator mechanism in Pakistan operating for both small and large firms. The results indicate that small firms' investment decisions are heavily influenced by sales growth then the large firms. It is not surprising since the small firms face problem in getting external finance due to higher default risk and borrowing cost. The results of user cost of capital and cash flow confirm that small firms rely heavily on the internal generated funds for investment purposes.

User cost of capital growth found to be negatively affecting the firms' investment for both large and small firms while the effects of user cost of capital growth on

investment spending figured out to be greater in magnitude in case of large firms. In the same time period, 1% increase in the user cost of capital growth results in 0.697% fall in investment for large firms while for small firms by 0.619%. Studying the total effects, 1% increase in the user cost of capital growth negatively affects the investment rate by 2.183% for large firms while by 0.348% in case of small firms. It is argued by Mishkin (1996) that business fixed investment decisions are affected mainly due to change in the real long term interest rate rather than the short term interest rate. Hence, this study also presents the long term user cost elasticity. The results indicate that 1% permanent increase in the user cost of capital growth results in the fall in investment spending by 0.558% for large firms while long term user cost of capital effects explored to be insignificant for small firms. It supports the notion presented by Mishkin (1996) in Pakistan. Higher effect of user cost of capital on large firms' investment spending imply that large firms base their investment decisions on external finance due to having easy access to borrowing from the banks and capital market. Similar results are found by Mojon *et al*. (2001) and Gaiotti and Generale (2001). The negative effects of user cost of capital growth on business fixed investment spending are indicative of the relevance of interest rate channel in Pakistan operating for both small and large firms. It also confirms the hypothesis that monetary policy exerts heterogeneous effects, different for different size firms.

Primary purpose to divide the firms into large and small is to investigate the existence of a broad credit channel in Pakistan. Results reveal that at the level 1% increase in the cash flow to capital ratio contributes to the 0.388% rise in investment for large firms while 0.847% in case of small firms. All the lags of the cash flow explored to be significant in case of small as well as large firms. First lag of the cash flow to capital ratio discovered to be negative in case of small firms, indicating a cyclical pattern.

Evaluating the total effects, 1% increases in the cash flow to capital ratio results in the 1.367% rise in investment by large firms while by 1.484% for small firms. It is interesting to find out that whether same effects persist in the long run or not. Results point out that 1% permanent increase in the cash flow to capital ratio significantly lead to the 0.349% rise in investment by large firms while by 0.589% for small firms. It clearly indicates that a strong broad credit channel operates in Pakistan. Small firms in Pakistan are financially constrained and are more affected by the monetary tightening then large firms. Results confirm that the effects of monetary policy are heterogeneous. In other words, monetary policy affects the firms of different sizes, differently and small firms face higher external finance premium then large firms due to which small firms base their investment decisions on cash flow. Among others, Karim (2010), Bryson (2009) and Gaiotti and Generale (2001) also found out strong broad credit channel in their studies.

By considering the total effects, investment behavior of small and large firms is strikingly different. Small firms' investment is highly influenced by the sales growth and cash flow (5.251 and 1.484) while large firms' investment behavior is characterized by the user cost of capital growth (-2.183). It is due to the easier access of external finance in case of large firms then small firms that lead to such behavior.

Diagnostic tests points out that model estimated for the small and large firms are significant and correctly specified. Instruments used are valid and there is no second order serial correlation problem among the differenced residuals. All the explanatory variables and time dummies found to be jointly significant in case of small as well as large firms analysis.

To conclude, on the base of above findings a strong broad credit channel is explored in Pakistan. Small firms' investment is more responsive to the cash flow then large firms, indicating that small firms are affected more by the monetary contraction. Effects of monetary policy explored to be heterogeneous leading to acceptance of hypothesis set by this study. Effects of sales growth explored to be higher for the small firms while large firms' investment explored to be more responsive to the user cost of capital growth then the small firms.

It is interesting to explore that whether monetary policy through the interest rate channel impacts the investment by the same magnitude or not during different regimes. This issue is addressed in the next chapter.

Chapter 7

MONETARY POLICY, INTEREST RATE CHANNEL AND FINANCIAL SECTOR REFORMS

State Bank of Pakistan (SBP) experienced a shift from the use of direct instruments to the indirect instruments to conduct the monetary policy. In pre 1990's era, monetary policy was regulated by the government under a credit plan but after 1990's, need was felt for the reforms in financial sector and monetary policy shifted towards the non-governmental control environment. Due to the above mentioned reason, it is important to analyze that whether monetary policy effects have changed substantially before and after the 1990's period or has remained the same. To accomplish this objective, this study divides the sample into pre (1974-1989) and post (1990-2010) reform period. This study is also interested in finding out the magnitude of the monetary policy through the interest rate channel on investment during different regimes. Pakistan's economy has undergone many changes. The era of 1971-1977 is witnessed of bad years for the Pakistan's economy. During the Bhutto's regime, economy was nationalized that affected the efficiency of the industries. Loss of East Pakistan and the increase in oil prices in 1973 badly affected the Pakistan's economy. The regime of Zia-ul-Haq from 1977-1988 witnessed the high rates of industrial growth, rise in demand and increase in remittances. The era from 1988 to onwards is characterized with structural adjustments that resulted in economic problems. In order to have sufficient number of lags, it is inappropriate to divide the sample according to the all political regimes of Pakistan. Thus, an attempt is carried out to explore the magnitude of monetary policy during different regimes by analyzing the three different time frames ranging from 1974-1985, 1986-1997 and 1998-2010, in this chapter.

7.1 MONETARY POLICY AND FINANCIAL SECTOR REFORMS

Before the financial sector reforms credit was provided to the prioritize sectors at the low interest rate and banks had to face the problem of excess liquidity but after the reforms, picture changed. Banks were allowed to charge interest rate of their demand and interest rate determination was left to the money market. Thus this study expects the effects of user cost of capital growth (interest rate channel) higher after the reforms. To test the above notion, sample is divided into pre and post reform era.

Table 7.1: Pre Financial Sector Reform Era, Dependent variable: $I_{i,t}/K_{i,t-1}$

Explanatory Variables	**Coefficients**	**Explanatory Variables**	**Coefficients**
$I_{i,t-1}/K_{i,t-2}$	-0.227 (0.033)***	$\Delta \log UC_{i,t}$	-1.582 (0.221)***
$I_{i,t-2}/K_{i,t-3}$	-0.355 (0.018)***	$\Delta \log UC_{i,t-1}$	0.316 (0.240)
$I_{i,t-3}/K_{i,t-4}$	-0.258 (0.024)***	$\Delta \log UC_{i,t-2}$	-0.678 (0.225)***
$\Sigma I_{i,t-n}/K_{i,t-n-1}$	-0.84***	$\Delta \log UC_{i,t-3}$	-0.054 (0.207)
$\Delta \log S_{i,t}$	1.972 (0.157)***	$\Sigma \Delta \log UC_{i,t-n}$	-1.998***
$\Delta \log S_{i,t-1}$	0.758 (0.103)***	$CF_{i,t}/K_{i,t-1}$	-0.217 (0.189)
$\Delta \log S_{i,t-2}$	0.959 (0.117)***	$CF_{i,t-1}/K_{i,t-2}$	1.206 (0.198)***
$\Delta \log S_{i,t-3}$	0.643 (0.172)***	$CF_{i,t-2}/K_{i,t-3}$	-0.053 (0.208)
$\Sigma \Delta \log S_{i,t-n}$	4.332***	$CF_{i,t-3}/K_{i,t-4}$	0.485 (0.164)***
Wald 1(p value)	0.0000	$\Sigma CF_{i,t-n}/K_{i,t-n-1}$	1.421***
Wald 2 (p value)	0.0000	*Long Term Sales Elasticity*	2.354 (0.243)***
m2 (Statistics Value)	0.639	*Long Term User Cost of Capital Elasticity*	-1.086 (0.387)***
Sargan (p value)	0.4372	*Long Term Cash Flow Elasticity*	0.772 (0.190)***

