Exogeneity, Cointegration and Economic Policy Analysis: An Application from Financial Development and Economic Growth

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By

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Abstract

This study analyzes the role of exogeneity and cointegration in economic policy decision making. To this end, we consider the case of financial development and economic growth nexus in case of Pakistan using the quarterly data over the period of 1972Q2 to 2012Q2. Liquid liabilities and private sector credit is used as a measure of financial development, whereas real GDP is used as an indicator of economic growth. We employ seasonal unit root test advanced by Hylleberg et al (1990) to examine the order of integration among variables under consideration. The results show that real interest rate and investment are level stationary whereas the remaining variables are stationary at first difference. To determine the long-run relationship between finance and growth we employ Johansen and Juselius (1990) multivariate cointegration test. We failed to obtain supportive result for long-run relationship between the variables. Lack of cointegration between the variables constraint us to employ variants of exogeneity test. Therefore, we employ the short run multivariate Granger causality test to determine the sources of causation. Results suggest that liquid liabilities causes' economic growth significantly however, the impact of credit to private sector on economic growth is insignificant. This means that private sector credit is weakly exogenous for economic growth. Besides, financial development other variables such as trade openness, private investment, government expenditure and real interest rate also play a crucial role in enhancing economic growth. Results show that trade openness and real interest rate has a significant effect on economic growth whereas the other variable does not cause growth significantly. The result of the study implies that policy makers should take appropriate steps to improve the credit availability in the economy. Both trade and financial liberalization has positive impacts on growth therefore, policy makers have to enhance the level of liberalization in both of these sectors.

Chapter 1
Introduction and objectives of the study

1.1 Introduction

An assessment of alternative economic policies is one of the main challenging issues in econometric modeling and the concept of exogeneity and cointegration helps in interpreting results generated by using econometric models. A reliable economic policy is very much depending on the distribution of policy targets conditional on policy instruments.

The concept of exogeneity, cointegration, causality and invariance are vital in determining the usefulness of estimated model for policy analysis. It can be argued that theory of cointegration deals with the non-stationary data issues, whereas the validity of the estimated model and its use for policy analysis is associated with the theory of exogeneity (Engle et al., 1983). Hoover (1990, P.123) defines causality as "A causes B if control of A renders B controllable. A causal relation, then, is the one that is invariant to interventions in A, in the sense that if someone or something can alter the value of A, the changes in B follow in a predictable fashion". Another concept of exogeneity is superexogeneity introduced by Engle, et al. (1983) and Engle and Hendry (1993).

The concept of exogeneity is very useful for policy analysis, therefore we briefly define the concept of exogeneity and then we use it to model the link between financial development and economic growth as a case study. The issue of exogeneity arises when seeking to analyze the behavior of a variable given the behavior of remaining variables. There are three types of exogeneity vs. Weak exogeneity, Strong exogeneity and super exogeneity.

The concept of weak exogeneity was introduced by Richard (1980). Weak exogeneity deals with conditional inference about the parameters of interest without loss of information. A variable is

said to be weakly exogenous if all the information about parameter of interest is obtained from conditional model. In other words, conditional model is used for conditional inference.

Strong exogeneity is necessary for conditional forecasting. Strong exogeneity requires weak exogeneity and Granger non-causality to provide the basis of conditional forecasting. The concept of superexogeneity is required for conditional policy analysis. Superexogeneity is based on the fact that a model cannot be used for policy analysis, if the policy would change the model on which the policy is based. Superexogeneity, therefore, extends the concept of weak exogeneity and includes the invariance of the parameters of the conditional model to interventions affecting the marginal model in order to sustain conditional policy analysis.

The present study uses exogeneity test to examine finance-growth linkages following Yang (2008). In Pakistan no research work is done on this issue. There are some studies which examined the relationship between financial development and economic growth (for example, Hassan, et al. 1996, Khan et al. 2005, Rahman et al. 2012, Sidra ,2011, Chaudary, 2008). However, no study is available that carried out superexogeneity test with respect to finance-growth nexus. This study employs the superexogeneity test within the framework of financial development and economic growth and tries to examine the issue of causality between finance and growth because its implication for policymaking is important and a variable cannot be used for policy analysis since it is exogenous. Now we take a brief look at the relationship of financial development and economic growth.

The role of financial development in economic growth is a longstanding issue among the economists. Financial development is a broader term in the sense that it includes all those activities which improve the quality as well as quantity of financial services. Financial development includes financial relaxation which implies a reduction of aimed credit distribution,

interest rates deregulation and remotion of barriers on capital movements (Kemal, 2000). In short financial development is the up gradation of banks, microfinance institutions, stock exchange, financial instruments and insurance firms. Financial sector has a strong relationship with the other sectors of the economy and it will affect the other sectors of the economy strongly. The advancement in financial system has a significant effect on growth in developing economies as compared to the developed economies because bank-based system creates more impact on growth rather than market-oriented system (Khan et al., 2007). Financial development enhances capital formation (McKinnon and Shaw, 1973).

A lot of empirical literature is available with different opinions on this issue. Goldsmith (1969) is of the view that financial improvement is a very crucial factor for long-run economic growth because it facilitates the allocation of funds between needy sectors. Schumpeter (1934) argued that the role of banks is very crucial factor for economic growth. Khan et al. (2005) found that financial sector development stimulates economic growth in case of Pakistan. Robinson (1952) views on financial development and economic growth contradicts with Goldsmith and Schumpeter, he observed that the development in the financial sector follows economic growth. MacKinnon (1973) supports the Robinson's views by arguing that it is not necessary that causation is unidirectional. According to Lucas (1988) economists have over emphasized on the role of financial development in economic growth.

There are mixed evidence on the direction of causality between finance and growth in the literature. Levine (1997) accepts that ambiguity and argues that till now the literature on finance-growth nexus is very helpful in understanding that nexus but that knowledge is still incomplete and need to be discussed further. Now we take a brief look at the financial sector of Pakistan.

Financial sector of Pakistan is improved especially after 1980; however, the sector is still underdeveloped as compared to the financial sectors of developed countries. The reforms in 1980's are mainly focused on developing financial institutions, financial markets and money, credit and exchange management. In 1980's, the Government of Pakistan has initiated a non-banking financial sector for the private sector investment but the major portion of funds was held by the public sector financial institutions. The State Bank of Pakistan (SBP) has adopted an easy monetary policy and takes other steps like privatization of banks, opening of new banks and the creation of security exchange commission of Pakistan to develop the financial sector.

