Financial Development and Agricultural Output in Pakistan

A dissertation submitted in partial fulfillment of the requirement for the degree of

Master of Philosophy in Economics

By

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17/M-Phil/PIDE/2008

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November, 2011

CERTIFICATE

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Abbreviations

ACAC	Agriculture Advisory Credit Council
ADBP	Agriculture Development Bank of Pakistan
ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
CUSUM	Cumulative Sum
CUSUMQ	Cumulative Sum of Squares
ECM	Error Correction Model
FBC	Federal Bank of Co-operatives
GDP	Gross Domestic Product
LM	Lagrange Multiplier
MPC	Marginal Propensity to Consume
NCCC	National Credit Consultative Council
OLS	Ordinary Least Square
PCA	Principal Component Analysis
PSCAC	Private Sector Credit Advisory Council
SBC	Schwartz Bayesian Criterion
SBP	State Bank of Pakistan
χ^2	Chi-Square

Acknowledgment

I wish to express my gratitude to my supervisor, Dr. Muhammad Idrees Khawaja, who has been helpful and offered invaluable assistance, support, and guidance throughout the study. His vital encouragement, support and advice from the preliminary to the concluding level enabled me to develop an understanding of the study. His supervision in developing the theoretical framework, hypothesis of the study and analysis of empirical results played a key role in the completion of this thesis. The editorial counseling that he offered has not only brought conceptual clarity into the script but has cast an imprint on my writing style that will be with me in times to come. It would have been next to impossible to complete this thesis without the help and guidance of my supervisor.

The dissertation has also benefited from comments offered by the external referee; Dr. Arshad Khan. The detailed comments offered by him, despite his busy schedule, have helped me a lot in improving this thesis. I owe thanks to him for his guidance on model specification and related issues. I remain indebted to him.

Special thanks are due to Dr. Ejaz Ghani, the Head of M-Phil Programme, for his understanding and assistance. He had provided a tough deadline that encouraged me to decide upon a topic for the dissertation and then firmly stick to that. Special thanks are also owed to the faculty members including Dr. Waqar Masood, Dr. Rehana Siddiqui, Dr. Muslehuddin, Dr. Muhammad Iqbal, Dr. Abdul Qayyum, Dr Etezaz Ahmed, Dr. Wasim Shahid, and Dr. Zafar Iqbal who taught me M-Phil courses. The concepts and understanding conveyed by them have certainly benefited this study.

Thanks are also due to all my graduate friends, especially my batch-mate; Muhammad Ramzan whose advice offered and time spent on the application of econometric techniques to the study has been enormous. I would also like to convey thanks to the Administration and I.T. department for providing the library and laboratory facilities.

Taking up the M-Phil task would not have been possible without the time and money my father had spent on me. He ensured that I go to good educational institutes of the time. Taking up the task would

not have been possible without the wishes and guidance of my mother as well who ensured that I give sufficient time to study since my childhood and persuaded me to go for further studies after my Masters. The moral support of my brothers and In-Laws throughout has been a good source of inspiration.

The lone sufferer, of the effort that has gone into this, has been my husband, *Haider*. His moral support during the dissertation work had made me stand up to the task. I would like to convey special thanks to him for the help and inspiration he extended. And thanks to All Mighty Allah, Who has made all the things possible for me.

Syeda Sidra Batool

Abstract

The study examines the relationship between financial development and agricultural output in Pakistan using annual data for the period 1972-2010. The study employs models to capture the interrelationship among financial development, agricultural investment, agricultural credit and agricultural output. The specific objective of the study is to examine the impact of financial development on output of the agriculture sector. To characterize the indirect impact of financial development on agricultural output, the study has also examined the impact of financial development on agriculture credit and agriculture investment. The results suggest that financial development does not exert statistically significant impact on agricultural output, agricultural credit, and private agricultural investment.

Chapter 1 Introduction

The importance of financial development in real sector has been the subject of immense discussion for many years. The theory lays emphasis upon the role of financial markets and institutions in determining long-run economic growth. Evidence suggests that there is indeed a strong positive association between financial development and economic growth. Financial development involves improvement in quality, quantity, efficiency, and competiveness of the services offered by financial intermediaries. The intermediaries include banks, stock exchanges, insurance firms, credit unions, microfinance institutions and money lenders, offering financial services to consumers, businesses, and other financial institutions[1]. A significant body of literature[2] argues that services provided by the financial sector are essential for economic development. Modern growth theory suggests that the financial development, by mobilizing savings and by facilitating the allocation of capital between competitive users, stimulate investment in new technologies across the economy, and thus increases overall productivity. The financial development has strong linkages with other sectors of the economy like external sector and real sector. The role of financial sector in explaining the components of productivity growth, specifically the role played in improving allocation of capital resources has remained the focus of policy makers' attention.

The importance of agriculture sector to any economy can be gauged from the fact that the sector provides food to consumers, fibers for the domestic industry, provides a market for industrial goods and above all stimulates economic growth. The agriculture sector of Pakistan is performing an important role in generating economic growth and its role in economic development cannot be denied as Pakistan is still characterized as an agricultural economy. It is the second largest sector of the economy with 21 percent contribution to GDP in the economy (FY 2010) and employs 45 percent of the Pakistan's labor force. The

[1] Financial Sector Team, UK (2004)
[2] Schumpeter (1911), McKinnon (1973), Shaw (1973), King and Levine (1993), and Greenwood and Jovanovic (1990)

agriculture sector is a primary supplier of raw materials for a number of industrial units, contributes substantially to exports and of course the sector is a source of food for the increasing population of Pakistan. However this growing agriculture sector needs adequate finance through banks to accelerate the overall growth. The financing needs in this sector for the production are met through infusion of agricultural credit or agricultural investment. Due to large rural population and low literacy rate in developing countries, usually the providers of financial services face distinct challenges when dealing with the agriculture sector. Various studies show three main factors as major contributors to agriculture growth[3]. These include: increased use of agricultural inputs, technological change, and technical efficiency. Improvement in these factors depends upon financial development in the economy. The discussion on the relationship between the relationship on financial development and agriculture output is adequately summed up by Abdullah et.al, (2009), by stating that the introduction of easy and cheap credit with an investor friendly environment will quickly boost agricultural growth.

1.1 Significance of the study

In the developing countries, financial intermediates play a vital role in facilitating economic growth at macro-level (Levine 2002). A more advanced intermediation facilitates to bring about allocation of funds to the most productive opportunities, thus resulting in rapid economic growth. Particularly, the development of financial system has greater impact on growth in developing countries than in mature economics because bank-based system is considered to generate greater impact on growth relative to the market-oriented system (Fase and Abma 2003, Iimi 2004, and Khan and Qayyum 2007). Hussain, *et al.* (2009) argues that the bank-based financial system matters more in Pakistan relative to market-oriented system. Therefore, banking industry is entrusted to facilitate the provision of financial services and solutions in most productive sectors of economy. The development of agriculture sector in Pakistan is more dependent on banking sector as low income groups or small farmers in agriculture sector are unable to save money due to number of reasons like personal needs and high prices of inputs. Farmers

[3] Won and Mao (1997), Abbas, *et al.* (2003), Ahmed and Munir (2005)

need credit for investing in agriculture and smoothening out seasonal variations in income[4]. Therefore using financial services to offer credit for buying inputs or increase capital investment at an affordable cost may greatly help in raising agriculture production and income of the farmers.

One of the advantages of financial development is that it widens the extent to which capital is allocated by the private sector. Capital formation, which depends on the rate of investment, plays a central role in raising the productive capacity of the sector. McKinnon and Shaw (1973) are of the view that an economy with an efficient financial system can achieve growth through efficient capital allocation. The role of the private sector in Pakistan's agriculture can be termed strategic. This is confirmed by 99 percent share in capital formation in Pakistan agriculture sector. Agriculture credit, which is an important instrument of financial development, allows farmers and entrepreneurs to undertake investment and adopt new technologies (Khandker and Faruqee 2003). McKinnon (1973) argues that farmers need to borrow in order to invest in new technologies therefore by increasing the availability of credit the financial intermediaries facilitate the capital formation for production purposes, and thus increase the overall productivity of the agriculture sector.

Credit constraint is generally considered to cast an adverse impact upon agricultural production. Much empirical evidence suggests that the infusion of finance in the form of credit appears to be an essential input for agricultural production. In many developing countries like Pakistan, lengthy, cumbersome and expensive procedures of obtaining loan constraints the supply of credit to small farmers and rural entrepreneurs. The level of literacy, health, and distance of households to banks are also important factors which influence availability of credit to the agriculture sector (Akram, *et al.* 2008). Moreover, the structure of agriculture sector is not as competitive and corporate in nature as compared to other major sectors of the economy in Pakistan. Therefore there is a need of well developed financial system which facilitates provision of credit to boost agricultural investment.

Recent studies show that there is indeed strong correlation between the financial development and economic growth. According to Levine (1997), financial system affects long run economic growth

[4] Pitt and Khandker, 2001 and Chaudhuri and Paxon, 2002

through its impact on capital accumulation and technological innovation. Likewise, Benhabib and Spiegal (2000), and Nazmi (2005) assert that financial development is considered very important and significant in forecasting economic growth and capital accumulation. Khan, *et al.* (2005) has examined the relationship between financial development and economic growth for Pakistan which shows the positive impact of financial depth and real deposit rate on economic growth in the long run. Moreover, improvement in growth through channels such as efficiency of investment, financial liberalization, capital accumulation, productivity growth and technical change has also been widely used to explain the finance-growth nexus[5].

Despite the growth of financial sector in the Pakistan, the sector is still characterized as an underdeveloped financial market which constrains resource mobilization and hinders economic growth. Financial sector reforms were initiated under broader macroeconomic structural adjustments programs in the early 1990s to ensure that a competitive and efficient financial sector come up to support development of the economy. However, the pace of saving mobilization or deposits and hence the private sector credit allocation remained relatively low and is not enough to stimulate private investment and growth.

Although there has been extensive empirical studies testing the views on the finance-growth relationship at aggregate level of the economy, few studies have investigated this relationship at a disaggregated level. Moreover, the earlier studies have examined the role of financial development using either a single indicator of financial development or different indicators separately[6]. Given the less developed nature of financial sector in Pakistan, it will be more appropriate to combine the indicators together as they tend to complement each other. Therefore we construct financial development index to represent the financial state variable and the values of this variable indicates overtime changes in sector.

This study takes the view that financial development affects various sectors of the economy differently. Therefore to test the impact of financial development on economic growth at the

[5] Choong and Chan 2011
[6] Kargbo and Adamu 2009

disaggregated level, this study focuses on one component of GDP i.e. agriculture sector. The study examines the direct and indirect impact of financial development on agricultural output.

The specific objective of this study is to examine the impact of financial development on output of the agriculture sector. This study examines the role of financial development on agricultural output through the following channel:

Financial Development → Agriculture Credit → Agriculture Investment → Agriculture Output

Therefore to characterize the channel specified above and to examine the indirect impact of financial development on agricultural output, the study investigates the impact of financial development on:

- Agricultural output
- Agricultural credit and,
- Agricultural investment.

The study employs models to capture the interrelationship among financial development, agricultural investment, agricultural credit and agricultural output. The study is focused of exclusively on Pakistan. For econometric investigation, the autoregressive distributed lag (ARDL) approach is applied using annual data over the period 1972-2010.

This study does not find a statistically significant effect of financial development on the underlying variables of the study i.e. agricultural output, private agricultural investment and agricultural credit (in the long run). Our findings are in accord with Lucas (1988), Sam (1999) and Kemal, *et al.* (2004).

There are three possible reasons for the insignificance of the relationship between the financial development and variables like agricultural output, credit, and private investment. These include reliance of the farmers on informal credit, amount of formal agricultural credit being determined by more by way of official directives rather than by market forces and the non-performing agricultural credit.

Evidence suggests that farmers do rely on informal credit however as there being no reliable estimates of the magnitude of informal credit on periodic basis this sort of credit does not figure into the financial development index that we have constructed and used in this study. Moreover for a major part of the period of this study (1973-2009) Pakistan has followed a repressive financial system whereby the banks were given targets of agricultural credit which the banks being in the public sector had to follow. Moreover a major part of the agricultural credit is extended by the Zarai Taraqiatti Bank Limited (ZTBL, formerly Agricultural Development Bank) which again is in public sector and thus the volume of its lending is determined by the government. Finally, misuse of agricultural credit, for example using the agricultural credit obtained from the banks for personal consumption will not show up the affect of credit on agricultural output. The non-performing loans of the agriculture sector, to an extent, reflect such misuse. It is these factors to collectively contribute to the statistically insignificant impact of financial development on agricultural output, agricultural credit and agricultural investment. If these concerns are addressed, some results, different from the results of this study cannot be ruled out altogether.

1.2 Organization of the Study

Rest of the study is organized as follows: Chapter 2 reviews the literature on the role of financial development in the economy in general and particularly on the agricultural sector. Chapter 3 briefly reviews the performance of Pakistan's agriculture sector in Pakistan. The theoretical framework of the study is explained in Chapter 4. Chapter 5 presents the empirical models and the data, estimation procedures and various statistical test employed are explained in chapter 6. The chapter 7 presents and analyzes the empirical results. Chapter 8 concludes the study.

Chapter 2 Literature Review

A large body of evidence exists to motivate the role of financial development in influencing growth and investment. The theoretical underpinnings of this relationship can be traced back to the work of Bagehot (1873), Schumpeter (1911), Goldsmith (1969), and Hicks (1969), followed by those of McKinnon (1973) and Shaw (1973). Their findings show that well working financial system plays a very important role in promotion of economic growth. Schumpeter (1911) was the first to analyze the framework of finance-led growth hypothesis and find that well developed financial system has a positive impact on growth. Financial development according to Schumpeter affects growth through improvement in productivity and technology. McKinnon (1973) considered an outside money model in which the accumulation of real money balances by firms is necessary to find investment projects. Whereas Shaw (1973) developed a debt intermediation approach in which high rates are essential for attracting savings, increase the supply of credit to productive and innovative activities, and in turn contribute to higher real output growth.

King and Levine (1993) investigate the empirical relationship of financial development with a number of variables including; real per capita GDP growth, rate of physical capital accumulation, the ratio of domestic investment to GDP, a residual measure of improvement in economic efficiency, and the future growth rate of the forgoing variables. Their findings show that high level of financial development is positively and significantly correlated with current and future rates of economic growth indicators. The study therefore concludes that Schumpeter (1911) and others are perhaps right about the importance of finance for economic development.

2.1 Impact of Financial Development on Overall Economic Growth

Generally, the literature has documented four views on the finance growth nexus; supply leading, demand following, finance and growth mutually support each other, and that the role of finance in promoting growth is overemphasized. Patrick (1966) identified two possible directions of causality

between financial development and economic growth. The supply leading hypothesis postulates the positive impact of financial development on economic growth, which means that the creation of financial institutions and the increase in supply of their services, leads to economic growth. Patrick argues that supply leading finance exerts positive impact on capital by improving the composition of existing stock of capital, allocate new investments efficiently and raise the rate of return on capital by providing incentives for increased saving and investment.

Endogenous growth literature explicitly models services provided by the financial institutions (see for instance, Greenwood and Jovanovic, 1990 and King and Levine, 1993b). These models show that economic growth performance is related to financial development, technology and income distribution (Caporal, *et al.* 2003). Empirically this has been demonstrated by Benhabib and Spiegal (2000) who introduced a variety of specifications; neo classical and endogenous growth, for the base growth equations and test the role of financial development using these specifications.

A contrary view, proposed by some economists (Van 1983 and Taylor 1983) predicts that financial development would slow down economic growth. According to this view, financial development does not stimulate growth. This view was originally put forth by Robinson (1952), who argues that economic growth creates the demand for financial services and the financial sector responds automatically to these demands popularly stated as "where enterprise leads, finance follows". Patrick (1966) argues that the creation of financial institutions and their related financial services are in response to the demand of these services by the savers and investors. Thus an increase in demand for financial services induces expansion in the financial sector as the real economy grows.

Numerous empirical studies have suggested positive association between financial development and economic growth [see among others; Bencivenga and Smith 1991, Levine 1997, Levine, et al. 2000, Majid 2008, Dawson 2008, Arestis, *et al.* 2001, Harvey, *et al.* 2001]. However, the support for the reverse causation; from real GDP to financial development, also exist in the literature [see for instance; Goldsmith 1969, Demetriades and Hussein 1996, Ireland 1994, Neusser and Kugler 1998, Halkos and Trigoni 2010]. Moreover, financial sector and real sector may mutually support each other while they

grow. [Al Yousif (2002), Sinha and Macri (2001), Brou (2011), Shan and Jianhong (2006), Gupta (1984), Luintel and Khan (1999), all have analyzed the two-way causality between finance and economic growth].

Demetriades and Hussein (1996) conducted the causality test between financial development and growth for 16 countries. They found little support to the view that financial development is the leading sector in the process of economic development however they have found considerable evidence of bi-directional causality between financial development and economic growth and some evidence of reverse causality. The results suggest that the causality patterns are very much country specific.

Some economists are in agreement with Lucas (1988) that financial development and economic growth are not casually related (see for example, Chang 2002, Kemal, *et al.* 2004, and Zhang 2009). Kemal, *et al.* (2004) examines the causal relationship between financial development and economic growth by using panel data from 19 high income countries for the period 1974-2001. Following King and Levine (1993), the control variables associated with the analysis of financial development and economic growth in Kemal, *et al.* (2004) are: inflation rate as a measure of macroeconomic stability, government consumption to GDP ratio as fiscal policy variable, and international trade openness as international trade policy variable. While incorporating effects of inflation rate on financial development, results from contemporaneous fixed effect model estimation show mixed picture. However, the negative and significant interaction term of the inflation and financial development shows that financial development is in fact more harmful for developed countries when inflation is high. When heterogeneous panel causality methodology is applied on a more refined model, most of the results of Kemal, *et al.* (2004) are in agreement with the Lucas (1988) who argues that "economies badly overstress the role of financial factors in economic growth".