Note:

- See table 6.3 for the details of variables, estimation technique, computation methods, Wald 1, Wald 2, m2 and Sargan test.
- Instruments used are lags 2 to 5 of investment to capital ratio, lags 1 to 5 of user cost of capital growth, lags 2 to 5 of cash flow to capital stock ratio and lags 2 to 4 of sales growth.
- Statistics significant at 1%, 5% and 10% is denoted by ***, ** and * respectively.

This study divides the data on the base of above analysis after the financial sector reforms as well.

Table 7.2: Post Financial Sector Reform Era, Dependent variable: $I_{i,t}/K_{i,t-1}$

Explanatory Variables	Coefficients	Explanatory Variables	Coefficients
$I_{i,t-1}/K_{i,t-2}$	-0.184 (0.015)***	$\Delta \log UC_{i,t}$	-1.501 (0.192)***
$I_{i,t-2}/K_{i,t-3}$	-0.257 (0.011)***	$\Delta \log UC_{i,t-1}$	-1.121 (0.271)***
$I_{i,t-3}/K_{i,t-4}$	-0.232 (0.010)***	$\Delta \log UC_{i,t-2}$	-1.119 (0.239)***
$\Sigma I_{i,t-n}/K_{i,t-n-1}$	-0.673***	$\Delta \log UC_{i,t-3}$	-1.582 (0.209)***
$\Delta \log S_{i,t}$	1.201 (0.175)***	$\Sigma \Delta \log UC_{i,t-n}$	-5.323***
$\Delta \log S_{i,t-1}$	-0.274 (0.191)	$CF_{i,t}/K_{i,t-1}$	4.088 (0.224)***
$\Delta \log S_{i,t-2}$	-0.204 (0.207)	$CF_{i,t-1}/K_{i,t-2}$	-0.832 (0.123)***
$\Delta \log S_{i,t-3}$	-1.204 (0.211)***	$CF_{i,t-2}/K_{i,t-3}$	0.526 (0.077)***
$\Sigma \Delta \log S_{i,t-n}$	-0.481***	$CF_{i,t-3}/K_{i,t-4}$	0.231 (0.082)***
Wald 1(p value)	0.0000	$\Sigma CF_{i,t-n}/K_{i,t-n-1}$	4.013***
Wald 2 (p value)	0.0000	*Long Term Sales Elasticity*	-0.288 (0.370)
m2 (Statistics Value)	0.034	*Long Term User Cost of Capital Elasticity*	-3.182 (0.457)***
Sargan (p value)	0.4147	*Long Term Cash Flow Elasticity*	2.399 (0.221)***

Note:

- See table 6.3 for details of variables, estimation technique, computation methods, Wald 1, Wald 2, m2 and Sargan Test.
- Instruments used are lags 2 to 5 of investment to capital ratio, lags 2 to 4 of sales growth, lags 1 to 5 of user cost of capital growth and lags 2 to 5 of cash flow to capital ratio.
- Statistics significant at 1%, 5% and 10% is denoted by ***, ** and * respectively.

Results reveal that there is substantial change in the coefficients of cash flow to capital ratio, sales growth and user cost of capital growth before and after the financial sector reforms. Investment process captured by the lags of dependent variables indicates that investment process for the pre reform era is relatively less smother as compared with the post reform era as indicated by the total effects of lag dependent variable. Plausibly it is due to the reason that pre reform period witnessed controlled credit allocation to the businesses that affected the investment process

negatively. Relatively smooth investment process after the financial sector reforms period seems attributable to the freedom of disbursement of credit to the businesses by the lenders.

Total effect of sales growth on firms' investment for the pre reform period is found to be 4.332 implying that 1% increase in the sales growth directs to the 4.332% significant increase in the investment while the impact of sales growth on investment ratio discovered to be -0.481 for the post reform era. However, for the post reform era sales growth has positive and highly significant contemporaneous effect on the investment ratio. Contemporaneously, 1% increase in the sales growth direct to the 1.972% rise in investment rate in the pre reform era while in the post reform period 1% increase in the sales growth leads to the 1.201% increase in the investment spending. In the long run, 1% permanent increase in the sales growth contributes to the 2.354% rise in investment in the pre reform era while in the post reform era long run sales elasticity explores to be insignificant. The higher impact of sales growth on investment spending in the pre reform era is possibly due to the problem of credit availability due to which firms base their investment decisions on the sales. The third lag of the sales growth is found significant and negative for post reform era. The result of cash flow to capital ratio, sales growth and user cost of capital growth contrary to the theoretical underpinnings is evident in the literature. The studies of Butzen *et al*. (2001), Karim (2010), Kalckreuth (2001), Chatelain and Tiomo (2001) and Chatelain *et al.* (2001) discovered the signs of coefficients in contradiction to the theory. The signs of cash flow to capital ratio, sales growth and user cost of capital growth contrary to the theoretical underpinnings indicate that investment rate is not sensitive to these variables.

The effect of the cash flow to capital ratio has drastic differences in case of post and pre reform era. The total effect of cash flow to capital ratio explored to be 1.421 for the pre reform period while 4.013 for the post reform era. For both the time periods long run effects of cash flow to capital ratio on investment rate explored to be significant at the 1% level. The positive and significant effect of cash flow to capital ratio on investment has been figured out by the studies, among others, Angelopoulou and Gibson (2007) and Bryson (2009). The greater effect of cash flow to capital ratio on firms' investment after the financial sector reform period highlights the importance and effects of financial sector liberalization. In the pre reform period, credit was allocated to the priority sectors of the economy at the subsidized rate and the interest rate was controlled by the government in the absence of market mechanism leading to the distortions in the interest rate charges setting by the financial institutions while after the reforms period banks and other financial institutions got the power to freely set the interest rate for their customers. It is evident in the history of monetary policy of Pakistan that interest rate was set at very low rates in the pre reform period[17]. Due to the given reason credit was available at the low rates in the pre reform era but at higher rates in the post reform period that, due to the higher cost of borrowing, results in the lower total cash flow sensitivity in the pre reform period but high cash flow to capital ratio sensitivity in the post reform era[18].