The literature on finance-growth nexus shows that there is a lot of ambiguity among economists on that issue, which is needed to be addressed and resolved. , In case of Pakistan there is contradiction among the economists and the studies on that issue gives mixed results. Some studies follow supply leading hypothesis (for example Hassan, et al. 1996, Wadud 2009, Khan et al. 2005) while some follow demand leading hypothesis (Sidra 2011, Rahman et al. 2012). This study tries to develop a linkage between finance and growth and determines the direction of causality using the tests of exogeneity.

1.2 Objectives of the Study

Since the immediate implications of super exogeneity is that with super exogeneity, conditional policy simulation does not involve any loss of information relative to simulation from the joint distribution. An important implication of super exogeneity is that the Lucas critique[1] cannot hold. Furthermore, under non-super exogeneity, inversion of economic relations is not meaningful.

[1] Lucas critique is named for Robert Lucas (1976). Lucas argues that reduced form models are not suitable for policy evaluation because when there is a change in policy, the economic agents may change their behavior thus the parameters of the model will change. Therefore, these models are not suitable for policy evaluation.

On the given important implications of exogeneity in policy analysis this study tries to develop the nexus between financial development and economic growth to examine the causal relation under the framework of exogeneity and cointegration for Pakistan using quarterly data over the period of 1973 to 2012. Based on the literature survey, it is unclear that either the development in the financial sector effects growth, growth effects financial development or both variables are jointly linearly dependent and any third variable cause's economic growth (Yang and Hoon, 2008). In the context of Pakistan Khan et al. (2005), Jalil and Ma (2008), Rehman, et al. (2008) and Uddin (2010) among others, carried out empirical research on finance and growth, but these studies did not focused on the issue of exogeneity. In case of policy analysis the concept of super exogeneity is more relevant. Hence, the main objective of this study is to examine that either financial development control causes economic growth or not with reference to Pakistan and employ superexogeneity test. Superexogeneity test requires the existence of long run relationship between financial development and economic growth. Based on the above cited discussion, we specify the objectives of the study as following:

- To examine the long run relationship between financial development and economic growth
- If the long run relationship exists between financial development and economic growth then we use the superexogeneity tests to examine the direction and sources of causality between finance and growth.
- If long run relationship does not exist between financial development and economic growth then we test for the short run multivariate Granger-causality.

1.3 Organization of the study

Chapter 2 reviews the literature on financial development and economic growth. Chapter 3 reviews the financial and trade reforms so far carried out in Pakistan. Chapter 4 discusses econometric methodology. Chapter 5 examines the data sources and time series properties. Descriptive analysis is also carried out in this chapter. Chapter 6 interprets the empirical findings and Chapter 7 concludes the study along with policy implication.

Chapter 2
Review of Literature

This chapter reviews literature available on finance and growth. Section 2.1 reviews the theoretical literature on the finance-growth nexus. Empirical literature review is given in section 2.2. Section 2.3 reviews the literature in case of Pakistan. Section 2.4 concludes the chapter.

2.1 Theoretical Literature Finance and Growth

The discussion on the relationship between financial sector development and economic growth was initiated by Schumpeter (1911) and our discussion lies with the fact that how financial development affects economic growth. Financial development can be defined as "a process that marks improvement in quality, quantity and efficiency of financial intermediary services" (Calderon and Liu, 2003). It is evident from the literature that financial sector improvement will improve the level of investment by decreasing managerial costs and through circulating local and foreign savings. A well-established financial system guarantees that finance is allocated optimally by improving trade, dispersing risks, allowing liquidity and good business opportunities. All these factors enhance the level of investment which will, in turn, boost up the economic growth. Although finance-growth nexus is well established in economic literature but there are several views about direction of causality as the policy implication is highly dependent on the direction of causality we discuss these views on the finance-growth nexus briefly .There are four views about the finance growth nexus;

1) Supply-leading view
2) Demand-following view

3) Mutual impact of finance and growth
4) No relationship between finance and growth

The supply-leading hypothesis suggests that financial development causes economic growth positively (Schumpeter; 1911). According to the demand-following hypothesis economic growth will affect financial development positively (Friedman and Schwartz, 1963). The third view, suggests that financial sector growth and economic growth mutually causes each other (Greenwood and Smith, 1997) and the last view demonstrates that there is no relation between finance and growth (Lucas, 1988). These mixed hypotheses raise the question about the direction of causality in the finance-growth nexus. Next section will take a look at the empirical literature review on the issue of finance and growth.

2.2 Empirical Literature Review

The subject of financial sector improvement and growth was first raised by Schumpeter (1912) he argues that advancement in the financial sector is a very important factor for real sector growth; his analysis was based on the idea that financial advancement would enhance investment by facilitating the mobilization of saving, resource allocation, risk management and reducing information costs. Therefore, all these elements will improve productivity of resources which will lead to economic growth. Similarly Bagehot (1873) also argued that financial advancement is a crucial factor of industrial revolution in England. However the pioneering empirical work on that issue is done by Goldsmith (1969), McKinnon (1973), Shaw (1973) and they found that financial development causes economic growth significantly.

Atje and Jovanovic (1993) examined the issue of finance and growth and found a positive relation between these variables. Robert et al. (1993) studied the impact of finance on growth on

the view that Schumpeter might be right .They used the data of 80 countries from 1960 to 1989.They have used four indicators of financial development and two of economic growth.[2] They argued that one measure could not properly indicate the level of financial development and economic growth. They used partial correlation coefficient to check the correlation between the indicators of financial development and economic growth and found that development in the financial sector and growth in the real sector has a strong relationship. Secondly, they focused on the issue that what will be the impact of financial progress on long run economic growth and found that improvement in the financial sector has a significant impact on long run economic growth. These findings are the same as suggested by the Schumpeter.

Levine (1996, 1997) found that improvement in the financial sector has a significant impact on economic growth. Similar results have been obtained by other economists named Savvides (1995) and Odedokun (1996). King and Levine (1993) examined that whether better financial services predicts economic growth or not for the next 20 to 30 years and found that the development in the financial sector predicts economic growth very well.