2.2 Impact of Financial Development on Economic Growth of Pakistan

A large number of empirical studies on finance-growth nexus are available, few of these are devoted to Pakistan. These include Hassan, *et al.* (1996), Sinha and Macri (2001), Khan, *et al.* (2005), Ma

and Jalil (2008), Wadud (2009), Hussain, *et al.* (2009), and Chaudary (2008). These studies support the supply leading hypothesis i.e. financial development is an engine of economic growth.

Khan, *et al.* (2005) examines the relationship between financial development and economic growth in Pakistan over the period 1971-2004, using Autoregressive Distributed Lag (ARDL) technique. They also study the structural stability of finance-growth relationship after the introduction of financial sector reforms. The study uses financial deepening and real deposit rate as proxies of financial development. Their results show positive impact of financial depth and real deposit rate on economic growth in the long run, while response of real deposit rate is low in the short run.

Ma and Jalil (2008) test the impact of financial development on economic growth of Pakistan and China. The paper uses deposit liability ratio and credit to private sector as proxies for financial development and finds that both the indicators have significant and positive impact on economic growth in Pakistan. The study finds that financial sector reforms distinctly increased the level of financial depth and helped in maintaining positive real interest rate. Moreover, a sound financial sector would efficiently allocate resources and diversify the investment opportunities in both the countries; Pakistan and China, conclude the study. Hussain, *et al.* (2009) estimates long run relationship between real per capita GDP, per capital physical stock, and measures of financial development and financial structures. The study finds that financial structure and financial development matters for the level of output and economic growth. The study also suggests that the low value of financial structure, supports the bank based financial system in Pakistan rather than market based system. Moreover their findings support that the impact of financial development on economic growth is more pronounced through the efficiency of financial system, there then through the volume of investment, at lower levels of income.

Chaudary (2008) quantifies the impact of financial liberalization in Pakistan on macroeconomic performance through growth and investment, over the time period 1972-2006. Pakistan initiated a number of structural reforms in 1990s to strengthen the financial sector and hence improved the performance of financial sector. The results show that financial development improved economic growth in long run as well as in short run. This points to the need to further improve the performance of financial sector.

Hassan, *et al.* (1996) have developed and estimated a medium-sized 24-equation macro econometric model for financial sector of Pakistan by disaggregating financial assets held by households, private businesses, and enterprises. The authors quantify three broad categories of financial sector reforms; interest rate liberalization, spread reducing reform, and financial deepening within the context of policy simulation exercise. Their findings suggest that financial sector reforms not only support Mackinnon-Shaw hypothesis but also influence the real sector of the economy. Wadud (2009) determines the long-run causal relationship between financial development and economic growth in some Asian countries; India, Pakistan and Bangladesh for the period 1976-2008. They use Johansen multivariate cointegration procedure to test the relationship between financial development and economic growth. They find unidirectional causality, that is, financial development stimulates economic growth.

Sinha and Macri (2001) examine the impact of financial development on economic growth over the period 1950-97 for eight Asian countries including Pakistan. Their results show positive and significant relation between income and financial variables for India, Malaysia, Pakistan, and Sri Lanka. While the multivariate causality shows mixed pattern, bidirectional causality between the income and financial variables for India and Malaysia, unidirectional causality, from financial variables to economic growth for Japan and Thailand, and the reverse causality for Korea, Philippines, and Pakistan.

2.3 Impact of Financial Development on Growth: Channels

Much recent work has attempted to determine the channels through which financial development influences economic growth. Channels such as efficiency of investment, financial liberalization, capital accumulation, productivity growth and technical change have been widely used to explain finance growth relationship (Choong and Chan 2011). Goldsmith (1969) shows that the financial ratio tend to increase with efficient use of capital stock. The results are based on the cross country study and the sample includes 35 countries, developed as well as developing. On the other hand, McKinnon (1973) and Shaw (1973) hypothesis asserts that financial liberalization is a mean to increase savings and investments and hence growth. Pagano (1993) shows how financial development can affect economic growth; by

transforming savings into investments, by allocating funds to projects where the marginal product of capital is highest, or by altering the saving rate. According to Levine (1997), financial system affects long run economic growth through its impact on capital accumulation (including physical as well as human capital) and through its impact on technological innovation. Benhabib and Spiegal (2000) results show that the liquidity ratio and the ratio of financial assets of the private sector to GDP both influence growth through improvement total factor productivity, while the size of the banking sector influences capital accumulation rates.

Greenwood and Jovanovic (1990) construct a model that allows examining the relationship between growth and income distribution, as well as between financial structure and economic growth. They suggest that financial structure enhances economic growth if investment is undertaken efficiently. Thus their model predicts that as income per capita rises financial structure becomes more extensive which in turn improves investment decisions and economic growth. Similarly, Nazmi (2005) constructs a general equilibrium model to analyze the impact of deregulation and financial deepening on the real sector. The paper is focused on Latin America and shows that financial development and investment were positively associated during 1960-1995. The study shows that financial development plays a very important and significant role in forecasting economic growth and capital accumulation.

Afangideh (2009) identifies various channels through which financial development is transmitted to the agriculture sub-sector of the economy in Nigeria and also investigates the effect of financial development on agricultural investment and output. They carry out the investigation by applying three stage least squares estimation technique on econometric models. They find that gross national saving, bank lending to agriculture, investment in agriculture and agricultural output are the channels through which financial development influences agricultural growth. Their model, based on historical simulation results, is considered well enough for forecasting and policy simulation. Their results suggest that financial development eases the financing constraints by increasing national saving, bank credit and investment activities in agriculture and thus enhances output level in the sector.

2.4 Impact of Financial Development on Sectoral Output

Although extensive theoretical as well as empirical literature is available on the finance growth relationship at aggregate level, few studies have so far analyzed this relationship at a disaggregated level (These few studies include: Rajan and Zingale 1998, Catorelli and Gambera 2001, Beck 2002, and Afangideh 2009). These studies suggest that as the sectoral output increases the demand for financial services increases, this in turn has positive impact on financial development and which contributes to economic growth.

Rajan and Zingale (1998) points out, in context of growth opportunities that the resources in the financial market are allocated according to industrial characteristics, with need for financial services varying across industries. This paper attempts to examine whether the industries that are more dependent on external financing will grow relatively faster in countries that have more developed financial system. The authors find that financial development influences economic growth rates by reducing the cost of external finance for financially dependent firms. The paper also suggests that financial development may increase the investment opportunities of the existing firms and innovation opportunities of new firms, and thus encourage growth in long-run. This suggests that the level of financial development may play a particularly beneficent role in determining the size composition of industry as well as its concentration.

Nuesser and Kugler (1998) focus on the long run interaction between growth in manufacturing sector and the financial sector and find that GDP of financial sector is cointegrated for many OECD countries not so much with manufacturing GDP but mostly with manufacturing total factor productivity. Hanif and Jafri (2006) explore the ability of the financial sector to channel savings to help overcome liquidity constraints of private sector and raise the international trade competitiveness of the textile sector of Pakistan. Their results suggest that greater extent to external finance has strong positive impact in improvement of textile sector competitiveness, both in long run and short run.

Khan and Qayyum (2007) tested the impact of financial and trade liberalizations and real deposit rate on economic growth in Pakistan over the period 1961-2005. They find long-run relationship between

the variables. However, the short run response of real deposit rate and trade policy variable is very low. They focused on the view that financial markets liberalization affects the cost of external finance and facilitates trade liberalization. However the authors further found that financial liberalization has relatively higher impact on real GDP than on trade liberalization.

Brou (2011) examines the finance-growth nexus on a sectoral basis for each member country of West African Economic and Monetary Union, over the period 1961-2005. Their results reveal the existence of long-run relation between financial development and sectoral growth, except for some member countries. The author suggests that the absence of cointegration among the financial development, industry output and agricultural output may exist due to minor role of banking sector in providing financing to these sectors. The direction of causality is unidirectional and in some cases while in others it is bidirectional. However, results show no-cointegration and non-causal relationship between financial development and agriculture output growth in some member countries.

Parivash and Torkamani (2008) investigate the effects of financial markets development on value added of agriculture sector of Iran over the period 1968-2005. The study employs two measures of financial development; total assets of financial intermediaries and total assets of financial markets. Using VAR model, they test the causal relationship between the development of financial markets and agricultural growth. Their results support the "supply-side" view that financial markets have significant effect on the growth of agricultural output in Iran.

2.5 Impact of Agricultural Credit and Agricultural Investment on Agricultural Output

In Pakistan, a number of studies have focused on the impact of institutional credit on agricultural production. Khandker and Faruqee (2003) show how credit allows the farmers and entrepreneurs to undertake new investment and smooth consumption by providing working capital. Zuberi (1989) estimates the production function in the agriculture sector of Pakistan and concludes that the impact of institutional credit comes through financing for seeds and fertilizers. The study explains that the agricultural development of Pakistan has been based on "high pay off" low-cost technology. The study

uses fertilizers and seeds as a proxy for capital and labor in agriculture output. The study finds that despite the availability of seed-fertilizer technology, agricultural production in Pakistan was relatively lower than the developing countries in the region. He finds that 70 percent of institutional credit is used for the purchase of seeds and fertilizers. Zuberi also emphasizes upon additional inputs and high level of education for the improving agricultural productivity.

Malik, *et al.* (1991) provides evidence for the role of institutional credit in agricultural production and on the determinants of access to institutional credit. The two-stage structure is used for estimation where the probability of access to institutional credit is predicted in first stage and this predicted value is used in the second stage to predict fertilizer use per acre. Like Zuberi (1989), their results show that institutional credit is an important determinant of expenditure on fertilizer/seed etc. Moreover the study finds that education, size, electrification, mechanization, and the mean level of village credit have significant and positive impact on the probability of access to institutional credit, while dependency, tenurial status, and dislike (attitude) reduce the probability of access.

Abbas, *et al.* (2003) examines the impact of institutional credit on agriculture production in Pakistan over the period 1972-2002. They estimate the agriculture production function relating agricultural output to agricultural credit, labor force, water availability, and cropping intensity. The results of the study suggest that agricultural credit has significant and positive impact on agricultural output. The positive impact of water availability, labor force, and cropping intensity show that these are the other important determinants of agricultural output. Moreover, the study also discusses various patterns and indicators of agricultural credit in Pakistan.

Abdullah, *et al.* (2009) has examined the role of agriculture credit on the growth of livestock sector of Pakistan. The results suggest that all the three variables; farm size, literacy rate and the amount of credit positively and significantly affect income from each milking animal. They also observed that the credit supply is correlated with the level of education and farm size, and contributes to increase in the number of milking animals per family. Thus credit availability can contribute to the growth of livestock

sector. Credit supply not only helps to expand the size economies but also absorbs the unemployed labor force by improving its efficiency through allocation of extra labor.

Endogenous growth models suggest that financial markets play an important role in channeling investment to its highest valued use (Greenwood and Jovanovic, 1990 and Bencivenga and Smith 1991). Therefore the financial development and private investment support each other. Khan (1988) and Naqvi, *et al.* (1993) have estimated disaggregated private investment functions for Pakistan using conventional econometric methodologies. Their findings suggest that value added in agriculture, remittances from abroad, private sector credit, general market conditions, and public investment are the determinants of agricultural investment.

Ahmed and Qayyum (2008) investigate the impact of public development expenditures and macroeconomic uncertainty on private fixed investment in the agriculture sector. They estimated the private investment function through the error correction mechanism. The results indicate that there is strong positive influence of public development expenditures on agricultural private investment in the long-run as well as short-run. The coefficient of macroeconomic uncertainty, which captures both political and economic instability, indicates that Pakistan has been facing the macroeconomic instability which has adversely influenced private investment activities in the agriculture sector.

Janjua and Javed (1998) examine the role of shocks, generated from fiscal and monetary policies, foreign policies, and uncertainty on investment decisions. They estimate the agricultural investment demand functions and argue that private fixed investment in agriculture has always adjusted to credit availability. Their results suggest that the growth of agricultural income and agriculture credit has positive and significant impact on agricultural investment both in the short and the long run. Real exchange rate, the relative price of capital in agriculture, the variation in export to GDP ratio, and the real exchange rate applicable to imports (serving as a proxy measure for uncertainty) have negative impact on private agricultural investment. These results also show that public investment in infrastructure would promote private agricultural investment and enhance growth.

The critical role of investment in output is emphasized by large body of literature (Levine and Renelt 1992, Ghura 1997, and Khan and Reinhart 1990, to mention a few). The significant effect of institutional credit on capital investment in Pakistan is supported by Qureshi and Shah (1992) who estimated the effect of different inputs on agriculture production over the period 1960-1990. They find that credit indirectly affects agricultural output through influencing the financing of capital purchases. They also present evidence that the institution of credit is viable if the interest spread is high enough to achieve the objectives set for the credit policy by the financial institutions.

Several studies report strong relationship between financial development and economic performance in the real sector. These include studies on Pakistan as well. However the literature on exact mechanisms through which the financial system could affect economic performance in the real sector of Pakistan is rather scant. Identifying the channels of finance-growth nexus is important for promoting and strengthening the role of financial development in the growth of the agriculture. This study is an attempt to fill this gap.

Chapter 3 Overview of Agriculture Sector

This chapter focuses on the performance of agriculture sector in terms of trends and growth of agriculture output since 1970.

3.1 Importance of Agriculture Sector

Agriculture sector is the basic and one of the important sectors of the Pakistan economy. Agriculture growth is closely linked to the non-agricultural growth of the economy as it has strong backward linkages to farm inputs and forward linkages to food and fiber processing. It provides food to the fast-growing population of Pakistan and makes significant contribution to the overall economic growth. The agriculture sector on average contributed 21.8 percent to the overall GDP growth during 2001-10. The annual growth rate of the sector during 1970s, 1980s, 1990s, and 2000s was 2.4, 5.4 and 4.4, 3.2 percent respectively. It employed 45 percent of population and accounted for 56 percent of total exports of the country. A major part of the rural population, which is around 62 percent, depends on agriculture for its income. The importance of agriculture sector is summarized in Table 3.1. It shows that the growth pattern in agriculture has been fluctuating overtime and the changes in the growth rate of GDP have been affected by the agriculture output. Since 1980-81 agriculture GDP at constant factor cost, has more than doubled, increasing from Rs 76 million in 1981 to Rs 158 million in 1998-99 with growth rate of 4.2 percent annually. The share of agriculture sector to GDP, however, has declined gradually since Pakistan came being in 1947, from over 35 percent in 1970-71 to about 21 percent in 2009-2010. The reason for the decline in share of the agriculture sector is the fact that the economy is following the typical development path: from agriculture to manufacturing to services.

Table 3.1 Importance of agriculture in Pakistan's economy

Year	Growth rate		Percent share of agriculture in		
	GDP	Agriculture value-added	GDP	Exports	Labor
1970-75	4.3	0.8	34.7	-	56.4
1975-80	5.3	3.9	31.2	-	53.3
1980-85	6.7	3.8	29.8	27	52.1
1985-90	5.6	4.4	26.6	28.7	51.3
1990-95	4.8	4.2	25.6	12.33	48.0
1995-00	4.0	4.9	25.9	9.82	46.8
2000-05	5.3	2.2	22.9	10.4	43.7
2005-10	5.6	3.5	20.8	-	44.1

Total export earnings of the Pakistan economy are directly or indirectly derived from agriculture sector. Leading pure agricultural exports or exports of agro-based manufactures include rice, cotton yarn, cotton fabrics, synthetic textile, ready-made garments, fish, leather, sport goods, fruits and vegetables. Of the total export earnings, the share of raw products and processed products constituted almost 56 percent of the total exports in 2008-09. Agricultural imports like wheat, edible oils, pulses, and consumer goods, account for 13 percent of total imports. The most direct agricultural input is fertilizer. However its share in value of imports is declining overtime.

3.2 Distribution of Agricultural Output

Agricultural output mainly consists of major crops (wheat, rice, sugarcane, and cotton), minor crops, livestock, fishery and forestry. Since 1970s major crops have played a dominant role in providing food security and foreign exchange earnings. Table 3.2 illustrates that the fluctuation in overall performance of agriculture sector has been largely dependent on the contribution of major crops in agricultural production. However the contribution the major crops have fallen gradually over time, from 55 percent in 1970-75 to 34 percent in 2005-10. Minor crops have shown sustained growth pattern than

that experienced by major crops. According to Khan (2000), minor crops have escaped the distortions created by government's procurement policies and have responded well to the relatively sharper price increases in the open and unregulated market. Moreover, till 1990 livestock used to account for nearly one-third of the agricultural output however since 1995 it is contributing more than 40 percent of the value added in agriculture, much more than the combined contribution of major and minor crops. The government gives high priority to the livestock farming and has placed it on the national development agenda. Policies are aimed at private sector led development of livestock are also being framed.

Table 3.2 Distribution of Agricultural Output

Year	Percent Share in Agricultural output			
	Major Crops	Minor Crops	Livestock	Forestry & Fishery
1970-75	55.39	13.68	28.60	2.32
1975-80	53.25	16.05	28.36	2.34
1980-85	48.88	14.37	24.59	2.86
1985-90	42.93	17.48	33.48	3.74
1990-95	40.74	17.33	38.28	3.65
1995-2000	37.87	15.89	43.99	3.05
2000-05	35.06	12.49	48.34	4.10
2005-10	34.37	10.41	51.72	3.81

3.3 Land Utilization

The total geographical area of Pakistan is 79.61 million hectares and currently the reported area is 72 percent of the total area. Of this area, about 38 percent is cultivable. Most of the area of Pakistan is arid or semi-arid. However the rainfall in monsoon and winter season is not sufficient for the irrigation. Thus for supplemental water, agriculture is largely based on the artificial means of irrigation. Pakistan depends on one of the largest irrigation system in the world called Indus basin irrigation system to support production of agricultural output. Basically, there are two principal crop seasons, namely the Rabi, which

lasts from April-June to October-December; and the Kharif, which begins in October-December and ends in April-May. Wheat is the major Rabi crop while cotton, rice and sugarcane are produced in the Kharif season. Table 3.3 reports the availability of water during Kharif and Rabi seasons. About 19.4 million hectares or 90 percent of the cultivated area is irrigated, while crop production on the remaining 2.2 million hectares depends mainly upon rainfall. Moreover, total cropped area rose more than 35 percent from 17 million hectares in 1970-75 to 23.6 million hectares in 2005-10. Table 3.3 shows that irrigation has increased gradually over the past four decades. During 1970-75, 13 percent of the total cultivated area was being used for multiple cropping (area sown more than once). This figure rose to 35 percent by 2005-10. This increasing trend was mainly due to the technological progress in Pakistan's agriculture, which has been through two phases. The first phase began in 1959 with the green revolution and the second one of mechanization was launched in 1972. Following the Green Revolution, more land was brought into cultivation and this in turn explains the increase in cultivable area[7]. Likewise the second phase, which has been of mechanization and the use of technology in the mid 1970s, led to greater use of tractors and machines like threshers which increased crop yields and the cropping intensity. Moreover the use of seeds of high yield variety and massive increase in tube wells also contributed to the increase in yield[8]. It could be seen that the technical progress had not affected the land utilization substantially, but still the output increased due to increase in yield.