The results of the user cost of capital growth on firms' investment rate confirm the above notion. Total effect of the user cost of capital growth on investment ratio turned out to be -1.998 for the pre reform period while -5.323 for the post reform era. In the long term, 1% permanent rise in the user cost of capital growth results in fall in investment rate by 1.086% in the pre reform period while by 3.182% in the post

[17]For detail see Zaidi (1999).
[18] Higher cash flow sensitivity is indicator of firms' financial constraints.

reform era. It is clearly indicative of the fact that monetary policy by the SBP has strengthened after the post reform era and monetary policy through the interest rate channel proxied by the user cost of capital growth has higher negative effect on investment spending after the financial sector reforms due to the determination of interest rate by the money market and banks' freedom to charge interest rate of their demand rather than directed credit at low interest rates.

For both the sample periods models are correctly specified. The test of instruments validity indicates that instruments used are valid and results do not suffer from the problem of second order serial correlation. Jointly, explanatory variables and time dummies are highly significant.

To conclude, results are supportive of a relatively stronger interest rate channel after the reforms period. It indicates that effect of monetary policy on firms' investment spending through the interest rate channel is stronger after the financial sector reform. Total effect of sales growth on the investment spending is found higher in the pre reform era while effect of cash flow to capital ratio on investment rate is found higher in the post reform period.

It is evident on the base of above analysis that the different time frames exhibit different dynamics. Thus this study further divides the data into different time frames to explore the heterogeneous effects of monetary policy through the interest rate channel, in the next section.

7.2 SAMPLE RESULTS UNDER DIFFERENT TIME PERIODS

Pakistan's economy has undergone many changes since Pakistan's creation. Pakistan's economy has enjoyed many good years as well as has experienced hard

times. From 1971-1977, the policy of nationalization was followed. Banks and insurance sector was nationalized and government was responsible for the monetary management. During the Zia-ul-Haq regime (1977-1988) initiatives were taken to liberalize the economy. In 1990's, era of financial sector reforms started and private investment in banking, and other sectors of the economy was allowed. Hence, it is intuitive to divide the sample period into different regimes. This study attempts to find out the difference in the effect of monetary policy through interest rate channel on firms' investment under the different time frames. The sample is divided into three time frames; one from 1974-1985, second from 1986-1997 and third from 1998-2010.

7.2.1 Time-wise Sample Split Empirical Results (1974-1985)

First of all, this study divides the sample from 1974-1985. It is expected that under this time frame results will be different from other time periods due to the different economic conditions prevailing in the country and external factors affecting the Pakistan at that time.

The results are discussed below:

Table 7.3: Time-wise Sample Split (1974-1985), Dependent variable: $I_{i,t}/K_{i,t-1}$

Explanatory Variables	Coefficients	Explanatory Variables	Coefficients
$I_{i,t-1}/K_{i,t-2}$	-0.206 (0.037)***	$\Delta \log UC_{i,t}$	-1.082 (0.337)***
$I_{i,t-2}/K_{i,t-3}$	-0.380 (0.022)***	$\Delta \log UC_{i,t-1}$	0.875 (0.331)***
$I_{i,t-3}/K_{i,t-4}$	-0.206 (0.033)***	$\Delta \log UC_{i,t-2}$	-0.202 (0.327)
$\Sigma I_{i,t-n}/K_{i,t-n-1}$	-0.792***	$\Delta \log UC_{i,t-3}$	0.255 (0.299)
$\Delta \log S_{i,t}$	1.738 (0.151)***	$\Sigma \Delta \log UC_{i,t-n}$	-0.154***
$\Delta \log S_{i,t-1}$	0.725 (0.109)***	$CF_{i,t}/K_{i,t-1}$	0.197 (0.241)
$\Delta \log S_{i,t-2}$	1.038 (0.167)***	$CF_{i,t-1}/K_{i,t-2}$	0.984 (0.283)***
$\Delta \log S_{i,t-3}$	0.597 (0.203)***	$CF_{i,t-2}/K_{i,t-3}$	-0.249 (0.293)

$\Sigma\Delta\log S_{i,t-n}$	4.098***	$CF_{i,t-3}/K_{i,t-4}$	0.744 (0.235)***
Wald 1(p value)	0.0000	$\Sigma CF_{i,t-n}/K_{i,t-n-1}$	1.676***
Wald 2 (p value)	0.0000	*Long Term Sales Elasticity*	2.287 (0.310)***
m2 (Statistics Value)	0.511	*Long Term User Cost of Capital Elasticity*	-0.086 (0.558)
Sargan (p value)	0.7046	*Long Term Cash Flow Elasticity*	0.935 (0.295)***

Note:

- See table 6.3 for details of variables, estimation technique, computation methods, Wald 1, Wald 2, m2 and Sargan Test.
- Instruments used are lags 2 to 5 of investment to capital ratio, lags 2 to 4 of sales growth, lags 1 to 5 of user cost of capital growth and lags 2 to 5 of cash flow to capital ratio.
- Statistics significant at 1%, 5% and 10% is denoted by ***, ** and * respectively.

Under the period of 1974-1985, sales growth, cash flow to capital ratio and user cost of capital growth has strong impact on investment, considering the total effects. Like most of the results of this study, this sample split on yearly basis also exhibit less smother investment process as depicted by the negative signs of lags of dependent variable. It implies that investment process in Pakistan is not a smooth process as far as the current sample period is concerned.

Effect of sales growth on investment for level and all its lags is strongly positive and significant. At the level, 1% increase in the sales growth leads to the significant 1.738% rise in firms' investment. All the lags of the sales growth discovered to be significant and positive. Considering the total effects, 1% increases in the sales growth leads to the significant 4.098% increase in the investment spending. It highlights the importance of sales accelerator mechanism in Pakistan. Long term sales growth elasticity also found out to be significant indicating that 1% permanent increase in the sales growth directs to the 2.287% rise in investment spending. Results are supportive of the sales accelerator mechanism in Pakistan under this time frame. The era from 1977-1988 is witness of increase in demand by the consumers. The

positive and significant effect of sales growth seems attributable to the economic conditions prevailing at that time.

We are particularly interested in the coefficient of user cost of capital growth to identify the relevance of interest rate channel. Under this period, contemporaneously, 1% rise in the user cost of capital growth significantly decreases the investment by 1.082%. The total effect of user cost of capital on firms' investment is discovered to be -0.154 and significant but long run user cost of capital elasticity found to be insignificant. It implies that at least for the short run user cost of capital growth discourages the firms' investment in Pakistan, under the period taken, thus supporting the relevance of interest rate channel in Pakistan.

For this period, cash flow has positive and significant impact on investment, leading to 1.676% significant increase in investment rate due to 1% rise in the cash flow to capital ratio, considering the total effect. At lags one and three, effect of the cash flow explored to be 0.984 and 0.744, respectively. Long run sensitivity of cash flow to capital ratio explored to be 0.935 indicating that 1% permanent increase in the cash flow to capital ratio contributes to the 0.935% rise in investment rate giving merit to significant role that cash flow plays in investment decisions by the firms.

From 1977-1988, financial aid from other countries, rise in domestic demand and increase in remittances skyrocketed that opened a new chapter of economic progress in Pakistan. The given reasons seems to explain the strong effect of cash flow to capital ratio, sales growth and user cost of capital growth on investment spending during this period. The stronger effects of these variables are due to the increased economic activity during this time frame.