Rousseau and Wachtel (1998) examined the relationship between financial liberalization and economic growth for five countries (United States, United Kingdom, Canada, Norway and Sweden). They used banks and non-banks assets as a measure of financial development. Their findings showed that financial development affects economic growth positively.

Beck, et al. (2000) found a positive relation between finance and growth. Studies based on endogenous growth models also emphasize the role played by the financial markets in promoting

[2] The first measure of financial development is liquid liabilities relative to GDP, second is the ratio of deposit money bank domestic assets to deposit money bank domestic assets plus central bank domestic assets, third is the ratio of claims on the non-financial private sector to total domestic credit (excluding credit to money banks) and the fourth measure is ratio of claims on the non-financial private sector to GDP.

Growth is decomposed into two components: the rate of physical capital accumulation and everything else

economic growth, including others; Benhabib and Spiegel (2000) argue that advancement in the financial sector causes growth and investment significantly. Christopoulos and Tsionas (2004) examined the finance-growth nexus using the panel data of 10 less developed countries from 1970 to 2000. They used the panel unit root test to check the stationarty of variables and then used Johansen (1988) multivariate cointegration test to examine the long run relationship. Thereafter, fully modified OLS is used to estimate the long run cointegrating vectors. Their results showed that a well-established financial sector has a positive impact on long-term economic growth but in short term it has no impact on growth. Their findings suggest that improving financial services will improve level of real output but with some delay. Similarly Bekaert et al (2005) used overlapping data technique by using data averaged over 5 year periods and found that an advanced financial system would cause economic growth significantly.

Yang and Hoon (2008) analyzed the impact of developments in the financial sector on the economic growth of Korea over the period of 1971 to 2002. They have used super exogeneity test to examine the causal direction between a well-established financial sector and real sector growth.[3] They have tested whether financial development is superexogeneous, growth is super exogenous or both. The results show that financial development passes the test of super exogeneity which implies that financial development control causes growth. They have also checked the reverse causality from growth to financial development but the results shows that growth does not control causes financial development. .They used the CUSUM (Cumulative Sum of Residuals) and CUSUMSQ (Cumulative Sum of Square Residuals) test to check the stability of the estimates of the error correction model and they found them stable.

[3] The past work on this issue give different result that is Financial Development causes growth, growth causes Financial Development and there is no relation between these two variables. So to overcome that issue of bidirectional causality they have used the concept of super exogeneity which is very close to control causality

Jude (2008) empirically analyzed the impact of advancements in the financial sector on real sector growth using a panel of 71 countries and found that the improvements in the financial sector has a crucial impact on the growth of real sector both in the long term and short term.

Kiran, et al. (2009) examines the impact of developments in the financial sector on real sector growth for a panel of ten countries over the period of 1968 to 2007. They used Peseran et al. (2003) test to check the unit root in the data and then used the Pedroni panel unit root test to estimate the long term relationship. Fully Modified Ordinary Least Square (FMOLS) is used to estimate the relationship between financial development and economic growth. The results suggest that growth in the financial sector is very crucial for growth in real sector.

The literature discussed till now argues that financial development will cause economic growth and not vice versa but there are several studies which have concluded that growth cause financial development and some says that financial development is not even the factor of growth. However there is a lot of controversy between economists on that issue of finance and growth. Now we take a look on those studies which does not follow the supply-leading hypothesis.

Robinson (1952) argues that in the finance-growth nexus finance follows growth. He analyzed that when economy grows the demand for financial services will increase which will in turn, boost economic growth. In short he found that financial development is not the leading factor but growth is the leading factor in the finance-growth nexus.

Kuznets (1955) and Friedman and Schwartz (1963) also support the same view that finance follows growth. Lucas (1988) argues that economists have over emphasized the impact of a well-established financial system in determining real sector growth. Mauro (1995) suggests that certain advance financial tools lead to the reduction in precautionary saving which causes growth adversely. Ram (1999) found that advancements in the financial sector have nothing to do with

the growth of real sector. Al Yousif (2002), Gupta (1984) and Brou (2011) found that financial sector improvement and real sector growth mutually causes each other.

Demetriades and Luintel (2001) examined the effect of financial development on economic growth especially focusing on the role of stock markets .They have used the quarterly time series data of five developed countries (Germany, US, UK, France and Japan) and examine the effect of stock market development on economic growth while controlling the effect of commercial banking sector and stock market volatility. They used the maximum likelihood approach of Johansen which is based on vector error correction model to determine the causality between economic growth and financial development. Furthermore, they used the test of weak exogeneity to examine the long run relationship between financial development and economic growth. Their finding suggests that there is a strong relationship between financial development and economic growth in the case of France, Germany and Japan but in case of United Kingdom and United States the relationship between economic growth and financial development is weak. Luintel and Khan (1999) found mutual causality in the finance-growth nexus for a sample of ten less developed countries. Similar results were found by Patrick (1966).

Kemal, et al. (2004) found that advancements in the financial sector are harmful for developing countries when inflation is high. Nadim (2008) has examined the effect of improvements in the financial sector on the growth of real sector using a heterogeneous panel in which he divided the countries in to four groups that is Low, Lower Middle, upper Middle and High income group countries. He introduced inflation in the estimation and examined the effect of both direct and indirect finance on economic growth. The results suggest that progress in the financial sector has no impact on the growth.

2.3 Financial Development and Economic Growth in Pakistan

Hassan, et al. (1996) estimated a macro economic model of financial sector of Pakistan and categorized the financial assets held by households, enterprises and private businesses. They found that financial advancements affect real sector growth of Pakistan positively. Wadud (2009) also found the similar results; his study is based on India, Bangladesh and Pakistan for the time period of 1976-2008.

Khan et al. (2005) analyzed the relationship between financial development and economic growth in case of Pakistan from 1971 to 2004. They used financial depth as a measure of financial development; growth is measured by real GDP. Other variables included in the model are: investment, real deposit rate and a dummy variable to capture the effect of financial reforms introduced in 1990. Auto regressive distributed lag (ARDL) approach is used to find the estimates of error correction model. CUSUM and CUSUMSQ test is used to determine the stability of estimates. Their results showed that in the long run financial development and real interest rate has a positive impact on economic growth while the impact of investment is although positive but is insignificant. Furthermore in the short run the effect of investment is positive and significant, while the impact of real interest rate is positive in this period but will be negative in next period. CUSUM test also verify the stable long run relationship between financial development and economic growth.