[7] Zaidi (2005)
[8] Khan (2000)

Table 3.3 Land Utilization **(Million Hectares)**

Year	Total Area	Reported Area	Cultivated Area	Irrigated Area	Area sown more than once	Cropped Area	Water Availability	
							Kharif	Rabi
1970-75	79.6	53.5	19.2	12.7	2.5	17.0	19.9	11.4
1975-80	79.6	54.3	19.8	14.2	3.3	18.4	21.0	14.8
1980-85	79.6	56.3	20.3	15.5	4.1	19.7	23.9	16.5
1985-90	79.6	57.9	20.8	16.2	4.8	20.5	26.5	18.8
1990-95	79.6	58.0	21.2	17.1	5.7	21.9	29.6	21.0
1995-2000	79.6	59.0	21.9	17.9	6.3	22.8	30.6	22.2
2000-05	79.6	59.4	22.2	18.3	6.8	22.3	31.5	23.1
2005-10	79.6	57.1	21.6	19.4	7.5	23.6	33.1	23.2

3.4 Overall Growth Performance of Agriculture Sector

Overall the growth performance of agriculture sector in Pakistan is marked by a mixed trend. The agricultural performance was most impressive in the 1960s. The high growth rate in this period owes to the Green Revolution that brought the high yield technology. Development of water resources and the use of fertilizers and new seeds facilitated the agriculture sector in adoption of the new high yield technologies. As a result, agricultural production grew by 3.8 percent annum during 1960-65 against 1950s. Pakistan's agricultural output grew dismal rate of of less than one percent in early seventies. The growth rate dropped from 4.5 percent in 1968-69 to 2.5 percent in 1976-77 as a result of natural (e.g. floods) and policy induced factors. It includes the uncertainty created by the selective implementation of land reforms in 1972 and 1975; moreover crops suffered due to severe climatic shocks, political instability in the country, high input prices as inflation reached a peak of 30 percent in 1974, pest and plant diseases, salinity and water logging etc. However the agricultural growth revived in the late 1970s after a few distinctly bad years.

The output growth of agriculture sector during 1980s improved from 3.7 percent in 1980-81 to 6.9 percent in 1988-89, which was mainly due to efficient use of essential inputs such as fertilizers, pesticides, high yield variety seeds. The role of institutional credit for production related activities has been quiet impressive in early 1980s as institutional credit became more accessible and was available at relatively cheaper terms— around 5 to 6 percent in the 1980s. Moreover, during the period; 1984-85 and 1989-90, the higher output of cotton has contributed significantly to more rapid agricultural growth than during the previous periods. However despite some recovery in wheat output, the growth rates of rice and sugarcane remained very low.

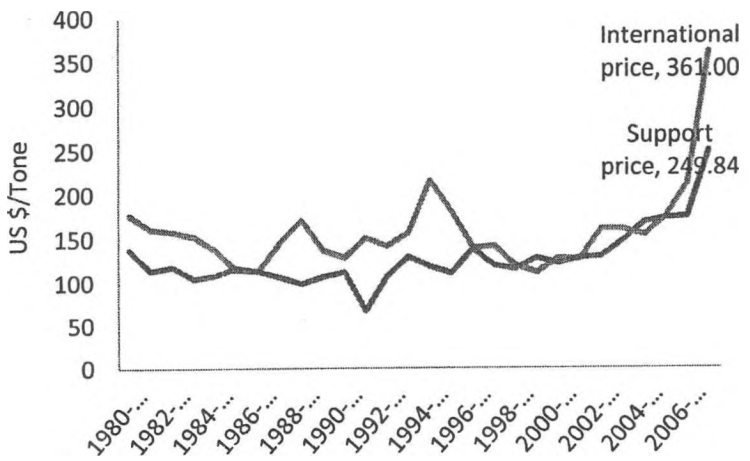
During early 1990s, the decline in agricultural growth was mainly due to slower growth of wheat, rice and cotton. Cotton crop had an attack of leaf curl virus whereas flood in the early 1990s and drought in the late 1990s were the other factors responsible for the lower growth of agriculture output. On the other hand, the high growth rates of sugarcane and livestock positively influenced the growth rate of agriculture sector in 1990s. The policy measures undertaken during of 1994-95 and 1995-96 had also exercised a positive effect on the agriculture sector. The structural adjustment programs also contributed to better performance of agriculture sector by way of improvement in terms of trade. (Abedullah, *et al.* 2009). However towards the end of 1990s the agricultural output declined again with the sector registering a low growth of 1.95 percent in 1998-99.

The agriculture sector recorded a negative growth rate of 2.2 percent in 2000-01. The overall performance during the year 2001 was badly affected by the drought conditions particularly in Sindh and Baluchistan areas. During the next few years (2002-03 to 2004-05), the performance of agriculture sector was good due to availability of irrigation water, and timely provision of fertilizers and credit to the farmers. However the aggregate performance during 2000-05 remained low. The volatility in the sector was high during 2000-05., with the range of growth varying from 6.3 percent to 1 percent. The fluctuations can be attributed to the poor performance of major crops in 2005-10. However, an increase in the livestock sector in the same period compensates for the below average performance of the major crops.

3.5 Support Price Policy

With a view to keeping the prices of agricultural output within reasonable limits and also to protect the farmers against unexpected decrease in market price, the government had introduced a price support policy. Prices used to set below the international price levels through deliberate government policies. In Pakistan wheat is the most important agricultural commodity, both in terms of production and consumption. It is contributing 14.4 percent to the total value added and 3.1 percent to GDP[9]. Wheat support price is the guaranteed minimum price at which the government buys wheat from the farmers. However the actual procurement prices paid by the government may exceed the support price depending on market conditions (Khan and Axel 2006). Throughout the 1990s, Pakistan was a net importer of wheat[10]. Thus as an importing country, increase in international wheat prices has continued to support domestic wheat prices in Pakistan. Graph 3.1 clearly shows that domestic wheat support prices were below during 1990s and overall follow the international wheat price levels.

Figure: 3.1



[9] Economic Survey
[10] Dorosh and Salam (2006)

3.6 Changes in Agricultural Inputs

Nevertheless, the government since the Sixties has also ensured the provision of agricultural inputs at reasonable prices. Table 3.4 shows that the availability of agricultural inputs has increased substantially from 1970-1 to 2009-10. Water availability, seeds, fertilizer, machinery, labor force, and credit are important inputs for agricultural production. However figures given in table 3.1 are in nominal terms. A better way to gauge the availability of inputs is through input-output analysis. The input-output analysis of the sector exposes the decreasing returns of the agricultural inputs. On the input side, the total availability of fertilizer off-take (in thousands of nutrient tons) was 296 in 1970-71 which reached 3400 during 2009-10. Similarly the use of improved high quality seeds (in thousand tones) meant for improving crop yield increased from 20 tons in 1971-72 to 305.8 tons in 2009-10. During the same period, the number of imported and manufactured tractors rose from 119 thousands to about 1070 thousands. The same is true for tube wells, which were providing 19 percent of irrigation in 1970 and their use have increased by more than 8 times since then. Another input, farm credit which is a major source of acquiring new technologies for the development of agriculture sector, has increased from a meager figure of 128 million rupees in 1971-72 to above 240 billion in 2009-10. On the output side, we see that the trend growth rate of agricultural output has been about 3.4 percent in the last 40 years. However the growth rate of agriculture output per capita is less than one percent. Therefore one might say that despite the impressive increase in the use agricultural inputs the output of the sector has not increased correspondingly.

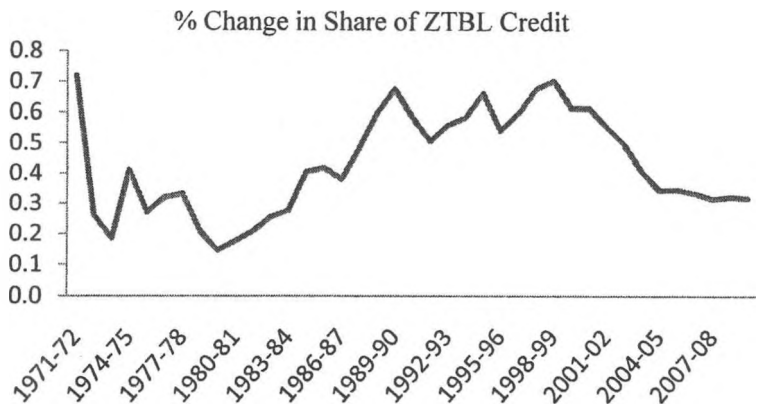
Table 3.4 Change in use of agricultural inputs b/w 1972 & 2010

	Water Availability (million hectares feet)	Improved seeds (000 tones)	Fertilizer off-take (000 N/T)	Tube Wells (000)	Tractors (000)	Credit (Rs million)
1971-72	28.8	30.4	419	119.3	18	128.8
2009-10	57.5	305.8	3400	1070.4	80.4	248120

3.7 Credit Disbursement

Credit for long has been identified as a major input in the development of the agriculture sector (Zuberi 1989, Malik, et al. 1991, and Abbas, *et al.* 2003). However farmers, particularly those with small holdings, have been greatly constrained by the inadequacy of the credit. Zarai Taraqiati Bank (ZTBL, formally Agricultural Development Bank of Pakistan) was the only source of institutional credit to the farmers till the early 1970s. It emerged as the largest specialized bank in Pakistan providing the financial/non-financial services to the agriculture sector. ZTBL mainly borrows from the State Bank of Pakistan and lends to small farmers. However some special funding programs of the banks are funded by the World Bank, the Asian Development Bank, and the International Fund for Agriculture Development (Hussain, *et al.* 2003). In Pakistan the main sources of institutional credit are: Zarai Taraqiati Bank of Pakistan and commercial banks. Graph 3.2 shows that the share of ZTBL in agricultural credit relative to other national institutions like commercial banks has changed over the time.

Figure: 3.2



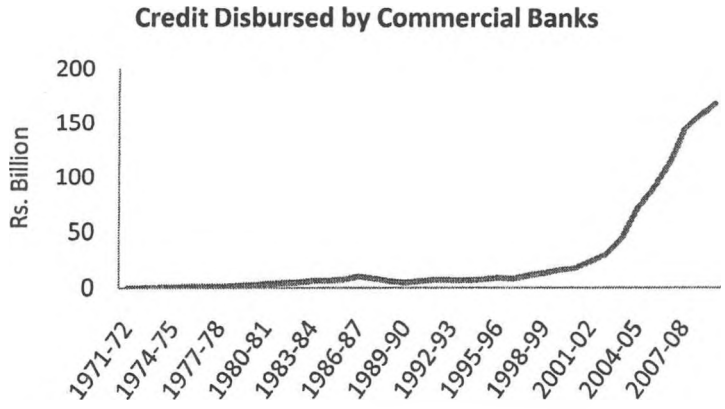
Most of the credit obtained by small farmers in Pakistan comes from the informal sources, including friends, relatives, moneylenders, traders, commission agents, and landlords. Many farmers prefer to acquire credit from the informal, informal sources because borrowing from informal sources has certain advantages over the formal credit sources. The reasons for this include: easy access and cash for consumption needs, lenders know the borrowers personally, and often lend without collateral[11]. Small farmers, where credit yield better results, cannot get loan from formal sources for development purposes like improving land, or to acquire seasonal inputs, although these investments could contribute to increasing the level of agriculture output[12]. Informal lenders extract monopoly profits from the borrowers; therefore there is a need to develop formal sources of credit.

Prior to the banking reforms of 1972, the role of credit co-operatives was not significant either. But later, the increase in agriculture credit was accompanied by the nationalization of five private banks in 1972. The co-operative system was also restructured under the Federal Bank of Co-operatives (FBC). The growth of institutional credit was quiet impressive in the 1970s, with the ZTBL and commercial banks accounting for most of the agricultural lending[13]. Later the challenges faced by the needy farmers

[11] Zaidi (2006)
[12] Khan (2000)
[13] Khan (2000)

as well as the financial institutions proved too much in terms of poor farmer participation, weak administrative capacity to extend and recover loans, and inefficient management of financial affairs (Khan, 2000 and Hussain, *et al.* 2008). Agriculture credit however shows an increasing trend in the post financial reform period (1990 onwards). Figure 3.3 shows that the share of credit disbursement to the agriculture sector by the other banks i.e. commercial banks has increased over the last decade.

Figure: 3.3



The government of Pakistan in 1972 established the National Credit Consultative Council (NCCC), recently named as Private Sector Credit Advisory Council (PSCAC), to review the overall credit in the economy along with sectoral and institutional credit ceilings. The NCCC staffed by government officers and the staff of the State Bank of Pakistan worked in close collaboration with the government. It makes recommendations to the government regarding credit expansion to promote economic development, while Agriculture Credit Advisory Committee (ACAC) of State Bank of Pakistan formulates the agricultural credit estimates. The NCCC reviews the proposals of the ACAC relating to the agricultural credit and assigns annual credit target to ZTBL, Federal Bank for Cooperatives (FBC), and commercial banks to promote investment in the agriculture sector.

Overall the performance of agriculture sector was not quite impressive as its share in GDP is declining overtime. Similarly export earnings from agriculture sector are declining. However livestock is contributing more than 40 percent of the value added in agriculture, much more than the combined

contribution of major and minor crops. Moreover it could be seen that the technical progress had not affected the land utilization substantially, but still the output increased due to increase use of seeds of high yield variety and massive increase in tube wells. The government has introduced different policies for example, agriculture pricing and marketing polices, for the development of agriculture sector. Availability of agricultural inputs has also increased substantially. However despite the impressive increase in the use agricultural inputs the output of the sector has not increased correspondingly.

Chapter 4 Theoretical Framework

4.1 Introduction

Before we embark upon the task of specifying a model that relates agricultural growth to financial development, it is important to show rigorously that financial development contributes to capital accumulation and growth at the disaggregated level. This chapter is devoted to establishing link between financial development and growth. A large body of literature has established that financial development plays a significant important role in the economic growth of the country. Variety of models predict that financial development facilitates growth by encouraging capital accumulation and technological innovation, facilitates the diversification of risks, increase the efficiency of financial intermediaries, and effectively allocates credit and funds to those sectors of economy that are more productive. Moreover by mobilizing savings and increasing the availability of credit, financial development stimulates investment in new technologies, thus increasing overall productivity and efficient resource use in the economy[14].

Literature suggests that overall financial development is necessary for economic growth at the macro-level. Number of studies report strong relationship between financial development and economic performance of real sector (Levine and Zervos 1998, Rajan and Zingales 1998, Benhabib and Spiegel 2000, and Brou 2011). Therefore the different sectors of economy need a focus of the policy makers in this perspective.

4.2 Role of Financial Development in Real Sector

A number of models (Greenwood and Jovanovic 1990, Pagano 1993, Bossone 1999, Nazmi 2005, Zhang) show that how financial development enhances the growth of the real sector. Bossone (1999), for example, builds a microeconomic general equilibrium model considering four agents in the economy;

[14] Policy division working paper UK

households, firms, banks and non-bank financial intermediaries. The model predicts that the development of financial infrastructure stimulates greater and efficient capital accumulation.

To capture the potential effects of financial development on growth, Pagano (1993) considers the simple endogenous growth model, 'AK' model. The model derived in his study shows that financial development can affect growth by transforming savings into investment, by increasing marginal productivity of capital, and by influencing gross saving rate. Zhang (2009) developed aggregate production function and used financial development as an 'input' in the production process; however his results do not support an association between financial development and economic growth.

Following Nazmi (2005) and others this study explores the effects of financial development on growth and investment in agriculture sector.

4.3 The Model

Consider an economy that consists of four agents: households, firms, banks and the government. Households are either workers or owners of capital. Workers are paid wages and owners earn dividends from investment in firms and banks. Foreign bonds and interest bearing deposits (time plus demand deposits) are used by the households for transactions i.e. the household current spending is limited by their deposit holdings (Brock 1989). The foreign bond and deposits earn interest with international bond rate (i^*) being more than the bank deposit rate (i_1). Firms must borrow to finance the purchase of capital besides using the hired labor for production. Interest (i_2) is charged by the bank on the amount lent to the firms. The bank also charges for providing financial information about the firms. The government is responsible to provide financial information about the borrowers and incur charges which are distributed on the households.