Diagnostic tests reveal that instruments are valid and there is no problem of second order serial correlation. Time dummies and variables are also jointly significant.

To summarize, the results are evident of relevance of interest rate channel in affecting the firms' investment in Pakistan during this time frame. Sales and cash flow are found to be important determinant of investment decisions.

7.2.2 Time-wise Sample Split Empirical Results (1986-1997)

To analyze further, sample is divided from 1986-1997. Like the results of previous time period, this period is also expected to show remarked differences in results.

Table 7.4: Time-wise Sample Split (1986-1997), Dependent variable: $I_{i,t}/K_{i,t-1}$

Explanatory Variables	**Coefficients**	**Explanatory Variables**	**Coefficients**
$I_{i,t-1}/K_{i,t-2}$	-0.773 (0.054)***	$\Delta \log UC_{i,t}$	-1.586 (0.350)***
$I_{i,t-2}/K_{i,t-3}$	-0.530 (0.063)***	$\Delta \log UC_{i,t-1}$	-2.054 (0.412)***
$I_{i,t-3}/K_{i,t-4}$	-0.181 (0.035)***	$\Delta \log UC_{i,t-2}$	-1.735 (0.399)***
$\Sigma I_{i,t-n}/K_{i,t-n-1}$	-1.484***	$\Delta \log UC_{i,t-3}$	-0.758 (0.248)***
$\Delta \log S_{i,t}$	0.415 (0.325)	$\Sigma \Delta \log UC_{i,t-n}$	-6.133***
$\Delta \log S_{i,t-1}$	1.962 (0.403)***	$CF_{i,t}/K_{i,t-1}$	-0.928 (0.344)***
$\Delta \log S_{i,t-2}$	0.992 (0.382)***	$CF_{i,t-1}/K_{i,t-2}$	-0.788 (0.250)***
$\Delta \log S_{i,t-3}$	-0.313 (0.333)	$CF_{i,t-2}/K_{i,t-3}$	-0.068 (0.206)
$\Sigma \Delta \log S_{i,t-n}$	3.056***	$CF_{i,t-3}/K_{i,t-4}$	1.170 (0.192)***
Wald 1(p value)	0.0000	$\Sigma CF_{i,t-n}/K_{i,t-n-1}$	-0.614***
Wald 2 (p value)	0.0000	*Long Term Sales Elasticity*	1.230 (0.457)***
m2 (Statistics Value)	0.312	*Long Term User Cost of Capital Elasticity*	-2.469 (0.485)***
Sargan (p value)	0.8299	*Long Term Cash Flow Elasticity*	-0.247 (0.279)

Note:

- See table 6.3 for details of variables, estimation technique, computation method, Wald 1, Wald 2, m2 and Sargan Test.
- Instruments used are lags 2 to 5 of investment to capital ratio, lags 2 to 4 of sales growth, lags 1 to 5 of user cost of capital growth and lags 2 to 5 of cash flow to capital ratio.
- Statistics significant at 1%, 5% and 10% is denoted by ***, ** and * respectively.

As is the case with other results of this study, in the case of sample period 1986-1997 investment process is not a smooth process.

Total effects of sales growth on investment ratio discovered to be positively and significantly affecting the investment of the firms. Jointly, 1% increase in the sales growth leads to the significant 3.056% rise in the firms' investment rate. First and second lags of sales growth explored to be positive and significant. Long term sales growth elasticity indicates that 1% permanent increase in the sales growth results in the 1.230% rise in investment giving weightage to the sales accelerator mechanism in Pakistan during this period as well.

Total effect of user cost of capital growth on firms' investment explored to be highly significant in negatively affecting the investment spending. In the same time period, 1% increase in the user cost of capital growth contributes to the significant 1.586% fall in firms' investment ratio. All the lags of the user cost of capital growth discovered to be negative and significant. For the period under consideration, 1% rise in the user cost of capital growth significantly declines the investment ratio by 6.133%, considering the total effect. Long run elasticity of this variable also explored to be significant indicating that 1% permanent increase in the user cost of capital growth results in the fall of investment rate of the firms by 2.469%. The negative effects of the user cost of capital growth on investment ratio points out towards the relevance of strong interest rate channel.

The negative signs of cash flow at level and second lag of the cash flow to capital ratio indicate that firms' investment is insensitive to the cash flow during these years. The total effect of cash flow to capital ratio on firm investment also turned out to be significant but negatively affecting the firms' investment. Only at third lag, effect of

cash flow to capital ratio on investment ratio turned out to be positively and significantly affecting the firm investment implying sort of cyclical process as discussed by the Butzen *et al.* (2001). The long run effects of cash flow to capital ratio explored to be insignificant and negative.

All the diagnostic tests reveal that model is significant and correctly specified. There is no clue that instruments are not valid. All the time dummies and the explanatory variables are jointly significant.

To summarize, under the given time frame a strong interest rate channel is found relevant in affecting the firms' investment during this period. Sales growth and cash flow positively affects the investment spending during this time frame.

7.2.3 Time-wise Sample Split Empirical Results (1998-2010)

The period from 1998-2010 is of crucial importance due to the events occurred during this time frame. During this period, Pakistan was affected by the floods, war on terror and political upheaval. Pakistan witnessed both the dictatorship and democracy during this era.

Table 7.5: Time-wise Sample Split (1998-2010), Dependent variable: $I_{i,t}/K_{i,t-1}$

Explanatory Variables	Coefficients	Explanatory Variables	Coefficients
$I_{i,t-1}/K_{i,t-2}$	-0.104 (0.022)***	$\Delta\log UC_{i,t}$	0.247 (0.235)
$I_{i,t-2}/K_{i,t-3}$	-0.200 (0.020)***	$\Delta\log UC_{i,t-1}$	0.104 (0.398)
$I_{i,t-3}/K_{i,t-4}$	-0.065 (0.015)***	$\Delta\log UC_{i,t-2}$	-0.682 (0.340)**
$\Sigma I_{i,t-n}/K_{i,t-n-1}$	-0.369***	$\Delta\log UC_{i,t-3}$	-0.995 (0.240)***
$\Delta\log S_{i,t}$	0.234 (0.514)	$\Sigma\Delta\log UC_{i,t-n}$	-1.326***
$\Delta\log S_{i,t-1}$	-1.658 (0.451)***	$CF_{i,t}/K_{i,t-1}$	8.271 (0.215)***
$\Delta\log S_{i,t-2}$	-1.406 (0.398)***	$CF_{i,t-1}/K_{i,t-2}$	0.190 (0.239)
$\Delta\log S_{i,t-3}$	-0.873 (0.315)***	$CF_{i,t-2}/K_{i,t-3}$	0.999 (0.205)***

$\Sigma\Delta\log S_{i,t-n}$	-3.703***	$CF_{i,t-3}/K_{i,t-4}$	-0.036 (0.125)
Wald 1(p value)	0.0000	$\Sigma CF_{i,t-n}/K_{i,t-n-1}$	9.424***
Wald 2 (p value)	0.0000	*Long Term Sales Elasticity*	-2.705 (0.984)***
m2 (Statistics Value)	0.267	*Long Term User Cost of Capital Elasticity*	-0.968 (0.798)
Sargan (p value)	0.4151	*Long Term Cash Flow Elasticity*	6.884 (0.322)***

Note:

- See table 6.3 for details of variables, estimation technique, computation methods, Wald 1, Wald 2, m2 and Sargan Test.
- Instruments used are lags 2 to 5 of investment to capital ratio, lags 2 to 4 of sales growth, lags 1 to 5 of user cost of capital growth and lags 2 to 5 of cash flow to capital ratio.
- Statistics significant at 1%, 5% and 10% is denoted by ***, ** and * respectively.