Jalil and Ma (2008) analyzed the relationship between financial development and economic growth for Pakistan and China over the period 1960-2005. They used the deposit liability ratio and credit to private sector as a measure of financial development and focused the reforms held in the financial system of Pakistan and China in 1990 and 1978 respectively. ARDL approach is used to estimate the model, their findings suggest that there is a positive and significant relationship between financial development and economic growth in Pakistan while in the case

of china their results suggest that deposit liability ratio has a positive and significant effect on growth, however, the effect of credit to private sector is positive but insignificant.

Rahman and Salahuddin (2010) estimate the relationship between economic growth and stock market development in Pakistan for the period of 1971 to 2006. They used the fully modified ordinary least square (FMOLS) and ARDL approach to estimate the long run relationship and error correction model (ECM) to estimate the short run relationship. They found a positive relationship between efficient stock markets and economic growth both in the long run and in the short run. Similar results were also found by Hussain, et al. (2009).

Chaudary (2008) examines the impact of financial improvement on economic growth for the time period of 1972-2006. The results of that study suggest that financial development has a significant effect on economic growth.

Sidra (2011) examines the relationship between financial development and agriculture output in case of Pakistan over the period of 1972-2010. The study mainly focuses on the impact of financial development on agriculture output; however, it also examines the effect of financial development on agriculture credit and agriculture investment. Her findings suggest that financial development is not affecting agriculture output in Pakistan.

Rahman et al. (2012) examined the effect of improvements in the financial sector on the growth of real sector using private sector credit as a measure of financial development. The results support the demand following hypothesis: that is causality runs from economic growth to financial development.

2.4 Conclusion

Most of these studies suggests that there is a strong relationship between financial development and economic growth in which some studies suggests that finance is the leading factor and some studies argues that growth is the leading factor in the finance-growth nexus, however, some

studies concludes that there is no relationship between financial sector development and economic growth hence, there is no consensus on the direction of causality. This difficulty arises partly from the limitations of testing causality in all previous studies. The question of causality is very important and long-standing so there is a need to use available structural approaches to test causality in the finance-growth nexus. One is the concept of superexogeneity given by Engle et al, (1983). This study tries to resolve the problem of causality in case of Pakistan using the tests of superexogeneity.

Chapter 3
Overview of Financial and Trade Reforms in Pakistan

3.1 Financial Reforms

3.1.1 Introduction

Sheng (1996) defines financial reforms as "the macroeconomic, microeconomic, institutional and regulatory measures taken to restore the problem banking system to financial solvency and health". Problem banking system means that non-performing loans has a major portion in the total loans provided by the financial sector. Financial reforms consist of those actions which make the financial market proficient and develop a competitive price mechanism. Financial restructuring is a long and complex process and its main objective is to strengthen the financial institutions, make them profitable so that they can effectively play their role in achieving the economic growth.

Theoretically financial sector reforms consists of following measures

I. Central bank autonomy
II. Focus on the allotment aspect of financial sector.
III. Developing competition in the financial system
IV. Imposing rate ceilings on bank deposits
V. Limits on the rates at which banks can expand credits
VI. Greater diversification of bank portfolios
VII. Restrictions on the activities in which banks can engage
VIII. Developing long term capital and foreign exchange markets

IX. Developing effective policies to deal with fixed rate loans, non-performing loans and subsidized selective credit

X. Strengthen financial risk management in payment systems

XI. Institutional development of banks

These measures are taken to improve the financial system of the economy. The following section briefly discusses the financial reforms undertaken by the Government of Pakistan (GOP) (Khan and Khan, 2007 and Hanif, 2003)

3.1.2 Financial reforms in Pakistan

Before 1990's financial system of Pakistan is a suppressed system and is controlled administratively by the government. The deposit and lending rates were set administratively by the central bank and real interest rates were negative for most of the time. Pakistan's financial sector was characterized with credit ceiling, direct allocation of credit as a tool of monetary policy and subsidized credit. In 1974 following the nationalization policy commercial banks were also nationalized and Pakistan Banking council (PBC) was established to control the banking sector of Pakistan.

In 1980's a non-bank financial sector was established for private investment but it did not have the required amount of funds because the major amounts of funds were held by the public institutions. Administrative control on the banking sector with multiple institutes (SBP, PBC) eroded the competition in the sector and results in inefficient services, weak accountability mechanism, large amount of non-performing loans, poor governance and high cost due to overstaffing. A major problem in that time period is the unavailability of credit required in the

economy because banks provides credit to the priority sectors irrespective of their efficiency and the sectors which were economically efficient got a little portion.

The capital markets were also inefficient, bond and equity markets were almost non-existent that's why the companies prefer debt over equity. The capital markets were characterized with lack of competitive price mechanism and low market capitalization. The foreign exchange market was also under-developed and was controlled heavily by the GOP. The market is inelastic to the demand and supply conditions of the external markets which hinders the capital inflows in the country.

Due to these distortions and inefficiencies in the financial sector, the GOP has decided to restructure the financial sector to stimulate economic growth in 1990's which includes a series of measures. A brief overview of various measures taken by the GOP to reform the financial sector and their impact on the economy are discussed below.

Financial reforms in Pakistan were initiated in the late eighties by the GOP. In the first phase of reforms the emphasis was on the banking sector. The market was opened for foreign and private banks, privatization of state-owned banks were initiated. In the first phase Muslim commercial bank and Allied bank were privatized. To improve the recovery of banking loans banking courts were established. The State Bank of Pakistan (SBP) got the status of a fully autonomous institute in 1994 and it could pursue monetary policy without any political interference. The SBP was granted independence in making and applying its policies but this independence was operational not the target independence.

There monetary policy was changed substantially in the reforms period. The SBP has adopted an easy monetary policy, the interest rate on national saving schemes, lending rate and deposit rate

was decreased however the spread between lending and deposit rate was still high and Interest rate spread is a crucial indicator of financial sector's efficiency. Credit ceiling as an instrument of monetary policy was abolished and open market operation was adopted as an instrument of monetary policy. These measures were taken to decrease the cost of domestic loans and to increase the private sector credit.