4.3.1 Households

A model of utility focusing on Labor-Leisure choice within the Ramsey framework is constructed (Barro and Martin 2003). An infinity lived household is endowed with one unit of time that can be used

for labor (l) or leisure (1-l) where each household works, consumes, holds money, and invests in financial institutions that pay the riskless rate of return (Taylor and Woodford 1999). Therefore, the households maximize their overall utility function U by choosing consumption and leisure, as given by;

$$U = \int_0^{\infty} (\ln C_t + \ln(1 - l_t))^{-rt} dt \tag{4.1}$$

Where C is the consumption and r is the rate of time preference. Economic agents can buy and sell bonds in international capital market at the interest i*. The households hold interest bearing foreign bonds (b_h) and interest bearing domestic deposits (d) as their financial wealth (z_h). Note that each household has savings in form of deposits and bonds. It is assumed that the household faces a deposit-in-advance constraint for transaction (writing cheques) which is a positive proportion ρ of consumption level, given as; $d_t = \rho C_t$ (4.2)

By imposing transversality condition $\lim_{t \to \infty} z_{t,h}^{-rt} dt = 0$, the household's budget constraint is given by;

$$z_{0,h} + \int_0^{\infty} (W_t l_t + D_{t,f} + D_{t,b} + \tau_t - C_t - (i_t^* - i_{1,t}) d_t)^{-rt} dt = 0 \tag{4.3}$$

Where $z_{0,h}$ is initial wealth, W is the wage rate, τ stands for government transfers, $D_{t,f}$ and $D_{t,b}$ are the dividends paid by the firms and the banks, respectively and the term $(i_t^* - i_{1,t}) d_t$ indicates the opportunity cost of holding deposits instead of bonds. Based on the constraints (4.2) and (4.3), consumption and leisure is chosen by the representative households to maximize its objective (4.1). This results in the following efficiency conditions;

$$\frac{1}{C_t} = \lambda(1 + (i_t^* - i_{1,t})) \tag{4.4}$$

$$\frac{1}{1 - l_t} = \lambda W_t \tag{4.5}$$

Equation (4.4) and (4.5) represents marginal utility of consumption and leisure, and λ is the shadow price of wealth.

4.3.2 Firms

A representative firm produces output with inputs; labor and capital following the Cobb-Douglas production function;

$$Y = Al_t^{\alpha} k_t^{1-\alpha} \tag{4.6}$$

The financial wealth of a firm, z_f is computed as bond holding of the firm (b_h) minus borrowings from the banks (X). It is assumed that firm has sufficient balance to pay for its labor but only through the financial intermediation; the firm must borrow to finance the purchase of capital (Gupta, 2011). Therefore, a firm purchases k units of capital at the price of one per unit and borrows X=k (the finance required to pay for k). The firm has to pay interest charged by the bank and which is calculated as the difference between the lending rate (i_2) and the expected domestic inflation rate (π). Equating the domestic inflation rate as world inflation rate (π^*) plus the depreciation rate (ε) with the assumption of perfect capital mobility ($i_t = i^* + \varepsilon$) and using the Fisher identity ($r_t = i_t^* - \pi_t^*$) for the real interest rate (r), the cost of capital (C) is given by;

$$C = (i_{2,t} - \pi_t)k_t = rk_t + (i_{2,t} - i_t^*)k_t \tag{4.7}$$

By imposing the transversality condition $\lim_{t\to\infty} z_{t,f}^{-\pi} dt = 0$, the present value of firm's dividend is given by;

$$\int_0^{\infty} D_{t,f}^{-\pi} dt = z_{0,f} + \int_0^{\infty} (Y_t - W_t l_t - rk_t - (i_{2,t} - i_t^*)k_t)^{-\pi} dt \tag{4.8}$$

By choosing capital and labor to maximize the present value of dividends (4.8), we obtain the first order conditions as follows;

$$\alpha l_t^{\alpha-1} k_t^{1-\alpha} = W_t \tag{4.9}$$

$$(1-\alpha)l_t^{\alpha}k_t^{-\alpha} = r_t + i_{2,t} - i_t^* \tag{4.10}$$

Dividing (3.10) by (3.9), the capital-labor ratio is obtained;

$$\frac{k_t}{l_t} = \frac{W_t}{r_t + (i_{2,t} - i_t^*)}\frac{1-\alpha}{\alpha} \tag{4.11}$$

4.3.3 Banks

Banks are taken to be pure financial intermediaries who are responsible of buying and selling bonds at the international interest rate (i*). They pay interest (i_1) to households on their demand deposits (d) and charge interest (i_2) on the loan X=k that they extend to the firms. Banks also face a reserve constraint as a part of bank deposits, $M_t = R_t d_t$ where M_t is real monetary base (Walsh 1984 and Gupta 2011). The operating cost $I(X)(1+g)$ is also charged by the banks (Nazmi 2005). Operating cost includes monitoring and information cost I(X) and a regulatory cost $1 \prec g \prec ((i_2 - i^*)X + (i^* - i_1)d - i^* M)/I(X)$, where it is assumed that the cost function is strictly decreasing and concave in X.

In equation (4.12) bank maximizes the present value of dividends by choosing X and demand deposits d subject to reserve requirement and transversality condition to get the first order conditions (4.13) and (4.14);

$$\int_0^{\infty} D_{t,b}^{-rt}\,dt = z_{0,b} + \int_0^{\infty}((i_{2,t} - i_t^*)X_t + (i_t^* - i_{1,t})d_t - i_t^* M_t - I(X)(1+g))^{-rt}\,dt \tag{4.12}$$

$$i_{1,t} = i_t^*(1-R) \tag{4.13}$$

$$i_{2,t} = i_t^* + I'(X)(1+g) \tag{4.14}$$

4.3.4 Government

The government as fiscal and monetary authorities is considered one body. The government sets the reserve requirements R and is responsible of collecting a fee from banks equivalent to monitoring and

regulatory cost $I(X)(1+g)$ which is then distributed to household as a lump-sum transfer payments τ by imposing the inflation tax on real monetary base (Brock 1989).

By imposing transversality condition $\lim_{t\to\infty} b_{g,t}^{-rt} dt = 0$, the government's lifetime budget constraint is given by;

$$\int_0^\infty \tau^{-rt} dt = b_{0,g} + \int_0^\infty (\dot{M}_t + \pi M + I(X)(1+g))^{-rt} dt \tag{4.15}$$

Where π is the inflation rate and πM is the inflation tax.

4.3.5 Equilibrium

The constraints of the four agents discussed above are added to obtain the economy's flow constraint. Equilibrium condition can be derived by substituting (4.14) into (4.11);

$$\frac{k_t}{l_t} = \frac{W_t}{r_t + I'(X)(1+g)} \frac{1-\alpha}{\alpha} \tag{4.16}$$

The model given by 4.16 relates financial sector development to the capital accumulation and economic growth. Equation (4.16) states that the production process becomes more capital intensive as the banking sector becomes efficient in monitoring the firms or when there is reduction in regulatory cost lend to decline in the intermediation spread $(i_2 - i^*)$. Thus the increased efficiency of banking system, the intermediation spread that is cost of financing through banks declines and thus narrows the wedge between the interest rate paid by firms and that received by households. This factor may affect the saving behavior i.e. by mobilizing savings in form of deposits, availability of credit and investment opportunities increases and hence increases the productivity of agriculture sector.

Chapter 5 Model Specification

To examine the impact of financial development on the agriculture sector of Pakistan, the study follows the equilibrium model given by equation (4.16). The objective of this study is to capture the effects of financial development on growth at disaggregated level. For this purpose, we have chosen agriculture sector and we seek to examine how financial sector development relates to capital accumulation and growth in the agriculture sector. Moreover despite the availability of sufficient literature on the finance-growth nexus, we are far from understanding the channels through which financial development may affect the agriculture sector. This lack of understanding regarding the channels of financing is one reason why it has been difficult to draw policy implications from the finance-growth nexus[15]. Therefore to identify the channels of financing, we will also analyze the impact of financial development on private investment in agriculture sector, and the bank credit to agriculture sector in Pakistan.

Based on these theoretical postulates and the structure of Pakistan economy, we specify the relationship between financial development and agricultural output. Moreover we also model the indirect impact of financial development on agricultural output i.e. through the impact of financial development on agricultural credit and agricultural investment.

5.1 Model of Bank Credit to Agriculture

The use modern technology for agricultural growth has necessitated the increased use of capital, which in turn requires sustained infusion of finance. Generally, well developed financial system reduces the likelihood of credit crunches and efficiently allocates credit to different sectors of economy. According to Levine (1997), financial development affects growth through two channels; capital accumulation and technological change. Financial development eases the access to bank credit and thus increases the availability of credit. Therefore an efficient financial sector of economy ensures the

[15] Rajan and Zingale (2005)

channeling of funds to the agricultural sector. With the expansion of agriculture the credit requirements in the sector will increase and the banking sector would keep pace with increased demand. Therefore, the impact of financial development on agricultural credit is expected to be positive on agriculture credit.

It is only logical to expect that volume of agricultural credit will be influenced by the relationship between the agricultural credit and gross national savings, we have shown earlier with the help of equation (4.16) that financial development reduces interest margin of the banking system which may encourage savings and thereby boost growth. In developing countries, sufficient funds may not be readily available for lending to potential borrowers. In this situation, mobilization of more savings, through both the public sector and the private sector, can increase financing to the different sectors of economy. It is expected that more savings, increases the availability of credit for productive and innovative activities and thus positively influenced the real output of agriculture sector.

Bank loans are an important source of funding for production activities in the economy. The demand for credit in agriculture sector is more than any sector as it has been non-monetary activity for the rural population of Pakistan.[16] The financing need of the sector mainly arises for fixed capital and working capital. Accelerator theory[17] suggests that as income increases in the economy, the investment level also increases. Accordingly with the expansion in the volume of agricultural output, the investment and hence the financing needs of the sector also increase. Therefore the financial institutions, in public as well as private sector, advance loans to make it possible for the farmers to acquire the new technologies in agriculture sector. Khandker and Faruqee (2003) argue that formal loans are mostly taken for production purposes while the informal loans are meant for consumption purposes in Pakistan. Therefore, the productivity level of borrowers determines the demand of agricultural credit. The foregoing discussion suggests that with the increase in demand for agricultural credit the agricultural output is likely to increase.

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[16] Abedullah, *et al.* (2009)
[17] Clark, P. K. (1979)

The banks satisfy the financing needs of the farmers by offering attractive financial services especially in form of small-sized loans and simple financial contracts. Banks charge for these financial services in the shape of interest rate. Therefore interest rate is expected to cast a negative impact on the volume of credit demand on the agriculture sector.

In simple aggregate demand Keynesian model, proposed by Capiello, *et al.* (2010), the relevant equation for the agriculture credit demand can be written as:

$$\ln AGC_t = \beta_0 + \beta_2 \ln AGY_t + \beta_3 \ln LR_t + \mu_t \qquad (5.1)$$

Equation (5.1) states that the agricultural credit demand depends positively on agricultural income and inversely on interest rate of loans, where AGC is bank credit to the agriculture sector, AGY is agriculture output, and LR is weighted average lending rate on advances while μ_t is error term. Including the affects of financial development and gross national savings, the equation (5.1) can be formalized as:

$$\ln AGC_t = \beta_0 + \beta_1 \ln FD_t + \beta_2 \ln AGY_t + \beta_3 \ln LR_t + \beta_4 \ln GNS_t + \mu_t \qquad (5.2)$$

Equation (5.2) states that agricultural credit depends upon agricultural output, financial sector development, lending rate, and the gross national savings, where FD is financial development and GNS is gross national savings. Therefore, the expected signs of variables are as follows;

$$\beta_1, \beta_2, \beta_4 \succ 0 and \beta_3 \prec 0$$

5.2 Model of Private Investment in Agriculture

We specify that private investment in agriculture sector as a function of financial development, agriculture output, lending rate, agricultural credit, and uncertainty. In this section we indicate the nature of relationship between the agricultural investment and the above referred variables and also discuss the rationale for the hypothesized relationship.

Classical and Keynesian investment theories suggest that investment is related to output and interest rate. The aggregate output influences private investment positively because (assuming rich people

have lower MPC) with the increase in income level, agents would save more money and therefore more money would be available for investment activities. On the other hand investment is negatively influenced by interest rate because increase in interest rate reduces the return of the investors (Naqvi, *et al.* 1983 and 1986, Bond, et al. 1997, Hanif, *et al.* 2010, and Khan and Din 2011).

Regarding the relation between private investment and financial development, several empirical studies suggest that financial development affects private investment positively (Benhabib and Spigel 2000, Huang 2006, Khan and Khan 2007, Afangideh 2009, Misati and Nyamongo 2010, and Gasmi, *et al.* 2010). These studies suggest that financial development influences investment through optimal allocation of financial resources. Financial development channels investment capital to its highest productivity level so that more productive firms find it easier to access the funds. Thus capital accumulation is considered as an important channel through which financial development affects economic growth. Therefore we hypothesize a positive relationship between financial development and private investment.

Private sector plays a major role in providing the capital investment in the agriculture sector. The main components of private investment in agriculture sector are farm machinery, transport, buildings and sheds, land improvement, water courses, cultivated assets, and non-monetized investments. Capital investment obviously requires funds. This is also borne out by number of studies including Qureshi and Shah 1992, Baltas 1983 and 2005, Oshikoya 1994, and Afangideh 2009. Therefore it is expected that the availability of credit has significant positive influence on the private investment.

Uncertainty refers to a situation where fixed investment decisions cannot be undone in case of unfavorable future events. Empirical evidence shows that the uncertainty that arises from macroeconomic instability, negatively affects the private investment decisions in developing countries (Serven 1998, Qayyum and Ahmed, Janjua and Javed 1998). Given the foregoing discussion the model for agricultural private investment can be written as;

$$\ln AGI_t = \gamma_0 + \gamma_1 \ln FD_t + \gamma_2 \ln AGY_t + \gamma_3 \ln LR_t + \gamma_4 \ln AGC + \gamma_5 UN + \varepsilon_t \qquad (5.3)$$

Where AGI is private agricultural investment, FD is financial development, AGY is agriculture output, LR is weighted average lending rate on advances, AGC is bank credit to agriculture sector, UN reflects uncertainty, and ε_t is error term. The expected signs of the variables are;

$$\gamma_1, \gamma_2, \gamma_4 \succ 0 and \gamma_3, \gamma_5 \prec 0$$

5.3 Model of Agricultural Output

The agriculture output can be specified as a function of labor force employed in the agriculture sector, investment made in the agriculture sector and financial development. Theoretical and empirical studies support the hypothesis that the level of financial development is a good predictor of subsequent economic growth. Endogenous growth literature explains that how financial development enhances the growth of real sector, by allocating resources to productive activities, mobilizing savings, and providing liquidity services[18]. Moreover, financial development mitigates financial constraints faced by agricultural production and ensures the channeling of funds to agriculture sector for production and developmental purposes (Afangideh 2009 and Parivash and Torkamani 2008). Shahbaz, et al. (2011) finds that, in Pakistan, credit to private sector, which is proxy for financial development, correlates positively with economic growth in the long run. To explain the finance-growth nexus in case of agriculture sector, financial development is used as an 'input' in the aggregate production function along with the other inputs of the agriculture sector.

Agricultural output is low in developing countries like Pakistan due to small holdings, traditional method of farming, poor irrigation facilities, low use and misuse of modern farm use technology etc. (Zuberi 1989). Given small income and no savings, farmers suffer from cash flow problems that liquidity constraint produces sub-optimal inputs use and hence output (Khandker and Binswanger 1989). Therefore the credit allows the farmers to acquire fixed or working capital[19], and thus enhance agriculture output. In

[18] AKA (2011)
[19] Siddiqi, et al. 2004

Pakistan, agriculture credit has for long been identified as a major input in the development of agriculture sector[20]. Timely availability of credit enables farmers to purchase the required inputs and machinery for carrying out farm operations (Soober, *et al.* 2009). Khan and Din (2011) find that fertilizers, pesticides, tractors and biological inputs like seeds of high yield are typically purchased using credit money. Therefore, it is expected that agriculture credit has a positive and statistically significant impact upon agriculture output.

Investment is a fundamental determinant of output. The nexus between investment and growth suggests that sustained economic growth is not possible without continuous capital formation. Therefore the role of private investment (gross fixed capital formation) is considered as one of the major engines of agricultural growth (Looney 1994, Ghura 1997, Janjua and Javed 1998, James, *et al.* 2006, Sial, *et al.* 2010).

In Pakistan, the role of government in the agriculture sector has been extensive. The government formulates different policies for example, agriculture pricing and marketing polices, for the development of agriculture sector. Price support mechanism has been introduced to ensure that minimum guaranteed prices are paid to the farmers. Under the mechanism the government buys wheat (or other commodity for which the price is declared by the government) from the farmers at the declared price. The objective is to protect the farmers from adverse market conditions. Faruqee and Carey (1995) state that "the setting of the guaranteed minimum price is a consultative process that takes into account many factors, including domestic and world demand and supply, cost of production, price of competing crops, and inter-sectoral considerations". In addition Pasha, *et al.* (1995) argues that to encourage wheat production, the government purchases wheat at a higher price from the producers and sells it at lower price to the consumers. This act is obviously translated into food inflation and increase in the general price level (Pasha, et al. 1995, and Khan and Axel, 2006). Khan (1999) finds that purchasing power of farmers has not deteriorated over time by changes in the support price of all major crops and retail fertilizers. To explore the impact of general price level on agricultural output wheat support price is used as an

[20] Malik, *et al.* 1991, Qureshi and Shah 1992, Abbas, *et al.* 1992, and Abedullah, *et al.* 2009, Waqas, *et al.* 2011

explanatory variable in the model. The support price by providing a guaranteed return the farmers influences their decision regarding whether or not to produce and thus influences the level agricultural output.