For the period 1998-2010, effect of sales growth explored to be negative. Only contemporaneous effects of sales growth on investment ratio discovered to be positive but insignificant. It implies that during the given period investment decisions by firms are not sensitive to the sales growth.

The effect of the user cost of capital growth exhibit kind of a cyclical process. Lag two and three of the user cost of capital growth found to be -0.682 and -0.995, respectively while user cost of capital at level and effects of first lag explored to be insignificant. Total effect of user cost of capital growth discovered to be -1.326 indicating that 1% increase in the user cost of capital growth results in the 1.326% decline in investment spending while the long term user cost of capital growth effects found to be insignificant. It indicates that at least in the short run user cost of capital has significant and negative effects on investment spending. The results under this regime also support the relevance of interest rate channel as indicated by the negative effect of user cost of capital growth on firms' investment spending.

For this period, cash flow has highly significant impact on firms' investment decisions. Contemporaneously, 1% increases in the cash flow to capital stock ratio contributes to the 8.271% rise in investment spending, significant at the 1% level.

Considering the total effects, 1% increase in the firms' cash flow to capital ratio leads to the 9.424% increase in the investment spending. Third and first lag discovered to be insignificant while second lag found to be 0.999, significant at the 1% level. Long run cash flow to capital ratio also explored to be significant and positive (6.884). Such high magnitude of the cash flow to capital ratio is due to the fact that during this period firms were credit constrained, because banks were investing most of their portfolio in the government securities thus leading to the shortage of credit for the private sector. Due to this reason, during this time frame firms aggressively based their investment decisions on cash flow.

During this time period, investment ratio explored to be insensitive to the sales growth, highly responsive to the cash flow to capital ratio while negatively reactive to user cost of capital growth.

Total effects of user cost of capital explored to be -0.154,-6.133 and -1.326 for the periods 1974-1985, 1986-1997 and 1998-2010, respectively. Result shows that interest rate channel has been strongest in the period of 1986-1997. It implies that effects of monetary contraction on the investment have been strongest during the period of 1986-1997. Total effects of the sales growth on investment have been strongest in the period of 1974-1985 while the effects of cash flow to capital stock ratio on investment ratio have been strongest during the time frame of 1998-2010.

For this time wise sample split, model is correctly specified; having valid instruments and suffers from no second order serial correlation problem.

To conclude, for every time wise sample split a strong interest rate channel is found relevant in Pakistan while the effect of monetary contraction has been strongest during 1986-1997.

As the results shows that effects of monetary policy are heterogeneous, this study conduct a sectoral investigation to explore the effect of monetary policy on firms' investment for the textile cotton, textile synthetic and chemical sector in the next chapter.

Chapter 8

MONETARY POLICY, USER COST OF CAPITAL AND FIRMS' INVESTMENT: A SECTORAL INVESTIGATION

There is clear evidence that monetary policy affects the firms' investment through the interest rate as well as broad credit channel but it is interesting to figure out that whether the monetary policy affects all the subgroups of the manufacturing sector by the same magnitude or any difference prevails. Thus, it is intrigue enough to investigate the investment behavior of different sub groups of the manufacturing sector.

This study investigates the Textile cotton**,** textile synthetic and chemical sector. Other sectors could not be worked out due to limitation of time. Only sectors having sufficient number of firms were chosen for analysis purpose. The sectors were not divided into small and large firms due to small number of firms in each sector and concentration was given to find out the interest rate channel only, identified by the user cost of capital. Since standard errors for the GMM two step estimation method suffers from small sample bias as documented by the Bryson (2009), estimation of chemical and textile synthetic sector is conducted by GMM one step estimation while the textile cotton sector is analyzed by using GMM two step estimation.

8.1 TEXTILE COTTON SECTOR

Manufacturing sector of Pakistan is largely consisted on the textile firms. Textile sector of Pakistan contributes 8% in GDP, provides 40% employment to the industrial labor force and 60% exports constitutes on textile products[19]. The growth of Pakistan's manufacturing sector has been concentrated in the textile sector. Special

[19] See Economic Survey of Pakistan (2012-2013)

policies are announced by the government to facilitate the textile sector. Hence, considering its importance in Pakistan's manufacturing sector, it is of immense importance to figure out that whether interest rate channel operates for this sector or not and what are those factors that determines the investment behavior of textile sector. This study analyzed the 206 textile cotton firms for the time period 1974-2010. The results are presented in table 8.1:

Table 8.1: Textile Cotton Sector, Dependent variable: $I_{i,t}/K_{i,t-1}$

Explanatory Variables	**Coefficients**	**Explanatory Variables**	**Coefficients**
$I_{i,t-1}/K_{i,t-2}$	-0.323 (0.004)***	$\Delta \log UC_{i,t}$	-0.382 (0.024)***
$I_{i,t-2}/K_{i,t-3}$	-0.364 (0.002)***	$\Delta \log UC_{i,t-1}$	-0.397 (0.017)***
$I_{i,t-3}/K_{i,t-4}$	-0.385 (0.002)***	$\Delta \log UC_{i,t-2}$	-0.069 (0.018)***
$\Sigma I_{i,t-n}/K_{i,t-n-1}$	-1.072***	$\Delta \log UC_{i,t-3}$	-0.424 (0.012)***
$\Delta \log S_{i,t}$	0.390 (0.031)***	$\Sigma \Delta \log UC_{i,t-n}$	-1.272***
$\Delta \log S_{i,t-1}$	0.260 (0.021)***	$CF_{i,t}/K_{i,t-1}$	4.468 (0.040)***
$\Delta \log S_{i,t-2}$	0.530 (0.015)***	$CF_{i,t-1}/K_{i,t-2}$	-0.019 (0.037)
$\Delta \log S_{i,t-3}$	0.287 (0.009)***	$CF_{i,t-2}/K_{i,t-3}$	0.748 (0.023)***
$\Sigma \Delta \log S_{i,t-n}$	1.467***	$CF_{i,t-3}/K_{i,t-4}$	1.046 (0.016)***
Wald 1(p value)	0.0000	$\Sigma CF_{i,t-n}/K_{i,t-n-1}$	6.243***
Wald 2 (p value)	0.0000	*Long Term Sales Elasticity*	0.708 (0.031)***
m2 (Statistics Value)	0.016	*Long Term User Cost of Capital Elasticity*	-0.614 (0.025)***
Sargan (p value)	0.1128	*Long Term Cash Flow Elasticity*	3.013 (0.033)***

Note:

- See table 6.3 for details of variables, estimation technique, computation method, Wald 1, Wald 2, m2 and Sargan Test.
- Instruments used are lags 2 to 4 of investment to capital ratio, lags 1 to 3 of sales growth, lags 1 to 3 of user cost of capital growth and lags 2 to 4 of cash flow to capital ratio.
- Statistics significant at 1%, 5% and 10% is denoted by ***, ** and * respectively.