To increase the private sector credit and to decrease the dependence on banks for credit the entry of non-bank financial institutions were liberalized, mergers and amalgamations were encouraged. Because of these measures a number of non-bank financial institutions were established.

Non-performing loans (NPL's) and defaults were a big hurdle in the financial development, a major amount of assets of the banking sector was stuck up in them. Due to these problems the banking sector was about to collapse in late 1996 so efforts were started to resolve that problem. Following measures were taken to resolve the problem of NPL's and defaults

- Financial institutions (recovery of finance) ordinance 2001 has been announced with strict provisions
- Willful default in the repayment of bank loans was included in the definition of corruption in the NAB ordinance 1999
- Government has established a committee for the revival of stick industrial units (CRISU) and corporate and industrial restructuring corporation (CRIC)

As a part of financial reforms, capital market was also developed to improve the level of investment in the country. Following measures were taken to reform the capital market (Khan and Khan, 2007 and Hanif, 2003).

- Foreigners were allowed to invest in almost all industries in Pakistan
- A credit rating agency Pakistan credit rating agency (PACRA) was established to develop the market for corporate papers
- A central depositary company was established to develop the paperless trading in stock exchange
- Capital market development programme was initiated in 1997 to improve the capital market
- An autonomous institute, Securities and Exchange Commission of Pakistan (SECP) was established.

3.1.3 Impact of Financial Reforms

In late eighties the GOP has initiated the financial reforms to spur economic growth and many measures were taken towards that objective. Now we take a look at different indicators of financial sector in table 3.2 which showed the level of financial development in the country

Table 3.1: Indicators of Financial Sector (in percent)

Year	Currency/M2	Currency/GDP	M1/M2	M3/GDP	M2/GDP
1971-80	32.29	13.53	-	-	33.90
1981-90	32.28	13.29	67.10	51.60	41.24
1990-00	37.56	14.73	76.01	60.63	39.24
2000	27.80	10.82	59.32	57.98	38.93
2001	26.02	10.31	58.48	55.90	39.64
2002	25.30	11.08	58.01	60.8	43.80
2003	25.04	11.77	61.23	64.36	46.99
2004	23.99	11.84	61.78	-	49.36
2005	23.00	11.18	72.48	-	48.61
2006	23.73	11.41	77.75	60.75	48.08
2007	22.85	11.56	77.45	62.71	50.59
2008	24.31	11.00	71.57	56.57	45.28
2009	24.28	10.15	72.52	53.55	41.82
2010	24.65	10.17	74.31	52.62	41.26
2011	23.12	8.78	73.90	48.67	37.97

Adopted from Khan and Khan, (2007) financial sector restructuring in Pakistan, Lahore school of economics and updated

Currency to M2 ratio decreases substantially after reforms it is 37.56% in 1990 and 27.80% in 2000 which means that less amount is held in currency by the public after reforms and it is due to the confidence on the banking system. Currency to GDP ratio is 14.73% before financial reforms and 10.82% after reforms which also show the development of banking sector. M1/M2 ratio has also declined after the reforms showing that saving is increased in the economy. There is not a significant effect of financial reforms on M3/GDP ratio and on M2/GDP ratio.

The financial sector of Pakistan was in a vulnerable state before 1990, so the GOP and SBP has initiated a financial reform programme to develop the financial sector. A lot of measures were taken to achieve the objective of financial development. These measures have improved the financial sector significantly as compared to the vulnerable state of 1990. Especially the banking

sector has showed a significant development and public confidence on the sector has increased. Capital market is not developed that much and there is a need to improve the bond and equity market

3.2 Trade Reforms

Trade reforms means a movement towards free trade through reduction of tariffs and other barriers and it is evident from the literature that free trade will affect growth positively through specialization. The idea of free trade was first given by David Ricardo he argued that every country has to specialize in that area in which it has comparative advantage as compared to the other countries. Adam smith also says that free trade has a positive impact on growth.

When Pakistan came into existence it was reported as an 'Economic Wreck' by the Time magazines because after partition there were only few industries in Pakistan and the major portion was in Indian borders, so there was a need of a good trade policy to achieve growth but due to a lot of problems no attention was given to the trade policy that's why exports during 1950's decreased by 5.7%. In 60's trade policy of Pakistan was inward oriented to protect the domestic industry there were high tariffs on imports of consumption goods while the tariff on raw material and capital goods were low which results in the growth of manufacturing sector of the country in 60's. In 60's trade were liberalized to some extent and the industrialization was also encouraged. 70's was the era of nationalization because a major portion of the industries was nationalized by the Government of Pakistan so the private sector was discouraged.

The rupee was devalued in that era so it increased the exports a little. In eighties the process of denationalization was started by the Government of Pakistan and the institutions nationalized in 1970's were denationalized. In eighties the trade liberalization process was initiated by the

Government of Pakistan the strategy of trade policy was shifted from inward oriented to outward oriented, trade barriers were reduced, import tariffs were reduced. This change in policy has increased the level of imports which has increased the competition in local market. The same policy was also followed in nineties and more measures were taken to liberalize the trade. Pakistan followed the structural adjustment program initiated by the IMF and World Bank. World Trade Organization (WTO) was established in 1995. SAARC Preferential Trading Arrangement (SAPTA) was signed in 1995. These steps helped in improving the trade of the country. Table 3.2 examines trade indicators from 1960 to 2012.

Table 3.2: Exports, Imports and GDP (billions of rupees)

Year	Exports	Imports	GDP	Trade as % of GDP
1960s	2.841	4.177	33.153	21.16852
1970s	11.242	18.853	106.856	28.16407
1980s	58.46	96.677	462.409	33.54974
1990s	293.336	349.471	1800.01	35.71
2000	514.28	561.99	3826.11	28.12961
2001	617.15	661.46	4209.87	30.37172
2002	677.86	681.88	4452.66	30.5377
2003	815.16	786.22	4875.64	32.84451
2004	883.7	825.4	5640.59	30.30002
2005	1019.78	1271.6	6499.78	35.25319
2006	1161.26	1770.39	7623.21	38.4569
2007	1230.66	1851.09	8673.01	35.53265
2008	1316.44	2446.01	10242.8	36.73263
2009	1636.2	2597.18	12724	33.27083
2010	2010.8	2877.88	14836.5	32.95036
2011	2149.39	3572.92	18062.9	31.67991
2012	2304.017	4073.6	20653.87	30.87855

Source: IFS CD-ROM 2012

It can be seen from this table that trade liberalization policies have a significant effect on the volume of trade, in 1960 share of trade in GDP is 21% which is increased to 35% in 1990. Trade

relative to GDP have shown a decline from 2000 to 2004 this could be due to the energy crises and terrorism after 2004 till 2008 trade volume has increased due to the effective trade policies by GOP. Due to global financial crises in 2008 trade volume has again decreased afterwards.