To explore the impact of financial development on agricultural growth, we use Cobb Douglas production function where agriculture output is an outcome of labor force and capital investment. The impact of financial development is included in the residual as specified in equation (5.4).

$$AGY_t = A(AGL_t)^{\alpha_1}(AGK_t)^{\alpha_2} \tag{5.4}$$

Where AGY is agricultural output, AGL is agricultural labor force, and AGK is capital investment in agriculture sector. Transforming into log-linear form and including financial development index (FD), we can re-write equation (5.4) as follows;

$$\ln AGY_t = \alpha_0 + \alpha_1 \ln AGL_t + \alpha_2 \ln AGI_t + \alpha_3 \ln FD_t + \xi_t \tag{5.5}$$

Water availability, wheat support price, and infrastructure are the other important determinants that may affect the agricultural output of Pakistan (Abbas, *et al.* 1992, Looney 1994, Tahir and Habib 2000, Iqbal, *et al.* 2003). However there are also many other inputs like seeds, fertilizers, land, tractors etc. that are not included in the model because the presence of agricultural credit accounts for the influence of these factors (Khan and Din 2011). Given the foregoing the model of agriculture output can be written as;

$$\ln AGY_t = \alpha_0 + \alpha_1 \ln AGL_t + \alpha_2 \ln AGI_t + \alpha_3 \ln FD_t + \alpha_4 \ln AGC_t + \alpha_5 SP_t + \alpha_6 \ln WA_t + \alpha_7 \ln INFST_t + \xi_t \tag{5.6}$$

Where SP is the wheat support price, INFST is infrastructure, WA is water availability while ξ_t is error term. The prior expectations of variables in equation (5.6) are;

$$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7 \succ 0$$

5.4 Summary

To examine the impact of financial development on agriculture credit, agriculture investment, and agriculture output three models have been empirically investigated. The models are summarized below;

$$\ln AGC_t = \beta_0 + \beta_1 \ln FD_t + \beta_2 \ln AGY_t + \beta_3 \ln LR_t + \beta_4 \ln GNS_t + \mu_t \quad (5.2)$$

$$\ln AGI_t = \gamma_0 + \gamma_1 \ln FD_t + \gamma_2 \ln AGY_t + \gamma_3 \ln LR_t + \gamma_4 \ln AGC + \gamma_5 UN + \varepsilon_t \quad (5.3)$$

and

$$\ln AGY_t = \alpha_0 + \alpha_1 \ln AGL_t + \alpha_2 \ln AGI_t + \alpha_3 \ln FD_t + \alpha_4 \ln AGC_t + \alpha_5 SP_t + \alpha_6 \ln WA_t + \alpha_7 \ln INFST_t + \xi_t \quad (5.6)$$

5.5 Finance-Growth Nexus

It is clear from the models the three discussed so far that there is an interdependent relationship among the agriculture output, agriculture investment, agriculture credit, and the financial development. Development of financial system may affect the agriculture output through the following channel;

Figure 5.1

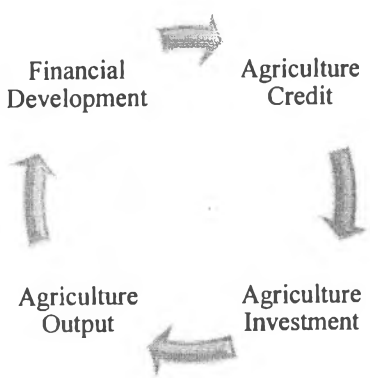


Figure 5.1 shows that financial development increases access to the credit of the farmers and thus the investment in agriculture is likely to increase with increase in financial development. The affect of investment on output, described in the channel, is supported by the fact that continued production is not

possible without continuous capital formation. The last element in the chain, agriculture output then feeds back into the system to influence the financial development[21]. Thus financial sector increase the funds available for the financing of investment, thereby improving the prospects of agriculture output.

The primary contribution of this study is that most of the studies on the finance-growth nexus usually look at financial development and economic growth at the aggregated level, this study focuses on only one component of the GDP i.e. the agriculture output. This study also analyzes the direct impact of financial development on agricultural investment and agricultural credit, the two elements in the chain that influences agricultural output.

[21] Supported by Demetriades and Hussein (1996)

Chapter 6 Data and Methodological Framework

This chapter describes the data, data sources, and the methodology of the research study. The study aims to use Autoregressive Distributed Lag (ARDL) cointegration method with annual time series data covering the period 1972-2010 (39 years). The Augmented Dickey-Fuller Test is used to test the stationary of the data series.

6.1 Measurement and Data Sources

To test the finance-growth nexus, different sets of indicators have been used in the literature for the measurement of financial development. These include bank based and market based indicators as a percentage of GDP. In conducting this research, the financial development indicators that reflect the extent of transaction services and efficient allocation of resources have been focused. The indicators of financial development to measure the services, aggregate size, and efficiency of financial sector of Pakistan[22] used in Khan and Qayyum (2007), have been used in this study

6.1.1 Financial Development Indicators

The first indicator, the ratio of bank deposit (BD) to GDP is one of the major indicators to measure the size, relative to the economy, of financial intermediaries. This is a typical measure of financial depth. King and Levine (1993) computed a typical measure of financial depth i.e. the ratio of liquid liabilities of financial system to nominal GDP. Another measure of financial development included in literature is liquid liabilities to GDP. However liquid liabilities to nominal GDP may not accurately reflect the provision of financial services in the economy as it is just an indicator of size of the financial sector and does not consider the allocation of capital. Demetriades and Hussein (1996) argue that a large component of broad money stock, that is, currency in circulation is held outside the banks therefore an

[22] An increase in the ratios of all indicators could be interpreted as "financial deepening".

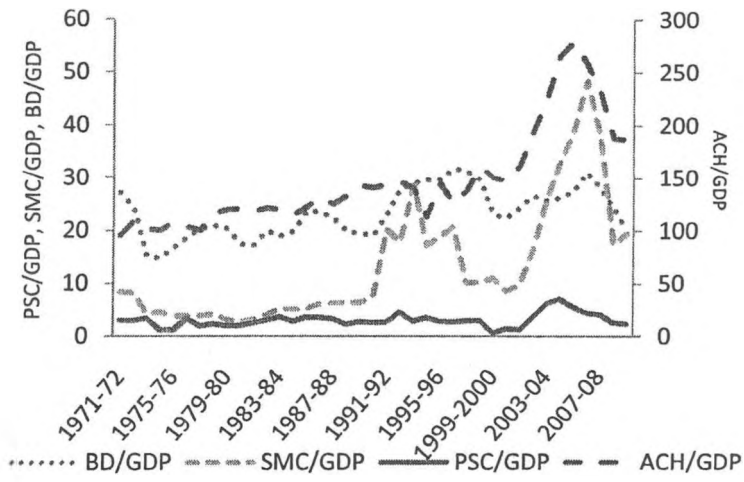
increase in liquid liabilities to nominal GDP may not essentially lead to increase in financial depth whereas an increase in deposit volume of the banks certainly causes increase in financial depth and therefore bank deposits are a better indicator of financial development. Moreover, bank deposits also reflect the availability of credit because bank loans are limited to the extent of volume of deposits. Therefore BD to nominal GDP is a good indicator of financial development.

The second indicator, the ratio of private sector credit (PSC) to GDP is defined as the credit extended to the private sector by banks and other financial intermediaries excluding credit extended to the government and public enterprises, and the credit extended by the monetary authority and development banks. It measures the overall degree to which banking sector allocates funds and provides financial intermediary services to firms and households. In case of sectoral distribution of private sector credit, this indicator provides relevant information to measure the adequacy of the level of credit provided for the domestic output. PSC to GDP is a preferred indicator because it improves on other measures of financial development used in the literature[23]. For example, Levine and Zervos (1998) use a measure of deposit money bank credit to private sector to GDP, which does not include credit by non-deposit money banks to private sector. Therefore, PSC to GDP is a broader measure of financial development for credit issuing financial intermediation.

The third indicator, the ratio of amount of house clearing (AHC) to GDP is used as an indicator of financial services development to measure the amount of money cleared by banks through cheques relative to GDP. The last and forth indicator, the ratio of stock market capitalization (SMC) to GDP is used to measure the existence of financial instruments and development of stock markets and includes the value of listed shares on domestic markets to GDP. According to Levine (1997), as stock markets become larger market participants may have greater incentives to acquire information about firms. Figure 6.1 depicts the overtime trend each the four financial indicators discussed in this section.

[23] See Levin, *et al.* (2000)

Fig. 6.1 Financial Development Indicators relative to GDP (%)



6.1.2 Financial Development Index: Construction

Inclusion of the financial variables, discussed above, in the model separately may cause serious problems of multicolinearity[24]. Furthermore, the inclusion of large number of regressors could cause serious estimation problems. In order to avoid the problem of correlation, we have constructed a financial sector development index. Given the merits and demerits of the different indicators of financial development discussed above, we feel an index of financial development constructed using the four indicators discussed above will better reflect the state of financial development of an economy rather than idea formed by looking at the values of a single indicator. Therefore we have developed an index of financial development that incorporates all the four indicators discussed in this section (BD, ACH, PSC, and SMC).This index has been used as a measure of financial development in the empirical investigation. The index has been constructed using principal component analysis. The state of financial development as reflected by the index of financial development is plotted in figure 6.2. The figure shows a steady improvement in the financial the state of financial development overtime. To test the robustness of results, we have also constructed an alternate financial development index using only two indicators of financial development; bank deposits and private sector credit. The rationale is that the stock markets and

[24] Kelly and Mavrotas (2003), Khan and Qayyum (2007)

the Clearing House facilities may not be as developed in Pakistan as these are in the developed economies (for results see Annex-A).

Figure: 6.2 Financial Sector Development Index

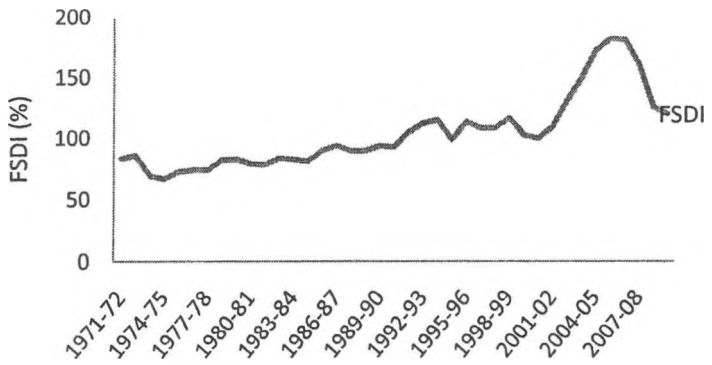


Table 6.1 displays the results obtained from the principal component analysis. The eigenvalues indicate that the first principal component (PCA1) explains 71 percent of the standardized variance whereas the other principal components accounts for only 15, 10 and 2 percent of the variance. Therefore the first principal component explains variation in the financial dependent variable better than the other principal components. The financial development index based on first principal component is formed as a linear combination of initial values of financial development measures (BD, SMC, ACH, and PSC) with weights[25] given by the first eigenvector.

[25] Weights have been normalized.

Table 6.1 Eigenvalues of Correlation Matrix

	PCA1	PCA2	PCA3	PCA4
Eigenvalues	2.85363	0.618855	0.423054	0.10446
Variance %	71.3408	15.4714	10.5764	2.6115
Cummulative %	71.3408	86.8121	97.3885	100

Eigenvectors

Variables	V1	V2	V3	V4
ACH/GDP	-0.52931	-0.28982	0.507635	-0.61493
BD/GDP	-0.44153	0.797494	-0.31913	-0.25926
SMC/GDP	-0.55598	0.079659	0.365133	0.742442
PSC/GDP	-0.46451	-0.52313	-0.71214	0.058507

Real GDP is the ratio of nominal GDP to consumer price index (base year 2000-01). Taking lead from Ahmed and Qayyum (2008), gross fixed capital formation in agricultural private sector has been used as a measure of private investment in the agriculture sector. The weighted average rate of return on the total advances of schedule banks has been used as the average lending rate (Islamic mode from 1993) and proxy for the relative cost of bank credit and capital investment. Gross national savings is the sum of private savings plus public savings. Real values of agricultural output, industrial output, service output, national savings, and agricultural investment at current factor cost have been normalized by consumer price index (base year 2000-01). Uncertainty is captured by percentage change in inflation. Cropping intensity is computed as the total cropped area to total cultivated area. Road density computed as road length to total area is used as proxy for infrastructure. Support price of wheat is given in units of 40 kg.

Data on average lending rate, inflation rate, national savings, and the components financial development indicators are from Statistical Handbook of Pakistan's Economy (SBP, 2010) and various issues of monthly Statistical Bulletin published by the State Bank of Pakistan. Data on gross fixed capital formation, agricultural output, industrial output, services output, agriculture labor force, water availability

(per acre feet), total cropped area, total cultivated area, total area and road length is from various issues of Pakistan Economic Survey published annually by the Government of Pakistan. The data on support price of wheat is (Rs per 40 kg) is from various issues of Agricultural Statistics of Pakistan. All the variables have been expressed in logarithmic form except cropping intensity and uncertainty.

6.2 Descriptive Statistics

Table 6.2 gives some summary statistics on the variables and indicates that there is enough variability in the variables. Results indicate that from 1971-72 to 2009-10, the average value of agriculture output is Rs. 6476.7 millions while the average value of private investment in agriculture sector is Rs. 402 million. The vast variation between the minimum and maximum values of agriculture credit suggests that the agriculture sector has experienced a highly variable level of credit availability. The mean level of water availability over the same period is 114.7 million hectares. Labor force employed in agriculture sector is 15.4 million annually. The average rate of return on total advances during the period 1971-72 to 2009-10 is 11.7 percent.

Table 6.2 Summary Statistics

	Variables				
	AGY	AGI	AGC	FD	AGL
Mean	6476.7	402.2	427.1	106.4	15.4
Max.	13893.7	1107.4	1331.4	199.4	24.2
Min.	2692.8	70.3	19.3	71.4	10.1
	WA	CRPI	INFST	GNS	LR
Mean	46.4	1.0	22491.9	4281.5	11.7
Max.	57.8	1.1	9749.0	10698.2	15.6
Min.	28.8	0.9	34404.7	553.4	7.2

Simple correlation coefficients between the variables are presented in Table 6.3. Agricultural output is highly correlated with inputs other than financial development. So, there is some crude evidence

positive relationship between agricultural output and all the agriculture inputs. Therefore private investment, labor force, credit, water availability, infrastructure and cropping intensity may be considered as the significant determinants of agriculture output. Table 6.3 shows that the financial development is positively but weakly correlated with all the variables. Moreover private investment in agriculture sector and agricultural credit are highly correlated with each other. Correlation coefficients in Table 6.3 may give a useful indication of the role of financial development in agriculture. But still this kind of investigation is not sophisticated enough to allow us to be confident about the results discussed above; therefore we undertake an econometric investigation.

Table 6.3
Correlation Coefficients

Variable	lnAGY	lnAGI	lnAGC	lnFD	lnAGL	lnWA	lnWSP	lnINFST	UN	lnGNS	lnLR
lnAGY	1.00	0.94	0.95	0.12	0.95	0.94	0.98	0.96	-0.19	0.95	0.34
lnAGI	0.94	1.00	0.94	0.27	0.94	0.91	0.92	0.91	-0.33	0.96	0.20
lnAGC	0.95	0.94	1.00	0.21	0.96	0.95	0.96	0.92	-0.20	0.94	0.38
lnFSDI	0.12	0.27	0.21	1.00	0.21	0.07	0.10	0.03	0.00	0.22	-0.55
lnAGL	0.95	0.94	0.96	0.21	1.00	0.89	0.96	0.88	-0.16	0.92	0.34
lnWA	0.94	0.91	0.95	0.07	0.89	1.00	0.94	0.98	-0.21	0.94	0.45
lnWSP	0.98	0.92	0.96	0.10	0.96	0.94	1.00	0.95	-0.13	0.93	0.42
lnINFST	0.96	0.91	0.92	0.03	0.88	0.98	0.95	1.00	-0.25	0.94	0.43
UN	-0.19	-0.33	-0.20	0.00	-0.16	-0.21	-0.13	-0.25	1.00	-0.40	0.09
lnGNS	0.95	0.96	0.94	0.22	0.92	0.94	0.93	0.94	-0.40	1.00	0.28
lnLR	0.34	0.20	0.38	-0.55	0.34	0.45	0.42	0.43	0.09	0.28	1.00

6.3 Estimation Procedure

For the time series analysis, it is essential to first determine the degree of integration of each variable in the model. The traditional test, Augmented Dickey Fuller, has been used to determine the staionarity of the variables. If the unit root test shows that all the variables are stationary then we simply apply standard ordinary least square (OLS). However many economic time series change overtime time, therefore it is possible that the time series variables are not stationary at the level or have a unit root. Therefore to avoid the spurious results from the classical regression, the use of stationary or differenced

variables is required for estimation. But use of differenced form of equation only provides partial or short run information and removes out the long run characteristics of the data set. To overcome such problem, the time series literature suggests a number of techniques to test the existence of long run relationship among the time series variables, for example residual based Engel-Granger (1987) test, maximum likelihood based Johansen (1995), and Johansen and Juselius (1990) test. However these techniques have some limitations. For example, Johansen cointegration technique requires large data sample for validity and in case of Engel-Granger procedure, the regression requires that one variable be used as a regressor and other as a regressand and both variables must be integrated of same order[26].

However to avoid these problems, bound testing approach to cointegration is employed within the framework of Autoregressive Distributed Lag (ARDL) popularized by Pesaran and Shin (1995), Pesaran and Pesaran (1997) and Pesaran, et al. (2001). This procedure has been used for the following reasons. Firstly, unlike most of the cointegration procedures, ARDL can be used to study small samples (Pesaran and Shin, 1999). Secondly, the ARDL procedure does not impose a restrictive assumption that all the variables under study must be integrated of the same order, thus it does not matter whether the regressors of the model are purely I(0), purely I(1) or mutually cointegrated. Thirdly, long-run and short-run coefficients are estimated simultaneously (Khan, *et al.* 2005). Fourthly, ARDL modeling incorporates sufficient number of lags to capture the general to specific modeling framework. According to the Pesaran and Shin (1999), modeling the ARDL with appropriate lags will correct for both serial correlation and endogeneity. Finally, the bounds testing procedure does not require the pre-testing of the variables included in the model for unit roots like other techniques such as the Johansen approach (Shrestha and Chowdhry, 2005 and Jalil, *et al.* 2008). Therefore, the approach is considered to be very suitable for analyzing the underlying relationship and has been increasingly used in empirical research in recent years.

The baseline ARDL model can be expressed as follows;

$$\Delta Y_t = \varphi_0 + \sum_{i=1}^{p} \varphi_{1i} \Delta Y_{t-i} + \sum_{i=0}^{q} \varphi_{2i} \Delta X_{t-i} + \rho Y_{t-1} + \Gamma_j X_{t-1} + \nu_t \qquad \text{j=1,2,....k} \qquad (6.1)$$

[26] Enders 2004, Dash 2005, Jalil, *et al.* 2008

Where Y is dependent variable, X is a vector of explanatory variables, k the number of regressors, p and q are the order of lag lengths, and Δ is the first difference operator. ARDL model is estimated by ordinary least square (OLS). The terms with summation in equation (6.1) represent short-run error correction dynamics and the terms with ρ and Γ signify long-run relation between the variables.