Results explored to be in line with literature. It is discovered that for textile cotton sector sales growth is an important determinant to accelerate the investment. Contemporaneously, 1% increase in sales growth turned out to be significantly and

positively affecting the firms' investment by 0.390%. All the lags of sales growth also discovered to be positive and significant at the 1% level. Total effects discovered to be 1.467, significant at the 1% level implying that 1% rise in sales growth results in 1.467% increase in investment rate. Long run sales growth elasticity also explored to be significant. Long run sales growth elasticity implies that 1% permanent increase in sales growth leads to the 0.708% increase in investment rate. Results points out towards sales accelerator mechanism operating in case of textile cotton sector of Pakistan. Textile cotton sector build up its capital if it expects its demand to rise.

Effect of user cost of capital growth on investment also proved effective in case of textile cotton sector. It is explored that at the level, 1% increase in the user cost of capital growth contributes to the 0.382% fall in investment. All the lags of user cost of capital growth turned out to be negative and significant at the 1% level. Total effects of user cost of capital growth indicates that 1% increase in the user cost of capital growth results in fall in investment rate by 1.272%. Long run elasticity of user cost is also explored significant. In the long run, 1% permanent increase in the user cost of capital growth results in 0.614% fall in investment spending. This is indicative of the notion that monetary policy significantly and negatively affects the investment spending in textile cotton sector through the interest rate channel. The strong effects of monetary policy on investment through interest rate channel in case of the textile sector is due to the reason that textile sector is highly dependent on the banking sector for its financial needs. It is evident that 40% of credit by banks to the manufacturing sector is used by the textile sector[20]. Due to this high dependence on borrowing by textile sector, contractionary monetary policy increases the borrowing cost for the textile sector.

[20] See Economic Survey of Pakistan (2012-2013) for reference.

Cash flow is considered an important determinant of firms' investment. It is explored that in case of textile cotton sector, investment is substantially affected by the cash flow. At level, 1% increase in the cash flow to capital ratio contributes to the 4.468% increase in investment ratio of the textile cotton sector. At the second and third lag the effect of cash flow on investment found to be positive and significant at the 1% level. Total effects points out that 1% rise in the cash flow to capital stock ratio lead to the 6.243% increase in investment. The long run cash flow elasticity also explored to be significant and positive. In the long run, 1% permanent increase in the cash flow to capital ratio results in the 3.013% rise in investment spending. Results reveal that cash flow is an important determinant of investment in case of textile cotton sector. Investment behavior of textile cotton sector is largely determined by the cash flow.

Diagnostic test points out that instruments applied by this study are valid and there is no problem of second order serial correlation among the residuals. The effect of time dummies and all explanatory variables explored to be jointly significant at the 1% level.

To summarize, it is explored that monetary policy has significant impact on the textile cotton sector and this sector is positively affected by the sales and cash flow.

8.2 TEXTILE SYNTHETIC SECTOR

The textile synthetic sector is of vital importance since it produces many kinds of valuable garments. Textile synthetic Products include swimsuits, fire resistant suits and blend of synthetic fiber with cotton. It is of immense importance for a country's needs. Hence, this study investigates that whether this sector is influenced by the user cost of capital (interest rate channel) or not and examines the factors affecting the

investment decisions. This study analyzed the 32 firms of the textile synthetic sector for the period 1974-2010. The detailed results are discussed in the table 8.2:

Table 8.2: Textile Synthetic Sector, Dependent variable: $I_{i,t}/K_{i,t-1}$

Explanatory Variables	**Coefficients**	**Explanatory Variables**	**Coefficients**
$I_{i,t-1}/K_{i,t-2}$	-0.735 (0.058)***	$\Delta \log UC_{i,t}$	-0.011 (0.236)
$I_{i,t-2}/K_{i,t-3}$	-0.814 (0.103)***	$\Delta \log UC_{i,t-1}$	-0.047 (0.217)
$I_{i,t-3}/K_{i,t-4}$	-0.577 (0.203)***	$\Delta \log UC_{i,t-2}$	-0.182 (0.284)
$\Sigma I_{i,t-n}/K_{i,t-n-1}$	-2.126***	$\Delta \log UC_{i,t-3}$	0.189 (0.241)
$\Delta \log S_{i,t}$	0.101 (0.101)	$\Sigma \Delta \log UC_{i,t-n}$	-0.051
$\Delta \log S_{i,t-1}$	0.251 (0.109)**	$CF_{i,t}/K_{i,t-1}$	0.616 (0.506)
$\Delta \log S_{i,t-2}$	0.351 (0.149)**	$CF_{i,t-1}/K_{i,t-2}$	0.827 (0.479)*
$\Delta \log S_{i,t-3}$	0.213 (0.118)*	$CF_{i,t-2}/K_{i,t-3}$	0.236 (0.559)
$\Sigma \Delta \log S_{i,t-n}$	0.916	$CF_{i,t-3}/K_{i,t-4}$	1.699 (0.549)***
Wald 1(p value)	0.0000	$\Sigma CF_{i,t-n}/K_{i,t-n-1}$	3.378**
Wald 2 (p value)	NA	*Long Term Sales Elasticity*	0.293 (0.126)**
m2 (Statistics Value)	0.686	*Long Term User Cost of Capital Elasticity*	-0.016 (0.264)
Sargan (p value)	0.9610	*Long Term Cash Flow Elasticity*	1.081 (0.521)**

Note:

- GMM one step estimates
- See table 6.3 for details of variables, computation method, Wald 1, Wald 2, m2 and Sargan Test.
- Instruments used are lags 1 to 2 of investment to capital ratio, lags 1 to 2 of sales growth, lags 1 to 2 of user cost of capital growth and lags 1 to 2 of cash flow to capital ratio.
- Statistics significant at 1%, 5% and 10% is denoted by ***, ** and * respectively.

Results reveal that sales growth accelerates the investment spending of this sector positively and significantly. Contemporaneous effects of sales growth on investment rate found insignificant. At the first, second and third lags, effect of sales growth on investment rate found to be positive and significant, 0.251, 0.351 and 0.213, respectively while total effects explored to be insignificant. Long run sales growth elasticity explored to be positive and significant at the 5% level indicating that 1% permanent increase in the sales growth leads to the 0.293% increase in investment rate

by textile synthetic sector in Pakistan. It indicates that sales accelerator mechanism works for the textile synthetic sector.

User cost of capital is used as a proxy of the interest rate channel. In case of this study, contemporaneous as well as all lags of user cost of capital discovered to be insignificant. Long run user cost of capital elasticity also explored to be insignificant. Result depicts that interest rate channel is not effective in the case of textile synthetic sector and investment of this sector is affected by the sales and cash flow.