Chapter 4
Econometric Methodology and Modeling

This chapter examines the methodology used to develop the econometric model. Section 4.1 gives the econometric methodology. Section 4.2 gives the econometric model which is used in empirical analysis. Section 4.3 gives the tests of superexogeneity.

4.1 Econometric Methodology

4.1.1 Exogeneity

The conventional econometrics divides all the variables in to exogenous and endogenous variables in a very arbitrary manner. Endogenous variables are determined within the model and exogenous variables are determined outside the model. Equivalently exogenous variables are often treated as independent of the errors. This assumption seems to be restrictive because for the efficient estimation independence of variables is sometimes unnecessary. The other issue is that one variable may be exogenous for one parameterization of the model but not for other re-parameterization of the same model. For example, a regression equation

$$y = bx + e$$

Let's write this as $y = b^* x + v$ where $b^* = b + 1$ and $v = e - x$, But $E(e \mid x) = 0$ does not imply that $E(v \mid x) = 0$. Hence x is not necessarily an exogenous variable in the second equation ($y = b^* x + v$). Under this assumption $E(e \mid x) = 0$, b is consistently estimable from the first equation and hence one can obtain consistent estimator for b^*, though we cannot estimate consistent estimator of b^* from the second equation. To overcome this defect from the definition of exogeneity, Engle at el. (1983) has given three definitions of exogeneity viz. weak exogeneity, strong exogeneity and super exogeneity.

4.1.2 Weak Exogeneity

The concept of weak exogeneity is proposed by Richard (1980) and analyzed by Engle (1983). To explain the concept of weak exogeneity consider the sequential joint density at time t of two variables $x_t = (y_t : z_t)'$ conditional on $X_{t-1} = (X_0, ...x_{t-1})$

$$D_x(y_t, z_t / X_{t-1}, \theta) \quad \text{Where } \theta = (\theta_1 .....\theta_n)' \in R^n \tag{4.1}$$

Where θ is parameter of interest.

The above equation is interpreted as data generating process (DGP). Generally, z_t is endogenous in the joint density function, but it may happen that the joint density can be factorized such that no analysis of how z_t is determined is necessary to learn how y_t is determined. The joint density can be factorized into a conditional density times a marginal density. We examine the conditions under which only the conditional density need to be analyzed to learn everything required about the parameters of interest in the system.

First, we take into account one to one transformations from the original 'n' parameters $\theta \in \Theta$ to new set of 'n' parameters $\phi \in \text{Ø}$, such that:

$$\phi = f(\theta) \qquad \text{Where } \phi \in \text{Ø} \text{ and } \theta \in \Theta \tag{4.2}$$

This function defines a one to one re-parameterization of $\theta's$ into $\phi's$ which belongs to the admissible parameter space Ø. Now $\phi's$ can be factorized into two components $\phi^* = (\phi_1^* : \phi_2^*)$, ϕ_i has n_i elements $(n_1 + n_2 = n)$ corresponding to the factorization of a joint density into a conditional density and a marginal density:

$$D_x(y_t, z_t / X_{t-1}, \theta) = D_{y/z}(y_t / z_t, X_{t-1}, \phi_1) D_z(z_t / X_{t-1}, \phi_2) \tag{4.3}$$

Where $D_{y/z}$ shows a conditional density function and D_z shows a marginal density function. Now z_t is treated as exogenous variable if the information about the whole system can be analyzed from the conditional density function only and marginal density function need not to be analyzed. Let treat the joint density which is under analysis, involve a subset ψ of the parameters θ, where ψ is a vector of $k \leq n_1$ parameters of interest now the necessary condition for z_t to be exogenous is that ψ must not depend on ϕ_2 and that we can learn everything required about ψ uniquely from ϕ_1 alone .i.e.

(i) $\psi = g(\phi_1)$

It means that we have to analyze only the conditional model for our parameters of interest. A second condition required to take z_t as exogenous is that ϕ_1 must not depend on ϕ_2 .

(ii) ϕ_1 and ϕ_2 are variation free.

Thus we define weak exogeneity as "z_t is weakly exogenous for the parameters of interest ψ if conditions (i) and (ii) hold"

It means that we can learn everything about the parameters of interest from conditional model alone and marginal model need not to be analyzed (Hendry, 1995)

4.1.3 Strong Exogeneity

If z_t varies with y_{t-1} then z_t is not exogenous variable. Thus, weak exogeneity by itself would not be adequate for analysis which need z_t to be unaffected by past y_s in multi-period conditional forecasting. Weak exogeneity is insufficient to sustain conditional predications more than one period ahead because z_t may vary with y_{t-1}, nor it can sustain policy statements, where changes in z_t are asserted to induce certain conditional changes in y_t. So if the purpose is conditional

forecasting weak exogeneity is not enough and in that case we need strong exogeneity which is defined as follow:

z_t is strongly exogenous for ψ if z_t is weakly exogenous for ψ and:

$$D_z(z_t / X_{t-1}, \phi_2) = D_z(z_t / Z^1_{t-1}, X_0, \phi_2) \qquad (4.4)$$

Where $X_{t-1} = (Y'_{t-1}, Z'_{t-1})'$

When the above conditions hold, z_t does not depend upon y_{t-1} and it entails that we can learn everything we want to learn about ψ conditional on z_t, and that statements about future $(Y_{T+i}, i = 1,....., H)$ conditional on $(Z_{T+i}, i = 1,....., H)$ are not vitiated by intermediate Y_{T+k} altering (z_{T+i}). (Hendry, 1995)

4.1.4 Super Exogeneity

An intervention at time t affecting the DGP $D_x(x_t / X_{t-1}, \theta)$ is defined as any action $\delta_t \in A_t$ by an agent from available action set A_t, which alters θ from its current value to a different value $\theta_t = g(\theta, \delta_t)$. Whereas $C^\delta(t)$ Denote a class of interventions at time (t) on D_x which potentially affect θ, defined by:

$$C^\delta(t) = \{\delta_t : \theta_t = g(\theta, \delta_t), \delta_t \in A_t\} \qquad (4.5)$$