The ARDL procedure is basically based on two steps. In first step, the order of lags on the first differenced variables is obtained from the unrestricted models by using the Akaike Information Criterion (AIC) or the Schwartz-Bayesian Criterion (SBC). The estimation of ARDL is based on the number of lags that minimize AIC or SBC. Pesaran and Shin (1999) show that SBC is better than AIC for ARDL approach and therefore we use the SBC. In second step, the bounds F-test is applied to examine whether there exists a long run cointegration relationship between the variables under study. The null hypothesis for no cointegration among the variables in equation (6.1) is $H_0: \rho = \Gamma_1 = \Gamma_2 = \ldots\ldots\ldots = \Gamma_k = 0$. Pesaran, *et al.* (2001) provides critical value bounds for a bound testing procedure (ARDL). Where the two sets of critical values; I(0) and I(1) stand for lower value bound and upper value bound. If the computed F value exceeds the upper bound, we conclude that there exists long-run relationship between the variables in the model while the F value below the lower bound entails the absence of long-run relationship between the variables. F value between the two bounds makes the test inconclusive.

The first step in ARDL model specification is to estimate equation (6.1) by the ordinary least square (OLS) and then apply F-test by equating lagged levels of the variables equal to zero for the existence of long-run relationship between the variables. In the second step, once the cointegration is established the conditional long-run estimates are derived from the reduce form ARDL model where at the steady state change is assumed to be zero i.e. difference terms equalizes to zero. The implied long-run relationship then is;

$$Y_t = \frac{\varphi_0}{-\rho} + \frac{\Gamma_j}{-\rho} X_t + \frac{\mu_t}{-\rho} \qquad (6.2)$$

This can be written as;

$$Y_t = \beta_0 + \beta_i X_t + \eta_t \tag{6.3}$$

Where X_t = vector of independent variables and η_t is white noise error. This involves selecting the orders of ARDL (p,q) using the lag length criteria SBC. In the third and final step, the short-run dynamics in terms of error correction model can be constructed by adding error term generated from the long-run equation.

$$\Delta Y_t = \psi_0 + \sum_{i=1}^{p} \psi_{1i} \Delta Y_{t-i} + \sum_{i=0}^{q} \psi_{2i} \Delta X_{t-1} + \vartheta EC_{t-1} + \omega_t \tag{6.4}$$

Here ψ_{2i} are the short-run dynamic coefficients, EC is the error correction term from the estimated cointegration model of equation (6.1), and ϑ is the speed of adjustment back to long-run equilibrium after the short-run shock. To ensure the fitness of the models, diagnostic tests (serial correlation, functional form, normality, and heteroscedasticity) and stability tests (CUSUM and CUSUMQ) are employed.

On the basis of ARDL procedure, the unrestricted error correction models corresponding to the equations (5.2), (5.3), and (5.6) are respectively given below:

$$\begin{aligned}\Delta \ln AGC_t = {} & \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta \ln AGC_{t-i} + \sum_{i=0}^{p} \beta_{2i} \Delta \ln FD_{t-i} + \sum_{i=0}^{p} \beta_{3i} \Delta \ln AGY_{t-i} + \sum_{i=0}^{p} \beta_{4i} \Delta \ln LR_{t-i} \\ & + \sum_{i=0}^{p} \beta_{5i} \Delta \ln GNS_{t-i} + \beta_6 \ln AGC_{t-1} + \beta_7 \ln FD_{t-1} + \beta_8 \ln AGY_{t-1} + \beta_9 \ln LR_{t-1} + \beta_{10} \ln GNS_{t-1} \\ & + \mu_{1t}\end{aligned} \tag{6.5}$$

$$\begin{aligned}\Delta \ln AGI_t = {} & \gamma_0 + \sum_{i=1}^{p} \gamma_{1i} \Delta \ln AGI_{t-i} + \sum_{i=0}^{p} \gamma_{2i} \Delta \ln FD_{t-i} + \sum_{i=0}^{p} \gamma_{3i} \Delta \ln AGY_{t-i} + \sum_{i=0}^{p} \gamma_{4i} \Delta \ln LR_{t-i} \\ & + \sum_{i=0}^{p} \gamma_{5i} \Delta \ln AGC_{t-i} + \sum_{i=0}^{p} \gamma_6 UN + \gamma_7 \ln AGI_{t-1} + \gamma_8 \ln FD_{t-1} + \gamma_9 \ln AGY_{t-1} + \gamma_{10} \ln LR_{t-1} \\ & + \gamma_{11} \ln AGC_{t-1} + \gamma_{12} UN_{t-1} + \varepsilon_{1t}\end{aligned} \tag{6.6}$$

and

$$\Delta \ln AGY_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta \ln AGY_{t-i} + \sum_{i=0}^{p} \alpha_{2i} \Delta \ln AGL_{t-i} + \sum_{i=0}^{p} \alpha_{3i} \Delta \ln AGI_{t-i} + \sum_{i=0}^{p} \alpha_{4i} \Delta \ln FD_{t-i}$$
$$+ \sum_{i=o}^{p} \alpha_{5i} \Delta \ln AGC_{t-i} + \sum_{i=0}^{p} \alpha_{6i} \Delta \ln SP_{t-i} + \sum_{i=0}^{p} \alpha_{7i} \Delta \ln INFST_{t-i} + \sum_{i=0}^{p} \alpha_{8i} \Delta \ln WA_{t-i} + \alpha_9 \ln AGY_{t-1}$$
$$+ \alpha_{10} \ln AGL_{t-1} + \alpha_{11} \ln AGI_{t-1} + \alpha_{12} \ln FD_{t-1} + \alpha_{13} \ln AGC_{t-1} + \alpha_{14} \ln SP_{t-1} + \alpha_{15} \ln INFST_{t-1}$$
$$+ \alpha_{16} \ln WA_{t-1} + \xi_{1t} \qquad (6.7)$$

If the long run relationship (cointegration) exists between the variables of agricultural credit model, private agricultural investment model, and agricultural output model, then the long run parameters of the models can be estimated using the following equations:

$$\ln AGC_t = \pi_0 + \pi_1 \ln FD_t + \pi_2 \ln AGY_t + \pi_3 \ln LR_t + \pi_4 \ln GNS_t + \mu_{2t} \qquad (6.8)$$

The coefficients of the cointegrating relationship are obtained from:

$$\pi_0 = \frac{\beta_0}{-\beta_6}, \ \pi_1 = \frac{\beta_7}{-\beta_6}, \ \pi_2 = \frac{\beta_8}{-\beta_6}, \ \pi_3 = \frac{\beta_9}{-\beta_6}, \ \pi_4 = \frac{\beta_{10}}{-\beta_6}$$

Similarly the long-run model of agricultural investment can be written as:

$$\ln AGI_t = \theta_0 + \theta_1 \ln FD_t + \theta_2 \ln AGY_t + \theta_3 \ln LR_t + \theta_4 \ln AGC_t + \theta_5 UN_t + \varepsilon_{2t} \qquad (6.9)$$

Where,

$$\theta_0 = -\frac{\gamma_0}{\gamma_7}, \ \theta_1 = -\frac{\gamma_8}{\gamma_7}, \ \theta_2 = -\frac{\gamma_9}{\gamma_7}, \ \theta_3 = -\frac{\gamma_{10}}{\gamma_7}, \ \theta_4 = -\frac{\gamma_{11}}{\gamma_7}, \ \theta_5 = -\frac{\gamma_{12}}{\gamma_7}$$

and the long-run model of agriculture output can be written as:

$$\ln AGY_t = \phi_0 + \phi_1 \ln AGL_t + \phi_2 \ln AGI_t + \phi_3 FD_t + \phi_4 \ln AGC_t + \phi_5 \ln SP_t + \phi_6 INFST_t$$
$$+ \phi_7 \ln WA_t + \xi_{2t} \qquad (6.10)$$

Where;

$$\phi_0 = \frac{\alpha_0}{-\alpha_9}, \ \phi_1 = \frac{\alpha_{10}}{-\alpha_9}, \ \phi_2 = \frac{\alpha_{11}}{-\alpha_9}, \ \phi_3 = \frac{\alpha_{12}}{-\alpha_9}, \ \phi_4 = \frac{\alpha_{13}}{-\alpha_9}, \ \phi_5 = \frac{\alpha_{14}}{-\alpha_9},$$

$$\phi_6 = \frac{\alpha_{15}}{-\alpha_9}, \phi_7 = \frac{\alpha_{16}}{-\alpha_9}$$

ARDL specification for the short run dynamics can be found by estimating the error correction models (6.11), (6.12), and (6.13).

$$\Delta \ln AGC_t = \rho_0 + \rho_1 \Delta \ln FD_t + \rho_2 \Delta \ln AGY_t + \rho_3 \Delta \ln LR_t + \rho_4 \Delta \ln GNS_t + \rho_5 ECM_1(-1) + \mu_{3t} \quad (6.11)$$

$$\Delta \ln AGI_t = \vartheta_0 + \vartheta_1 \Delta \ln FD_t + \vartheta_2 \Delta \ln AGY_t + \vartheta_3 \Delta \ln LR_t + \vartheta_4 \Delta \ln AGC_t + + \vartheta_5 UN_t + \rho_6 ECM_2(-1) + \varepsilon_{3t} \quad (6.12)$$

and

$$\Delta \ln AGY_t = \delta_0 + \delta_1 \Delta \ln AGL_t + \delta_2 \Delta \ln AGI_t + \delta_3 \Delta \ln FD_t + \delta_4 \Delta \ln AGC_t + \delta_5 \Delta \ln SP_t + \delta_6 \Delta INFST_t + \delta_7 \Delta \ln WA_t + \delta_8 ECM_3(-1) + \xi_{3t} \quad (6.13)$$

Where,

$$ECM_1 = \ln AGC_t - \pi_0 - \pi_1 \ln FD_t - \pi_2 \ln AGY_t - \pi_3 \ln LR_t - \pi_4 \ln GNS_t \quad (6.14)$$

$$ECM_2 = \ln AGI_t - \theta_0 - \theta_1 \ln FD_t - \theta_2 \ln AGY_t - \theta_3 \ln LR_t - \theta_4 \ln AGC_t - \theta_5 UN_t \quad (6.15)$$

and

$$ECM_3 = \ln AGY_t - \phi_0 - \phi_1 \ln AGL_t - \phi_2 \ln AGI_t - \phi_3 FD_t - \phi_4 \ln AGC_t - \phi_5 \ln SP_t - \phi_6 INFST_t - \phi_7 \ln WA_t \quad (6.16)$$

6.4 Unit Root Test

Even though the ARDL approach does not require pretesting of unit root test, but still it is essential to check the stationarity of time series variables first because if the variables are non-stationary then the ARDL procedure will give spurious results (Shresta and Chowdhury, 2005 and Ma and Jalil 2009). The traditional Augmented Dickey-Fuller (ADF) test is employed to test the order of integration of each variable, represented by the following models:

Model 1 (with intercept):

$$\Delta y_t = c_1 + by_{t-1} + \sum_{k=1}^{p} d_k \Delta y_{t-k} + \varepsilon_t \quad (6.4)$$

Model 2 (with intercept and trend):

$$\Delta y_t = c_1 + by_{t-1} + c_2 t + \sum_{k=1}^{p} d_k \Delta y_{t-k} + \varepsilon_t \quad (6.5)$$

Table 6.4

Augmented Dickey-Fuller test results

Model: $\Delta y_t = c_1 + by_{t-1} + c_2 t + \sum_{k=1}^{p} d_k \Delta y_{t-k} + v_t ; H_o : b = 0, H_a : b \succ 0$

Unit-root tests at logarithmic levels			Unit-root tests at first differences		
Variables	Constant	Constant & Trend	Variables	Constant	Constant & Trend
LnAGY	1.68	-4.53	*LnAGY*	-6.49*	-7.08*
LnAGI	-1.04	-2.54	*LnAGI*	-5.89*	-5.82*
LnAGC	-3.35*	*-5.06	*LnAGC*	-4.76*	-4.74*
LnAGL	0.16	-1.88	*LnAGL*	-7.47*	-7.39*
LnWA	-2.48	-1.22	*LnWA*	-10.63*	-5.97*
LnINFST	-1.99	-0.43	*LnINFST*	-1.68	-2.37
LnFD	-1.28	-2.25	*LnFD*	-5.87*	-5.78*
lnSP	-0.05	-2.36	*lnSP*	-5.88*	-5.87*
LR	-3.43*	-3.46	*LR*	-4.84*	-4.77*
UN	-3.16*	-3.28	*UN*	-7.50*	-7.78*

*Note:*Denotes significance at the 5% and the rejection of the null hypothesis of non-stationarity.Critical values are -2.94, -3.53, and -1.95 for first, second and third models respectively.*

The results of ADF test are given in Table (6.4) and show that the variables lending rate, agricultural credit, and uncertainty are stationary at level i.e. I (0), where as other variables are non-stationary at level and stationary at first difference i.e. I (1). The test shows that variables included in the

study are either stationary at I (0) or I (1). Thus the ADF supports the use of ARDL to determine the long-run relationship among the variables.

Chapter 7 Empirical Results and Analysis

In this chapter, ARDL framework models for equations (5.2), (5.3) and (5.6) are estimated by OLS to study the static long-run relationship between the variables. As mentioned earlier that SBC has been used to determine the lag length of variables under consideration. The criteria yields lag of one in each model. The bounds F-test has been used to determine the existence of cointegration among the variables. Given the relatively small sample size (39 observations) and the use of annual data, the lag length of 2 is used in the bounds test[27]. The critical values used in this study are extracted from Pesaran, *et al.* (1999). If there is evidence of cointegration among the variables of the models, a further two-step procedure is undertaken to obtain the long run and short run parameters. The diagnostic tests are employed at this stage of the estimation procedure. Similarly the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMQ) tests for parameter stability of the models are also performed against the critical bounds of 5 percent level of significance. If the computed values lie within the critical bounds then the null hypothesis of stability cannot be rejected.

7.1 Model of Bank Credit to Agriculture Sector

Given our model (equation 5.2), we estimate the unrestricted error correction (EC) model (6.5) with bank credit to agriculture sector as the dependent variable. To determine the existence of cointegration among the agricultural credit and its determinants, we have computed F statistics with intercept and no trend. These are reported in table 7.1.

[27] Pesaran and Shin (1999)

Table 7.1 F-Statistics for Cointegration Relationship

Dep. Var.	F-calculated	Critical value bounds of the F-statistics with intercept and no trend (k = 5)						Outcome
		1%		5%		10%		
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	
lnAGC	11.2213	3.41	4.68	2.62	3.79	2.26	3.35	cointegration

The calculated F statistics exceed the upper critical bound therefore the null hypothesis of no cointegration is rejected. Thus there exists long-run relationship between agricultural credit, financial development, agricultural output, lending rate, and gross national savings.

7.1.1 Long-Run Results

The estimated long-run results are given in Table 7.2.

Table 7.2 Estimated Long-Run Coefficients: Agriculture Credit & Financial Development

Equation (5.2): Dependent variable is lnAGC

Regressor	Coefficient	Standard Error	T-Ratio	Probability
C	-4.890	0.471	-2.915***	0.007
lnFD	0.586	0.290	0.567	0.575
lnAGY	1.894	0.216	2.461**	0.020
lnLR	-1.040	0.210	-1.391	0.174
lnGNS	3.939	0.928	1.192	0.242

***(**) denotes 1%(5%) level of significance

The results show that agriculture output is the key determinant of agriculture credit. The coefficient of agriculture output has the expected positive sign and exerts statistically significant impact on agricultural credit. The estimated coefficient implies that 1 percent increase in agriculture output

increases agriculture credit by 1.8 percent. The result that output creates demand for finance in form of credit demand is in accord with Robinson (1952) view that finance follows growth i.e. economic growth creates demand for financial services, especially credit. According to this view, increase in agricultural output creates demand for agricultural credit to buy inputs required to increase the output. However the estimated coefficient of the lending rate is insignificant and negative. This finding supports the claim made by Khandker and Faruqee (2003) that the interest rate is not a good predictor of the demand of credit as it hardly varies. One main reason for the non-significance of the lending rate is that a large part of the credit to the agriculture sector has been extended on concessional terms through ZTBL, and the concessional rate has not changed as frequently as the market rate.

The estimated coefficient of financial development reflects statistically insignificant impact of financial development on agricultural credit. One reason for this could be that a major part of agricultural credit comprises the credit extended by the ZTBL. The ZTBL being a public sector bank, the lending policy and the lending volume of the bank depends more upon government decisions which one would expect to be a function of number economic as well as political considerations. Therefore the financial development may not have a direct linkage with demand for and supply of agricultural credit. Moreover for variety of reasons, including low literacy levels, cumbersome banking procedures etc. people may prefer informal credit over formal agricultural credit. Though the farmers might be availing informal credit and at times making good use of it this variable cannot be included in the financial development index that we have constructed because reliable periodic data on informal credit is not available. Yet another reason for the insignificant result could be that the stock market of Pakistan may not be contributing much agriculture in terms of availability of agricultural finance. This view is substantiated by the fact that no major agricultural firm is listed on any of the stock exchanges in Pakistan. Singh (1997) also corroborates view by stating that the role of stock markets is very little in the economic in the economic growth of developing countries.

The impact of gross national savings on agricultural credit is insignificant. Theory suggests that increase in gross national savings from private and public sector may cause increase in lending including

lending to the agriculture sector. The insignificance could be due to the fact that the magnitude of the agricultural credit for the large part of the period under study, rather than being determined by market forces, has been determined annually by the government through National Credit Consultative Council (NCCC) The NCCC used to assign targets of agriculture credit annually which the banks being in the public sector had to follow. It is noteworthy here that almost the entire banking industry was in the public sector till 1990. Two banks, Muslim Commercial bank and Allied bank were privatized in 1990 and 1991 and then yet another two banks were privatized in year 2001 and 2002. The government decisions, even if based on economic considerations only and taken on merit, might be miss judgment of the economic scenario by a handful of policymakers charge with decision making. Moreover the decisions being influenced by rent seeking cannot be ruled out. Thus the public nature of the banking industry and the allocation of credit targets through the NCCC should be kept in view while looking at the absence of statistically significant relationship between gross national savings and agricultural credit as well as between the lending rate and the agricultural credit.