Cash flow is considered an important determinant of corporate investment. In case of this study, only first and third lags explored to be significant indicating sort of a cyclical process. In other words, this cyclical process implies that investment of this sector is significantly affected after a gap of one year. Result of first lag reports that 1% increase in the cash flow to capital ratio contributes to the 0.827% rise in investment rate. Total effects as well as long run cash flow elasticity also discovered to be significant. Considering the total effects, 1% increase in the cash flow to capital stock ratio results in rise in investment by 3.378%. In the long run, 1% permanent rise in the cash flow to capital ratio results in 1.081% increase in investment rate. Hence, in the long run as well as short run cash flow is an important determinant of investment for the textile synthetic sector.

As far as diagnostic tests are concerned, J statistics value accepts the null hypothesis that instruments are valid and the second order serial correlation test indicates that there is no problem of serial correlation among the residuals. All the explanatory variables found to be jointly significant while the significance of the time dummies could not be computed because of inability to compute the restriction variance.

To conclude, monetary policy doesn't affect the textile synthetic sector via interest rate channel. It is also of important note that the investment of textile synthetic sector is positively affected by cash flow and sales.

8.3 CHEMICAL SECTOR

Chemical sector of any country plays an important role in the economic development. Since Pakistan is an agrarian country, chemicals industry is of immense importance because of producer of fertilizers and pesticides that are necessary inputs for the cultivation. Chemical sector of Pakistan mainly produces fertilizer, pesticides, dyes and medicines. This sector in Pakistan is consisted on small scale firms thus suffers from diseconomies of scale. Hence, Pakistan has to rely on imported chemicals to fulfill needs of agriculture and industry. Chemical sector is considered capital intensive in nature. Chemical sector of Pakistan suffers from the problem of low research and development expenditures[21]. Chemical sector of Pakistan grew at the rate of 16.35% in 2012 as compared to 2011[22]. Considering the importance of this sector, this study aims to figure out its investment behavior and whether monetary policy affects this sector or not. This study has taken into account 37 firms of chemical sector for the analysis purpose.

Table 8.3: Chemical Sector, Dependent variable: $I_{i,t}/K_{i,t-1}$

Explanatory Variables	Coefficients	Explanatory Variables	Coefficients
$I_{i,t-1}/K_{i,t-2}$	-0.046 (0.077)	$\Delta \log UC_{i,t}$	-0.336 (0.110)***
$I_{i,t-2}/K_{i,t-3}$	-0.147 (0.031)***	$\Delta \log UC_{i,t-1}$	-0.133 (0.169)
$I_{i,t-3}/K_{i,t-4}$	-0.083 (0.039)**	$\Delta \log UC_{i,t-2}$	-0.615 (0.227)***
$\Sigma I_{i,t-n}/K_{i,t-n-1}$	-0.276***	$\Delta \log UC_{i,t-3}$	-0.299 (0.201)
$\Delta \log S_{i,t}$	0.089 (0.175)	$\Sigma \Delta \log UC_{i,t-n}$	-1.383***

[21] See Implication of liberalizing Trade and investment with India (2005)
[22] See Economic Survey of Pakistan (2012-13)

$\Delta \log S_{i,t-1}$	-0.049 (0.290)	$CF_{i,t} / K_{i,t-1}$	-0.202 (0.325)
$\Delta \log S_{i,t-2}$	-0.126 (0.243)	$CF_{i,t-1} / K_{i,t-2}$	-0.702 (0.321)**
$\Delta \log S_{i,t-3}$	-0.042 (0.254)	$CF_{i,t-2} / K_{i,t-3}$	0.590 (0.198)***
$\Sigma \Delta \log S_{i,t-n}$	-0.128	$CF_{i,t-3} / K_{i,t-4}$	0.540 (0.172)***
Wald 1(p value)	0.0000	$\Sigma CF_{i,t-n} / K_{i,t-n-1}$	0.226***
Wald 2 (p value)	NA	*Long Term Sales Elasticity*	-0.100 (0.561)
m2 (Statistics Value)	0.030	*Long Term User Cost of Capital Elasticity*	-1.084 (0.441)***
Sargan (p value)	0.9999	*Long Term Cash Flow Elasticity*	0.177 (0.393)

Note:

- GMM one step estimates
- See table 6.3 for details of variables, computation method, Wald 1, Wald 2, m2 and Sargan Test.
- Instruments used are lags 2 to 3 of investment to capital ratio, lags 2 to 3 of sales growth, lags 2 to 3 of user cost of capital growth and lags 2 to 4 of cash flow to capital ratio.
- Statistics significant at 1%, 5% and 10% is denoted by ***, ** and * respectively.

Results reveal that both the short and long term sales growth effects turned out to be insignificant and negative. Contemporaneous effect found to be positive but insignificant. It indicates that sales don't affect the investment spending in case of chemical sector of Pakistan.

The effect of user cost of capital growth on investment rate is of particular interest for this study. Contemporaneous effect and second lag explored to be highly significant at the 1% significance level. At the level, 1% increase in the user cost of capital growth discourages the investment spending by 0.336% while after two years by 0.615%. The effect of user cost of capital discovered to be significantly and negatively affecting the investment after gap of one year indicating sort of cyclical process as documented by Butzen *et al.* (2001). Total effects also explored to be highly significant in negatively affecting the investment rate. In the long run, 1% permanent rise in the user cost of capital growth results in fall in investment by 1.084%. User cost of capital discovered to be significantly affecting the investment rate negatively in the short run as well as

long run. Overall results supports that monetary policy affects the chemical sector investment through the interest rate channel.

The overall effect of cash flow to capital ratio on investment rate discovered to be positive in case of chemical sector. Second and third lags explored to be significant and positive. The second lag indicates that 1% increase in the cash flow to capital stock ratio results in increase in investment rate by 0.590% and after three years by 0.540%. Most of the firms in chemical sector are small due to which chemical sector exhibits positive investment to cash flow sensitivity. Total effects also discovered to be significant (0.226). Long run cash flow to capital ratio elasticity found to be insignificant indicating that in the long run cash flow doesn't play important role in the determination of investment by the firms of chemical sector.

Cross sector analysis on the base of long run effects of textile cotton, textile synthetic and chemical sector indicates that the effect of user cost of capital on investment spending is highest in case of chemical sector while explored insignificant for the textile synthetic sector. It implies that the chemical sector is affected more strongly by the monetary contraction then the textile cotton sector while the interest rate channel doesn't significantly operate for the textile synthetic sector as indicated by the insignificant effects of user cost of capital growth on investment. Investment rate in case of sample used by this study explored to be on average 0.311, 0.294 and 0.199 for chemical, textile cotton and textile synthetic sectors respectively that explains why chemical sector is affected most strongly by the monetary contraction while textile synthetic sector is not significantly affected by monetary actions. The same picture emerges in case of on average capital stock. It is argued by the Karim (2012) that capital intensive sectors are affected more strongly by the monetary contraction then the labor intensive sectors giving weightage to the results of this study. Effects of cash

flow on investment have been strongest for the textile cotton sector as far as the total effects are concerned. Likewise, considering the long term effects, effect of sales is more profound in case of textile cotton sector then the textile synthetic sector while sales explored insignificant for the chemical sector.