Then $C^\delta = \{C^\delta(t).t = 1,2,.....T\}$ are possible interventions include changes in monetary, fiscal and exchange rate policies, wars and financial and technological innovations. Now Super exogeneity is defined as "z_t is super exogenous for ψ if z_t is weakly exogenous for ψ and ϕ_1 is invariant to a class of interventions $C^{\phi 2}$ i.e. ϕ_1 is constant over $C^{\phi 2}$". Under super exogeneity $\phi_2 \in C^{\phi 2}$ can change without affecting ϕ_1. This definition says that ϕ_1 does not change if ϕ_2 is changed which is an issue outside the model where as in weak exogeneity when we say that ϕ_1

and ϕ_2 are variation free is an issue inside that model so it does not rule out the possibility that ϕ_1 may change if ϕ_2 is changed. Now if a model passes the tests of superexogeneity it can be used for conditional policy analysis. (Hendry, 1995)

4.2 Econometric Model

To examine the superexogeneity test we consider financial development and economic growth nexus with reference to Pakistan as case study. To this end, we specify the following finance-growth model following Yang and Hoon (2008):

$$Y_t = \alpha + \beta_1 FD_t + \beta_2 PINV_t + \beta_3 OPEN_t + \beta_4 G_t + \beta_5 R_t + u_t \qquad (4.6)$$

Where Y, FD, PINV, OPEN, G and R are real GDP, financial development, private investment, trade openness, government expenditure and real interest rate respectively. Whereas $\beta's$ are parameters and u_t is error term. Equation (4.6) can be transformed into superexogeneity modeling. To examine superexogeneity between financial development and economic growth consider the joint density function of economic growth Y_t and financial development (FD_t) at time t. We can factorize this into a conditional density function and a marginal density function as:

$$D_J(Y_t, FD_t / Z_t; \lambda_t) = D_c(Y_t / FD_t, Z_t; \lambda_{1t}) D_M(FD_t / Z_t; \lambda_{2t}) \qquad (4.7)$$

Where D_j represents the joint density of Y_t and FD_t, D_c represents conditional density of Y_t given FD_t and D_M represents the marginal density function of FD_t given Z_t. Here Z_t represents the available information including past values of Y_t and FD_t as well as past values of other conditioning variables. The vectors λ_t, λ_{1t} and λ_{2t} are vector of parameters that vary over time. FD_t to be super exogenous for λ_{1t} if and only if there is no loss of information about λ_{1t}

by neglecting to model D_M (weak exogeneity of FD_t for λ_{1t}) and if changes in λ_{2t} do not imply changes in λ_{1t} (invariance of λ_{1t} to changes in λ_{2t}).

The conditional and marginal distributions can be transformed into regression equations following Hoover (1990) and Engle and Hendry (1993) as:

$$Y_t = \beta FD_t + Z'_{1t}\gamma + e_t \qquad (4.8)$$

Where Z_{1t} represents vector of all other conditioning variables included in the analysis. Error term e_t is assumed to be normally distributed with zero mean and constant variance. Equation (4.8) is a regression equation of conditional model which tests the null hypothesis that FD_t is superexogeneous for β in the linear regression of Y_t conditional on FD_t, given that the error in the conditional equation is assumed to be normally distributed.

In the next step we parameterize the marginal equation as:

$$FD_t = \delta Z'_{2t} + u_t \qquad (4.9)$$

Where Z_{2t} represents the past values of FD_t and other conditioning variables enters in the regression equation. The construction of Z_{2t} is assumed to allow for regime shifts in the DGP for FD_t.

The vector Z_{1t} includes: gross capital formation relative to GDP as private investment (PINV), government consumption expenditure relative to GDP as a proxy of fiscal policy (G) and ratio of import plus export to GDP as a proxy of trade openness (OPEN). Whereas Z_{2t} includes real interest rate represented as R. By using these variables we parameterize the conditional and marginal equations respectively as:

$$D(Y_t / FD_t, Z_{1t}) = \Delta \ln Y_t = \alpha + \sum_i \beta_i \Delta FD_{t-i} + \sum_i \gamma_i \Delta \ln Y_{t-i} + d \ln Y_{t-1} + eFD_{t-1} + \sum_i f_i \Delta PINV_{t-i} + \sum_i g_i \Delta G_{t-i} + \sum_i h_i OPEN_{t-i} + e_t \quad (4.10)$$

$$D(FD_t / Z_{2t}) = \Delta FD_t = \alpha + \sum_i b_i \Delta FD_{t-i} + cFD_{t-1} + \sum_i k_i R_{t-i} + u_t \quad (4.11)$$

Where FD shows financial development which is defined as "financial depth which is measured by the broad money (money + quasi money) divided by nominal GDP lagged by one year, Broad money includes the sum of currency outside the banks plus demand, time, savings and residents foreign currency deposits". Except for financial development, all other variables are treated as control variables additionally explaining economic growth in the conditional equation and marginal equation. These variables were taken following the standard literature on finance and growth the variable government expenditure relative to GDP is used as proxy of fiscal policy. This variable can affect growth in many ways depending on the way it is used. If the law and order conditions were improved, government is able in enforcing the market and property right rules effectively that will enhance the private sector which will effect growth positively. On the other side if government policy measures are such as they create a negative impact on private sector due to undue taxes, weak banking rules etc., in that case government expenditure relative to GDP effects growth adversely. According to Keynes, if the prices were sticky in downward direction government expenditure causes growth positively. Trade openness is the ratio of exports plus imports relative to GDP which measures that to which extent the local markets have approach in international markets. Literature on that issue suggests that greater the approach of local markets to international markets, the greater will be the competition, which in return, increase the productivity and hence growth. The variable private investment shows the amount of investment in the country and it is well evident from literature that investment causes growth

significantly. Real interest rate is also included as a control variable to account for its effect on financial development in both equations. The variables FD and Y are introduced in level as well as in the first difference form in the error correction model to capture the impact of both the long-term and short-term effects. For the stability of estimated coefficients, we will perform stability test such as, CUSUM of squares, CUSUM and recursive residuals