7.1.2 Short-Run Dynamics

The results of short-run dynamics are reported in Table 7.3.

Table 7.3 Error Correction Representation of ARDL Model

Equation (5.2) Dependent variable is lnAGC

Regressor	Coefficient	Standard Error	T-Ratio	Probability
ΔlnAGC(-1)	0.756	0.108	7.020***	0.000
ΔlnFD	0.417	0.144	2.893***	0.007
ΔlnAGY(-1)	0.369	0.472	0.781	0.440
ecm(-1)	-0.808	0.217	-3.718***	0.001

ecm=lnAGC+*4.89**C-*1.894**lnAGY-*0.586**lnFD+*1.040**lnLR-*3.939**lnGNS

R-Squared = 0.496	R-Bar-Squared = 0.450	SER = 0.0689
DW-Statistics = 2.0478	RSS = 0.1568	
Akakike Info. Criterian = -2.409	Shwarz Bayesian Criterion = -2.235	

*** denotes 1% level of significance

The coefficient of error correction term (-0.808) is negative and highly significant. The negative and significant coefficient of error correction term indicates the existence of cointegrating relationship among the variables of agricultural credit model given by equation 6.11. The magnitude of feedback coefficient implies that disequilibrium occurred due to the previous year's shock and convergence into the long-run equilibrium is at the rate of 80 percent.

Unlike the long-run results, the short-run changes in financial development are positive and statistically significant at the 1 percent level. This result is as hypothesized. The result implies that as the economy grows, the financial sector grows with it to meet the increasing demands that are placed on it. We know that financial development captures the ease of access to bank credit and thus the financial development increases the availability of credit. The result show that with the expansion of agriculture the credit requirements in the sector have increased and the banking sector have kept pace with increased demand. The short-run changes in lagged agricultural credit have positive and significant effect on current agricultural credit at 1 percent level of significance. The rate of return on advances and gross national saving are insignificant in short run as well and have therefore been dropped from the model estimated.

7.1.3 Diagnostic Results

Table 7.4

ARDL-VECM Model Diagnostic Tests			
LM Test Statisitics			
Serial Correlation	$\chi_2(1)=0.2268$	Normality	$\chi_2(2)=1.3817$
Functional Form	$\chi_2(1)=1.639$	Heteroscedasticity	$\chi_2(1)=0.9726$

The diagnostic results reported in table 7.4 show that the model of agricultural credit given by 6.5 passes the tests of serial correlation, functional form misspecification, non-normality of residuals, and heteroscedasdicity. Figures 7-a and 7-b show that both the cumulative sum (CUSUM) and cumulative

sum of squares (CUSUMQ) tests stay within the bounds, indicating that all the coefficients in the model are stable over the study period.

Figure 7-a

Plot of Cumulative Sum of Recursive Residuals

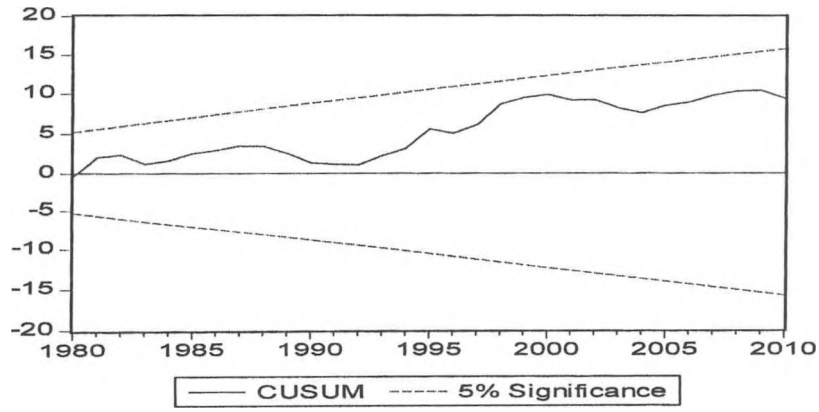
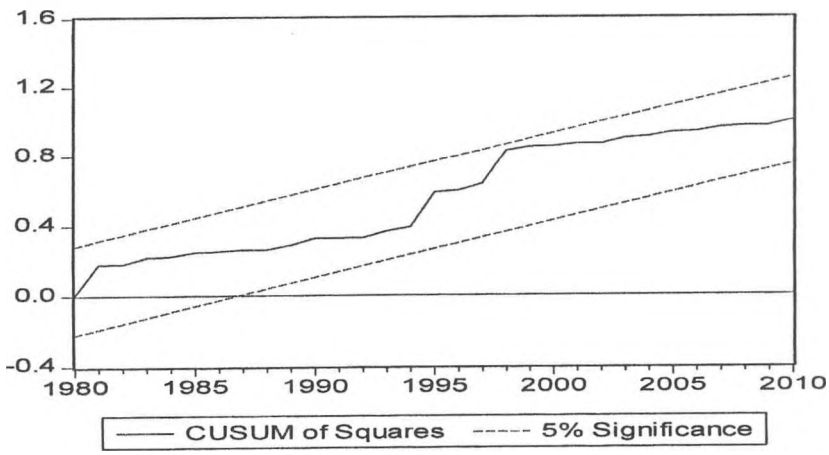


Figure 7-b

Plot of Cumulative Sum of Squares of Recursive Residuals



7.2 Model of Private Investment in Agriculture Sector

Now we turn to test the results of agriculture investment equation 5.3, which are obtained by estimating the unrestricted error correction model (5.6) regression. To determine the existence of

cointegration among the agricultural credit and its determinants, we have computed the bound F statistics without using intercept and trend. The results are reported in Table 7.5.

Table 7.5 F-Statistics for Cointegration Relationship

Dep. Var.	F-calculated	Critical value bounds of the F-statistics with no intercept and no trend (k = 6)						Outcome
		1%		5%		10%		
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	
lnAGI	4.97237	2.66	4.05	2.04	3.24	1.75	2.87	cointegration

The calculated F statistics exceed the upper critical bound value, using no intercept and trend which implies that the null hypothesis of no cointegration is rejected and there exists long-run relationship between private investment, agricultural credit, agricultural output, lending rate, and uncertainty.

7.2.1 Long-Run Results

Having found the long run relationship (cointegration) between the variables of agriculture investment model (equation 5.3), the long run model (6.9) is estimated to obtain the long run parameters. The results for long-run relationship are reported in table 7.6.

Table 7.6 Estimated Long-Run Coefficients: Agriculture Investment & Financial Development

Equation (5.3) Dependent variable: lnAGI				
Regressor	**Coefficient**	**Standard Error**	**T-Ratio**	**Probability**
lnFD	-0.037	0.265	-0.096	0.924
lnAGY	0.739	0.190	2.674***	0.012
lnLR	-1.009	0.200	-3.469***	0.002
lnAGC	0.239	0.049	3.339***	0.002
UN	-1.590	0.338	-3.230***	0.003

*** denotes 1% level of significance

The estimated coefficient of financial development is statistically insignificant. The finding is not in accord with the financial development framework proposed by McKinnon (1973) and Shaw (1973) that financial development may enhance growth through private investment boom. One reason for the insignificance of the relationship between the financial development and private investment in agriculture sector could be that some of the components of private investment in agriculture sector e.g. improvement in water courses are believed to fall in public domain and the private sector expects that the government will undertake investment in this area. Secondly as explained earlier a major part of agriculture lending is made through ZTBL, and the lending volume of ZTBL depends more upon government decisions rather than purely upon financial development.

The estimated coefficients of agriculture output, average lending rate, and agriculture credit have the expected signs. The result shows that there is negative relation between the lending rate and private investment in the agriculture sector. The estimated coefficient of lending rate is 1, negative and significant. The result is logical and in agreement with findings of other studies. The impact of agriculture output on private investment is positive and significant (0.7). The positive sign of agriculture output supports the income-accelerator theory that investment is an increasing function of changes in the output level. The influence of agricultural credit on private investment in agriculture sector is significant and

positive. The result implies that with one percent increase in banking credit to agriculture sector, private investment increases by 0.24 percent in the long-run. The positive effect of agriculture credit on private investment supports the Qureshi and Shah (1992) finding that optimal use of financial resources promotes private investment in the agriculture sector.

In case of inflation uncertainty, results are strongly supportive of the negative association between uncertainty and private investment. This implies that volatility in inflation rate negatively affects the private investment decisions in the agriculture sector. This result is in accord with the findings by Serven (1998) for developing countries, and Qayyum and Ahmed (2008) for Pakistan.

7.2.2 Short-Run Dynamics

Table 7.7 reports the short-run results.

Table 7.7 Error Correction Representation of ARDL Model

Equation (5.3) Dependent variable is lnAGI				
Regressor	**Coefficient**	**Standard Error**	**T-Ratio**	**Probability**
ΔlnAGI(-1)	0.462	0.144	3.197***	0.003
ΔlnAGY	1.162	0.410	2.835***	0.008
ΔlnLR(-1)	-0.407	0.261	-1.558	0.129
ΔUN	-0.921	0.282	-3.262***	0.003
ecm(-1)	-0.874	0.243	-4.420***	0.000
ecm=lnAGI-*.739**lnAGY+*0.037**lnFD+*1.009**lnLR-*.239**lnAGC+*1.59**UN				
R-Squared = 0.5776		R-Bar-Squared = 0.5248		SER = 0.06652
DW-Statistics = 1.9167		RSS = 0.141603		
Akakike Info. Criterian = -2.4575		Shwarz Bayesian Criterion = -2.2398		
*** denotes 1% level of significance				

The coefficient of error correction term (0.87) is negative and statistically significant at the 1 percent level. The negative and significant coefficient is an indication of cointegrating relationship among private investment, credit, output, lending rate, financial development, and uncertainty. The magnitude of the coefficient shows a fairly high speed of adjustment to equilibrium after the shock.

The signs of short-run results are maintained in the long-run. The results suggest that the insignificant impact of financial development on private investment in short-run is similar to the long-run results. The effects of short-run changes in agriculture output and uncertainty are significant at 1 percent and have the expected signs. Unlike the results for lending rate in the long run the results for short run changes in lending rate show insignificant impact of lending on private investment in agriculture sector[28]. The effect of lagged private investment is positive. This result is in accord with the findings by Looney (1999).

7.2.3 Diagnostic Tests

Table 7.8

ARDL-VECM Model Diagnostic Tests			
LM Test Statisitics			
Serial Correlation	$\chi_2(1)=1.0881$	Normality	$\chi_2(2)=0.9606$
Functional Form	$\chi_2(1)=0.155$	Heteroscedasticity	$\chi_2(1)=1.0569$

Table 7.8 reports the diagnostic tests, conducted on the model of private investment and found no evidence of serial correlation, non-normality of residuals, functional form misspecification, and heteroscedasticity. The plot of the CUSUM and CUSUMQ stability tests, shown in figures 7-c and 7-d, indicate the stability in the coefficients of the model, as they lie within the bounds.

[28] Similar to the results of LR on "bank credit to agriculture" model

Figure 7-c

Plot of Cumulative Sum of Recursive Residuals

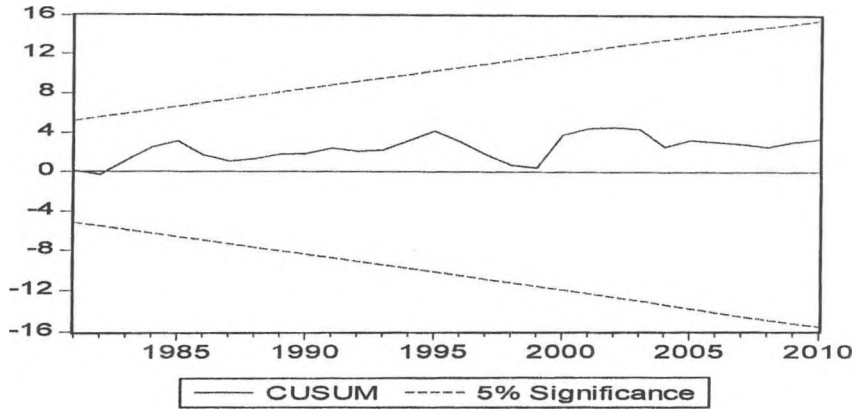
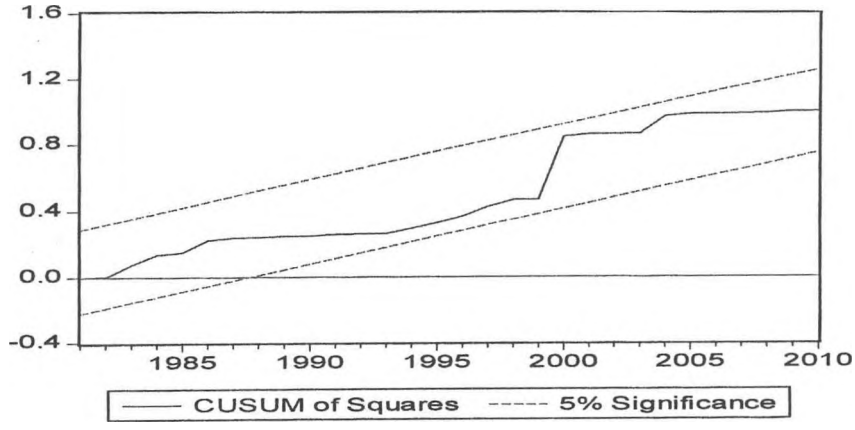


Figure 7-d

Plot of Cumulative Sum of Squares of Recursive Residuals



7.3 Model of Agricultural Output

With respect to our model (equation 6.6), the unrestricted error correction model (6.7) regression is estimated, with agriculture output as the dependent variable. To determine the existence of long-run relationship between the variables of agricultural output model, the computed F-statistics is reported in table 7.9 using no intercept and trend. The null hypothesis of no cointegration among the variables is

$\alpha_9 = \alpha_{10} = \alpha_{11} = \alpha_{12} = \alpha_{13} = \alpha_{14} = \alpha_{15} = \alpha_{16} = 0$. The calculated F-statistics of agricultural output model is above the upper critical value which is an evidence of cointegration among the variables of the model.

Table 7.9 F-Statistics for Cointegration Relationship

Dep. Var.	F-calculated	Critical value bounds of the F-statistics with no intercept and trend (k = 8)						Outcome
		1%		5%		10%		
lnAGY	3.7416	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	Cointegration at 5%
		2.66	4.05	2.04	3.24	1.75	2.87	

7.3.1 Long-Run Results

The results obtained from estimation of equation 6.10 are reported in table 7.10.

Table 7.10 Estimated Long-Run Coefficients: Agriculture Output & Financial Development

Equation (5.6): Dependent variable is lnAGY

Regressor	Coefficient	Standard Error	T-Ratio	Probability
lnAGL	0.871	0.184	2.943***	0.007
lnAGI	0.094	0.034	1.714*	0.098
lnFD	0.072	0.065	0.693	0.495
lnAGC	-0.091	0.026	-2.158**	0.040
lnINFST	0.578	0.118	3.054***	0.005
lnSP	0.136	0.035	2.416**	0.023
lnWA	0.016	0.229	-0.043	0.966

*(**)(***) denotes 10%(5%)(1%) level of significance

The impact of financial development on agriculture output is insignificant. The magnitude of the coefficient (0.072) shows that the impact is almost negligible. The results do not support the view that financial development plays an important role in the output of agriculture sector. This result completely contradicts the McKinnon (1973) and Shaw (1973) hypotheses that financial intermediaries play essential role in promotion of economic growth. However it is important to note that McKinnon and Shaw conclusion is based on study of the aggregate economy, while this study is for only one component of the economy; the agriculture sector. In case of financial development and agriculture output, Demetriades and Hussein (1996) argue that in Pakistan the banking sector plays only a minor rule in the financing of agricultural activities as most of the farmers rely on agricultural cooperatives and informal markets. Therefore one reason for the insignificance of the relationship between financial development and variables like agriculture output and private investment in agriculture sector could be that financial development indicators fail to capture the role played by the informal credit market.

The estimated coefficients of the long-run relationship show that water availability does not have significant effect on agriculture output though the sign is positive. The positive sign supports the view that crop production can be enhanced by increasing water availability. The estimated coefficient of private investment is positive and significant. The result is as hypothesized. This implies that sustained capital formation plays boosting agricultural output. The estimated coefficient of wheat support price is 0.136, which is positive and significant. The result confirms that price support policies change the incentives of the farmers, which in turn significantly affects agricultural output.

Moreover, agricultural credit exerts significant but negative effect on agriculture output. The coefficient of agriculture credit implies that the agricultural productivity declines by 0.09 percent with one percent increase in bank credit to agriculture sector. The result is in accord with the findings by Khan and Din (2011), but contradicts the findings of Malik, *et al.* (1991) and Iqbal, *et al.* (2003). Khan and Din (2011) argue that negative association between agricultural credit and agricultural output in Pakistan could be due to miss allocation of credit. We tend agree with Khan and Din (2011) as the non performing loans of the agriculture sector reflect strong possibility of the miss allocation of agricultural credit. Dong,

et al. (2010) argues that with limited access to credit the amounts and combinations of inputs may deviate from optimal levels which in turn adversely effects output. Moreover, the credit share of ZTBL in total credit is declining over the time though it is the only institution with total focus on agriculture sector in Pakistan. Khandker and Faruqee (2003)[29] argue that the small land holders, credit to whom yields better results, have poor access to formal loans while the large land holders receive bulk of the formal credit, as they can offer collateral. Moreover because of the high financial risk, low return, and high operational cost, financial institutions have strict requirements for the lending in rural areas. Therefore the agriculture credit does not exert positive impact on agriculture output.