GMM requires that there should be no problem of second order serial correlation among the transformed residuals and validity of the instruments should be tested. Second order serial correlation test and Sargan test indicates that model doesn't suffer from the problem of second order serial correlation among the residuals and instruments used found to be highly valid. Jointly, explanatory variables explored to be significant at the 1% level but time dummies could not be computed due to inability to compute restrictions variance.

To conclude, interest rate channel explored to be operative in case of chemical and textile cotton sectors while interest rate channel is not operating for the textile synthetic sector.

In the next chapter, this study briefly concludes the results and presents the policy implications on the base of results.

Chapter 9

CONCLUSIONS AND POLICY RECOMMENDATIONS

9.1 CONCLUSIONS

This study explores the relevance of interest rate and broad credit channel in Pakistan using disaggregated firm level data of manufacturing sector during the period 1974-2010. Neo-classical investment model is adopted for this purpose. The results have shown many interesting dimensions and features. Interest rate channel is identified through the user cost of capital growth while broad credit channel is detected by using cash flow to capital stock ratio. The results of full sample depict that firms' investment decisions are affected negatively by the user cost of capital growth while positively by the cash flow to capital stock ratio and sales growth. The results of full sample are indicative of relevance of a strong interest rate channel in Pakistan through which monetary policy affect the investment, thus affecting aggregate demand and inflation. Thus the hypothesis that monetary policy affects the business fixed investment spending through the interest rate channel and the sales growth leads to the rise in firms' investment is accepted in case of Pakistan.

It is evident in the literature on monetary transmission mechanism that monetary policy has heterogeneous effects upon the firms. The effect of sales growth is explored to be more profound for small firms as compared with large firms due to higher borrowing cost in case of small firms because of the severe information asymmetries. It leads to the acceptance of hypothesis that sales accelerate the investment spending. Large firms' investment discovered to be more sensitive to user cost of capital growth than small firms due to the large firms' greater access to bank borrowing and other sources of external finance. Thus the hypothesis that the

monetary policy exhibit heterogeneous effect for the firms having different financial position is strongly accepted. It is argued that the small firms, that face the problem of informational asymmetries, rely more on internal generated funds due to the higher cost of borrowing. Results of this study support this notion. Small firms discovered to be more sensitive to the cash flow then large firms indicating the existence of strong broad credit channel in Pakistan. The existence of strong broad credit channel in Pakistan indicates that effects of monetary contraction are intense for the small firms as compared with large firms. Thus the hypothesis is accepted that effects of monetary policy are heterogeneous and the monetary policy affects the business fixed investment spending through the broad credit channel as well in Pakistan.

This study figured out that whether monetary policy affect the firms' investment through the user cost of capital by the same magnitude or not under different time periods, particularly before and after financial sector reforms. The results of pre and post financial sector reforms period depict that sales growth affects the firms' investment positively in the short and long run in the pre reform period while in the post reform era, only contemporaneous firms' investment is influenced positively by the sales growth. It indicates that for both periods sales accelerate the firms' investment while the effect of sales growth on the firms' investment has been strongest in the pre reform era due to the problem of credit availability during this period. The effect of user cost of capital growth found to be higher after the financial sector reforms as compared with pre reforms era indicating the strengthening of monetary policy due to the market based monetary management rather than subsidized and directed credit at low rates. It leads to the acceptance of the hypothesis that the firms' investment is affected differently after the financial sector reforms. The

sensitivity of cash flow to investment ratio explored to be higher after the reforms than the pre reform era due to the higher cost of borrowing in the post reform era.

For the period 1974-1985, sales growth and cash flow to capital ratio explored to be positively affecting the investment rate while user cost of capital growth found out to be negatively affecting the investment spending. Interest rate channel explored to be operative for this period. Financial aid from abroad, rise in domestic demand and increase in remittances during this period explains the significant effects of the user cost of capital, cash flow and sales. During the time period 1986-1997, sales growth, cash flow to capital ratio and user cost of capital growth found significant with expected signs for most of the lags. Effects of the monetary policy through the user cost of capital discovered to be highly significant for this period.

For the period 1998-2010, firms' investment explored to be insensitive to the sales growth, negatively affected by user cost of capital growth while positively sensitive to the cash flow. Under this era, sales accelerator mechanism is not operative for the firms of manufacturing sector while interest rate channel is discovered relevant in affecting the investment spending. Time-wise comparison of results explored that the impact of monetary policy on firms' investment through the user cost of capital has been strongest in the period of 1986-1997. Effect of cash flow and sales discovered to be strongest during 1998-2010 and 1974-1985 respectively.

Monetary policy exerts different effects on different sectors of the economy. It is evident that different subsectors of the manufacturing sector behave differently in terms of monetary policy effects. This study analyzed the textile cotton, textile synthetic and chemical sector to gauge the impact of monetary policy on investment

through the interest rate channel. Hypothesis set by this study that the different sectors are affected differently by the monetary policy is accepted.

Investment of textile cotton sector explored to be negatively affected by the user cost of capital growth while positively affected by the cash flow to capital ratio and sales growth. Results are evident of the fact that monetary policy affects the investment spending of textile cotton sector by altering the user cost of capital. The hypothesis that sale is an important factor determining the investment is accepted in this case.

Investment of textile synthetic sector is explored to be positively affected by the sales growth and cash flow to capital ratio while both short and long term effects of user cost of capital turned out to be insignificant. It indicates that monetary policy through the user cost of capital or interest rate channel doesn't affect the investment spending of textile synthetic sector. In other words, interest rate channel is not operational for this sector.

In the case of chemical sector sales growth has insignificant effect on investment ratio both in short and long term leading to the conclusion that sales doesn't play significant role in determination of chemical sector investment. Investment spending of the chemical sector explored to be positively affected by cash flow while negatively affected by the user cost of capital. Results points out that the monetary policy through the user cost of capital or interest rate channel affects investment spending of chemical sector.

Sector wise comparison indicates that the effect of monetary policy through the interest rate channel has been strongest for the chemical sector. The strong effects of user cost of capital in this case is due to the notion that capital intensive sectors like

chemical are affected more by monetary contraction. Effects of sales growth and cash flow discovered to be strongest for the textile cotton sector.

9.2 POLICY RECOMMENDATIONS

On the base of above analysis this study presents the following policy recommendations in order to incorporate in the monetary policy formulation by the monetary authorities:

- Interest rate drives all the transmission channels of monetary policy whether it is interest rate channel, broad credit channel, exchange rate channel or asset price channel. Thus monetary authorities can influence the investment by changing the interest rate. By altering the policy rate central bank can control the investment, thus inflation and aggregate demand.
- Monetary authorities should take into account the balance sheet positions of firms of different sizes in the formulation of monetary policy because firms having severe informational asymmetries, usually small firms, found to be affected more by monetary contraction than the large firms. In other words, monetary policy exerts distributional effects and policy rate should be set by considering the financial condition of firms of different sizes.
- Monetary authorities should consider the financial position of different sectors in their monetary policy formulation since each sector is affected in a different way by monetary policy due to different financial conditions.

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