The magnitude of the coefficient of agriculture labor is positive, significant and as hypothesized, this shows that impact of labor force on agriculture output is substantial. The marginal product of labor in agriculture sector is 0.87 in the long-run. The magnitude of the labor force coefficient shows that the agriculture sector of Pakistan is labor intensive, as about 45 percent of total work force is engaged in the sector. In rural areas of Pakistan, agricultural labor is usually provided mostly by poor and landless households who work on farm land mostly as either seasonal or permanent workers to earn a living. Moreover due to lack of mechanized facilities, labors are engaged for higher yields subsistence crops like wheat, rice, maize as well as for labor intensive cash crops like seasonal vegetables.

The estimated coefficient of infrastructure is 0.578, which is positive and statistically significant at 1 percent level. This shows that agriculture sector of Pakistan benefits from the improvement in infrastructure like road development due to increase in the choices of the farmers not only in the selection of appropriate inputs but the selection of efficient product markets as well (World Bank Report 2005).

7.3.2 Short-Run Dynamics

Short-run dynamic parameters are obtained by estimating an error correction model (6.13) associated with the long run estimates.

[29] Their findings are only for ZTBL's credit.

Table 7.11 Error Correction Representation of ARDL Model

Equation (5.6) Dependent variable is lnAGY

Regressor	Coefficient	Standard Error	T-Ratio	Probability
ΔlnAGY(-1)	0.20	0.13	1.72*	0.10
ΔlnAGL	0.42	0.14	2.91***	0.01
ΔlnAGI	0.09	0.03	3.27***	0.00
ΔlnSP	0.10	0.05	2.01**	0.05
ΔlnAGC(-1)	-0.05	0.02	-2.18**	0.04
ΔlnINFST(-1)	0.53	0.18	3.03***	0.01
ecm(-1)	-0.87	0.23	-3.87***	0.00

ecm=lnAGY-.094*lnAGI-.*871*lnAGL-.*072*lnFD+.*091*lnAGC-.*578*lnINFST +0.016*lnWA -.*136*lnSP

R-Squared = 0.54425	R-Bar-Squared = 0.45309	SER = 0.01586
DW-Statistics = 2.0779	RSS = 0.0075	
Akakike Info. Criterian = -5.288	Shwarz Bayesian Criterion = -4.9834	

***(**)(*) denotes 1%(5%) and (10%) level of significance

The results of short-run dynamics coefficients associated with the long-run relationships are obtained from the ECM equation (6.13) are given in Table 7.11. The estimated error correction coefficient is -0.87, has the correct sign and is highly significant at the 1 percent level. The significant coefficient ensures that the long-run equilibrium can be attained among the variables of the model. The magnitude of coefficient implies that the 87 percent of disequilibrium caused by previous year's shock is corrected in the current year.

The short run results for private investment are similar to the long-run results. That is private investment casts significant impact on agricultural output in the short run. However this time short-run changes in lagged credit availability and lagged infrastructure have significant effect on agricultural output. As seen in the results for long run labor force exercise positive and significant influence on agricultural output in the short run as well. This kind of relationship holds for infrastructure and wheat support price as well.

7.3.3 Diagnostic Tests

Table 7.12

ARDL-VECM Model Diagnostic Tests			
LM Test Statisitics			
Serial Correlation	$\chi_2(1)=0.2389$	Normality	$\chi_2(2)=0.0533$
Functional Form	$\chi_2(1)=0.3159$	Heteroscedasticity	$\chi_2(1)=0.6935$

The regression for the underlying equation 6.7 fits well as R^2=57%. LM statistics for diagnostic tests are reported in table 7.12, which shows that the ARDL model of agriculture output is free from serial correlation, non-normal errors and heteroscedasticity. Moreover, Ramsey RESET test for misspecification reports that the χ^2 statistics value is less than the critical value of 3.84, which implies that the ADRL model is correctly specified. The results of CUSUM and CUSUMQ stability tests are plotted in figures 7-e and 7-f, which suggest that the relationships among the coefficients of agriculture output model are stable.

Figure 7-e

Plot of Cumulative Sum of Recursive Residuals

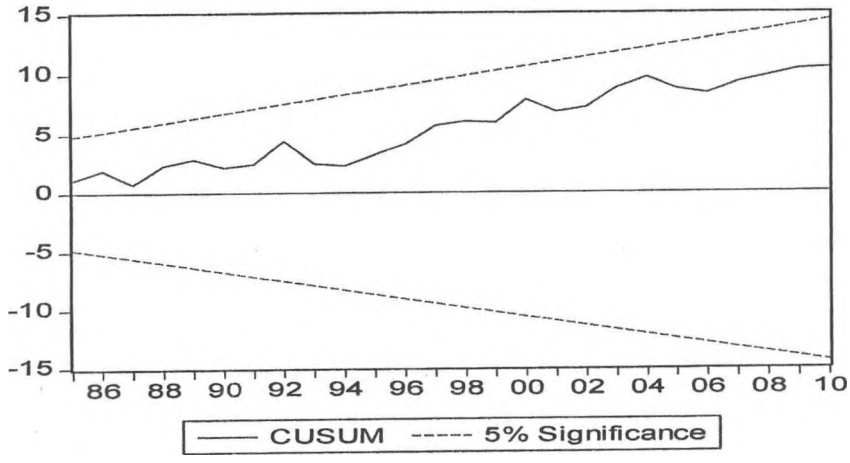
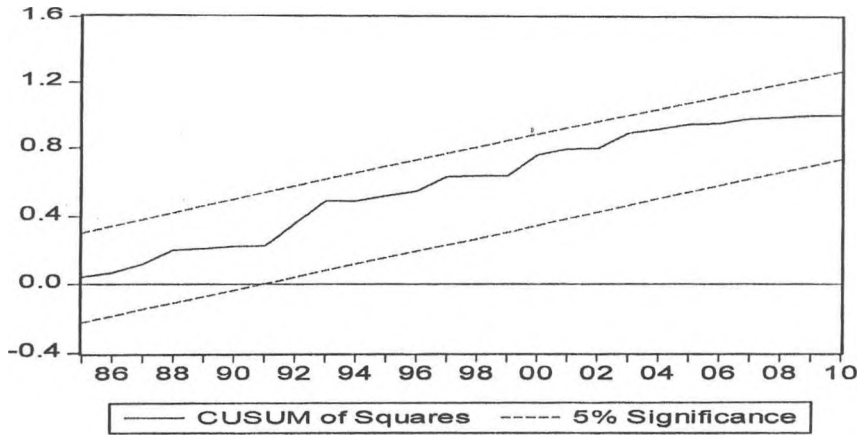


Figure 7-f

Plot of Cumulative Sum of Squares of Recursive Residuals



7.4 Nexus between the Dependent Variables and the Financial Development

The interdependent relationship between the financial development, agriculture output, credit and investment has been confirmed by the estimated results for Pakistan. With the development of financial sector, credit to the agriculture sector increases, this increases investment opportunities in the sector which in turn increases productivity of the agriculture sector. Thus the development of financial system affects the agricultural output through the following channel;

Financial Development → Agriculture Credit → Agriculture Investment → Agriculture Output

To confirm that the last element in the chain, agriculture output feeds back into the system to effect financial development or not, we apply a pair wise Granger Causality test. Table 7.13 clearly shows that there is no evidence of causality between financial development and agricultural output.

Table 7.13 Pair wise Granger Causality Test
(Agriculture Output and Financial Development)

Null Hypothesis:	Obs.	F-Statistic	Probability
LNAGY does not Granger Cause LNFD	38	0.293	0.592
LNFD does not Granger Cause LNAGY		0.059	0.809

Overall the findings demonstrate that financial development does not exert significant impact on agricultural output, agricultural credit, and private agricultural investment in Pakistan. However, financial development significantly affects agriculture credit in short run. Bank credit and private investment are the sources of financing in the agriculture sector of Pakistan. However, the estimated results clearly show that the private investment does not have any direct link with the development of financial sector. Results confirm that the financial development is only weakly correlated with the dependent variables. It is worth noting that the results do not necessary means that there is no stable relation between financial development and agricultural productivity. It is possible that the some sources of finance in agriculture sector are not accounted for in the financial development indicators[30]. In addition, the significant effect of private investment on agriculture output shows that for efficient investment activities, farmers need credit and therefore they go for loans from different sources. However the misallocation and misuse of these loans exerts negative impact on output level of agriculture sector.

The most important issue related to the insignificant role of financial development is the limited access of farmers to formal sources of finance for agriculture production. Farmers take loans for different purposes; for example agricultural production, purchase of land and machinery and consumption purposes, to pay-off old loans, household expenses, non-agricultural production etc. But in actual practice the amount of funds utilized for agricultural production may be insufficient to boost the output of the

[30] Aka (2011)

agriculture sector. Farmers have limited access to the formal finance and the dominance of informal finance negatively[31] affects the agricultural productivity. Due to limited access of farmers to the financial institutions, the services of these institutions are also limited. Moreover the involvement of public sector in determination of credit volume and agricultural credit policies may also hinder the efficient allocation of resources.

[31] See Khandker and Faruqee (2003)

Chapter 8 Conclusion and Policy Implications

This study has examined the existence of long run relationship between financial development, agricultural output, agricultural credit, and agricultural investment for Pakistan using the data for the period 1972 to 2010. Overall our findings demonstrate that financial development does not exert significant impact on agriculture output, agriculture investment and agriculture credit in Pakistan. The ARDL bounds testing approach to cointegration has been used to establish the existence of long run relationship and the ECM for the short run dynamics. Stationarity of the series has been examined by using the ADF unit root test.

The idea of the study stems from the fact that output of agriculture sector is a major contributor to GDP ever since the independence of Pakistan. The agriculture sector needs adequate finance from financial institutions especially to employ capital intensive techniques based on sophisticated technology to accelerate the overall growth. Moreover the well functioning financial sector is in any case essential for sustained economic growth of any sector of the economy. The financing needs in agriculture sector for the production will be met in form of credit or investment. Thus the role of financial institutions in agriculture sector is mainly to facilitate higher levels of agriculture credit, investment, and output. In this study we have examined the finance-growth nexus in the context of agriculture sector.

The main contribution of the study is that so far finance growth nexus has not been analyzed for the agriculture sector of the Pakistan. The role of financial development on the agriculture credit, investment, and output has been examined in this study. The specific objectives of this study, which is exclusively focused on Pakistan, were:

i. To analyze the direct impact of financial development on agriculture output of Pakistan.
ii. To explore the interdependent relationship between financial development, agriculture credit, agriculture investment, and agriculture output.

iii. To investigate the indirect impact of financial development on agriculture output through the channels of private investment and credit.

A theoretical model is used to study the relationship between the financial development and growth through the investment channel. Following assumptions of the model, three models are estimated with agriculture credit, agriculture investment, and agriculture output as dependent variables. Financial development is included as an explanatory variable in each of these models to determine the impact of development of financial development on the agriculture sector. In both long run and short run, financial development exerts negative and insignificant impact on agriculture output. The result does not support the supply leading hypothesis of finance-growth nexus in the agriculture sector of Pakistan.

The empirical results also reveal that financial development does not significantly affect agriculture credit and agriculture investment in long run, however financial development significantly affects agriculture credit in the short run. Agriculture credit on the other hand exerts significant but negative impact on the agriculture output, while agriculture investment positively and significantly affects agricultural output. Therefore the hypothesis that financial development affects agriculture output through the credit and investment channels is not verified in the case of Pakistan.

The results further show that agriculture output significantly affects the agricultural credit and investment, both in short run and long run. Lending rate exerts insignificant impact on agriculture credit while the impact is significant on agriculture investment. Uncertainty adversely affects private agricultural investment in Pakistan. Wheat support price and road development enhance agricultural output. Results also show that labor force and capital are the main determinants of the agriculture output both in the long run and short run.

In general, the role of financial development is not limited to providing credit. Developed financial system tends to promote efficiency in allocating investments and hence contributing to the productivity growth by mobilizing savings, evaluating projects, managing risks, monitoring managers,

and facilitating transactions[32]. All this is not verified in the case of the agriculture sector of Pakistan. The study supports the view that in Pakistan institutional financing and services are far from reaching all farmers. As most of the farmers borrow from informal sources and the role of banking industry is limited. Formal credit institutions have usually failed in providing credit to the target households and producers due to mismanagement and poor performance. This is confirmed by the negative impact of agriculture credit on agriculture output. Moreover, most of the agricultural credit policies in Pakistan depend upon government decisions which do not have any direct link with financial development. Moreover the informal financing does not figure out into the financial development index used to examine the impact of financial development upon agricultural output, credit and investment. Therefore the results of this study do not essentially imply that financial development does not influence output.

The insignificant impact of financial development on output could be due inability to include informal credit in the financial development index. This inability stems from data constraints as reliable estimate of the magnitude of informal credit are not available, especially on periodic basis. Another reason for the negative impact of agricultural credit on agricultural output could be the misuse of agricultural credit. As the farmers obtain the credit from ZTBL on concessional terms, knowing that they may not face penal action of any sort if they default on the loan, they may use the loan for personal consumption rather buying agricultural inputs or undertaking agriculture investment. The fulfillment of personal cash needs through agricultural loans may make the farmers lax and less motivated to improve agricultural output. Moreover, Zafar, *et al.* (2011) argues that the private sector or few banks may be reluctant to serve the agriculture sector due to its seasonality and the inherent risks of farming. Therefore the contribution of financial development in improving agricultural output may not be significant.

[32] King and Levine (1993)

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Annex. A

Estimated long-run results of FDI (BD and PSC)

A-1 Model of Bank Credit to Agriculture Sector

Table: Anx 1.1 Estimated Long-Run Coefficients using the ARDL Approach

Equation (5.2): Dependent variable is lnAGC

Regressor	Coefficient	Standard Error	T-Ratio	Probability
C	-9.594	0.989	-2.702**	0.011
lnFD	1.499	0.244	1.709*	0.097
lnAGY	3.017	0.212	3.967***	0.000
lnLR	0.241	0.288	0.233	0.817
lnGNS	-1.456	1.064	-0.381	0.706

***(**)(*) denotes 1%, 5% & 10% level of significance

Table: Anx 1.2 Error Correction Representation for the Selected ARDL Model

Equation (5.2) Dependent variable is lnAGC

Regressor	Coefficient	Standard Error	T-Ratio	Probability
ΔlnAGC(-1)	0.743	0.097	7.626***	0.000
ΔlnFD	0.400	0.136	2.951***	0.006
ΔlnAGY(-1)	0.766	0.431	1.778*	0.085
ecm(-1)	-0.887	0.198	-4.471***	0.000

ecm=lnAGC+*9.954**C-*3.017**lnAGY-1.499*lnFD-0.241*lnLR+*1.456**lnGNS

R-Squared = 0.555	R-Bar-Squared = 0.514	SER = 0.065
DW-Statistics = 1.905	RSS = 0.139	
Akakike Info. Criterian = -2.533	Shwarz Bayesian Criterion = -2.359	

***(*) denotes 1% & 10% level of significance

A-2 Model of Private Agricultural Investment

Table: Anx 2.1 Estimated Long-Run Coefficients using the ARDL Approach

Equation (5.3) Dependent variable: lnAGI

Regressor	Coefficient	Standard Error	T-Ratio	Probability
lnFD	0.016	0.091	0.124	0.902
lnAGY	0.701	0.126	3.827***	0.001
lnLR	-0.988	0.188	-3.621***	0.001
lnAGC	0.242	0.051	3.270***	0.003
UN	-1.613	0.327	-3.398***	0.002

*** denotes 1% level of significance

Table: Anx 2.2 Error Correction Representation for the Selected ARDL Model

Equation (5.3) Dependent variable is lnAGI

Regressor	Coefficient	Standard Error	T-Ratio	Probability
ΔlnAGI(-1)	0.460	0.145	3.172***	0.003
ΔlnAGY	1.140	0.413	2.761**	0.010
ΔlnLR(-1)	-0.421	0.261	-1.611	0.117
ΔUN	-0.927	0.283	-3.269***	0.003
ecm(-1)	-0.970	0.244	-4.378***	0.000

ecm=lnAGI-.*747*lnAGY-.067*lnFD+.*929*lnLR-.*227*lnAGC+*1.643*UN

R-Squared = 0.574617	R-Bar-Squared = 0.521444	SER = 0.066758
DW-Statistics = 1.90901	RSS = 0.142610	
Akakike Info. Criterian = -2.4504	Shwarz Bayesian Criterion = -2.2327	

***(**) denotes 1% & 5% level of significance

A-3 Model of Agricultural Output

Table: Anx 3.1 Estimated Long-Run Coefficients using the ARDL Approach

Equation (5.6): Dependent variable is lnAGY

Regressor	Coefficient	Standard Error	T-Ratio	Probability
lnAGL	0.890	0.177	3.218***	0.003
lnAGI	0.103	0.032	2.058**	0.050
lnFD	0.028	0.035	0.507	0.616
lnAGC	-0.099	0.026	-2.427**	0.023
lnINFST	0.595	0.116	3.275***	0.003
lnSP	0.152	0.044	2.228**	0.035
lnWA	-0.037	0.229	-0.105	0.917

***(**) denotes 1% & 5% level of significance

Table: Anx 3.2 Error Correction Representation for the Selected ARDL Model

Equation (5.6) Dependent variable is lnAGY

Regressor	Coefficient	Standard Error	T-Ratio	Probability
ΔlnAGY(-1)	0.225	0.131	1.720***	0.096
ΔlnAGL	0.435	0.141	3.082*	0.004
ΔlnAGI	0.067	0.028	2.415**	0.022
ΔlnSP	0.083	0.047	1.749***	0.091
ΔlnAGC(-1)	-0.051	0.024	-2.085**	0.046
ΔlnINFST(-1)	0.532	0.171	3.115*	0.004
ecm(-1)	-0.906	0.220	-4.127*	0.000

ecm=lnAGY-*.103**lnAGI-*.890**lnAGL-*.028**lnFD+*.099**lnAGC-*.595**lnINFST +0.37*lnWA - *.152**lnSP

R-Squared = 0.56742	R-Bar-Squared = 0.47699	SER = 0.01546
DW-Statistics = 2.3297	RSS = 0.00717	
Akakike Info. Criterian = -5.3329	Shwarz Bayesian Criterion = -5.02815	

***(**)(*) denotes 1%, 5% & 10% level of significance