4.3 Testing superexogeneity

The test for superexogeneity constitutes the F-test under the null hypothesis that the estimated residuals $u_t^{\wedge}$ and squared residuals $u_t^{\wedge 2}$ are the stable coefficients in equation (4.11). For this we incorporate $u_t^{\wedge}$ and $u_t^{\wedge 2}$ into equation (4.10) and obtain the following equation

$$\Delta \ln Y_t = D(Y_t / FD_t, Z_{1t}) + hu_t^{\wedge} + ku_t^{\wedge 2} \qquad (4.12)$$

Where $u_t^{\wedge}$ and $u_t^{\wedge 2}$ are obtained from the marginal equation. If h is insignificant then we conclude that FD_t is weakly exogenous for the parameters of $D(Y_t / FD_t, Z_{1t})$. If both h and k are insignificant then FD_t is superexogeneous for the parameters of $D(Y_t / FD_t, Z_{1t})$ if the conditional equation (4.10) is found to be stable and FD_t is superexogeneous, then it concludes that FD_t control causes Y, since superexogeneity is a sufficient condition to control causality. We will also test the reverse causality from Y to FD_t by employing same procedure described above.

Testing of superexogeneity requires existence of cointegration between financial development and economic growth. However, if we fail to obtain cointegration between finance-growth then

we test for the short run multivariate granger causality between finance and growth. To this end we consider a VAR model of order k:

$$Y_t = \mu + A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots\ldots\ldots\ldots\ldots + A_{k-1} Y_{t-k} + e_t \qquad (4.13)$$

Since Y_t is a 6×1 vector of I(1) variables in which

$Y_1 = RGDP, Y_2 = OPEN, Y_3 = FD, Y_4 = G, Y_5 = PINV$ and $Y_6 = RI$. Where RGDP is real GDP, OPEN indicates trade openness, FD is financial development, G shows government expenditure, INV denotes private investment and RI shows real interest rate. Existence of no cointegration means that rank of Π matrix is zero; therefore the model we estimate is a simple VAR model of order k at first difference. That is:

$$\Delta Y_t = \mu + \mathrm{B}_1 \Delta Y_{t-1} + \mathrm{B}_2 \Delta Y_{t-2} + \ldots\ldots\ldots\ldots + \mathrm{B}_{k-1} \Delta Y_{t-k+1} + e_t \qquad (4.14)$$

This model is represented explicitly as:

$$\Delta Y_{1t} = \mu_1 + \sum_{i=1}^{k-1} \alpha_{1,i}\, \Delta Y_{1,t-k} + \sum_{i=0}^{k-1} b_{1,i}\, \Delta Y_{2,t-k} + \sum_{i=0}^{k-1} c_{1,i}\, \Delta Y_{3,t-k} + \sum_{i=0}^{k-1} d_{1,i}\, \Delta Y_{4,t-k} + \sum_{i=0}^{k-1} \gamma_{1,i}\, \Delta Y_{5,t-k} + \sum_{i=0}^{k-1} \delta_{1,i}\, \Delta Y_{6,t-k} + e_{1t} \qquad (4.14.1)$$

$$\Delta Y_{2t} = \mu_2 + \sum_{i=0}^{k-1} \alpha_{2,i}\, \Delta Y_{1,t-k} + \sum_{i=1}^{k-1} b_{2,i}\, \Delta Y_{2,t-k} + \sum_{i=0}^{k-1} c_{2,i}\, \Delta Y_{3,t-k} + \sum_{i=0}^{k-1} d_{2,i}\, \Delta Y_{4,t-k} + \sum_{i=0}^{k-1} \gamma_{2,i}\, \Delta Y_{5,t-k} + \sum_{i=0}^{k-1} \delta_{2,i}\, \Delta Y_{6,t-k} + e_{2t} \qquad (4.14.2)$$

$$\Delta Y_{3t} = \mu_3 + \sum_{i=0}^{k-1} \alpha_{3,i}\, \Delta Y_{1,t-k} + \sum_{i=0}^{k-1} b_{3,i}\, \Delta Y_{2,t-k} + \sum_{i=1}^{k-1} c_{3,i}\, \Delta Y_{3,t-k} + \sum_{i=0}^{k-1} d_{3,i}\, \Delta Y_{4,t-k} + \sum_{i=0}^{k-1} \gamma_{3,i}\, \Delta Y_{5,t-k} + \sum_{i=0}^{k-1} \delta_{3,i}\, \Delta Y_{6,t-k} + e_{3t} \qquad (4.14.3)$$

$$\Delta Y_{4t} = \mu_4 + \sum_{i=0}^{k-1} \alpha_{4,i}\, \Delta Y_{1,t-k} + \sum_{i=0}^{k-1} b_{4,i}\, \Delta Y_{2,t-k} + \sum_{i=0}^{k-1} c_{4,i}\, \Delta Y_{3,t-k} + \sum_{i=1}^{k-1} d_{4,i}\, \Delta Y_{4,t-k} + \sum_{i=0}^{k-1} \gamma_{4,i}\, \Delta Y_{5,t-k} + \sum_{i=0}^{k-1} \delta_{4,i}\, \Delta Y_{6,t-k} + e_{4t} \quad (4.14.4)$$

$$\Delta Y_{5t} = \mu_5 + \sum_{i=0}^{k-1} \alpha_{5,i}\, \Delta Y_{1,t-k} + \sum_{i=0}^{k-1} b_{5,i}\, \Delta Y_{2,t-k} + \sum_{i=0}^{k-1} c_{5,i}\, \Delta Y_{3,t-k} + \sum_{i=0}^{k-1} d_{5,i}\, \Delta Y_{4,t-k} + \sum_{i=1}^{k-1} \gamma_{5,i}\, \Delta Y_{5,t-k} + \sum_{i=0}^{k-1} \delta_{5,i}\, \Delta Y_{6,t-k} + e_{5t} \quad (4.14.5)$$

$$\Delta Y_{6t} = \mu_6 + \sum_{i=0}^{k-1} \alpha_{6,i}\, \Delta Y_{1,t-k} + \sum_{i=0}^{k-1} b_{6,i}\, \Delta Y_{2,t-k} + \sum_{i=0}^{k-1} c_{6,i}\, \Delta Y_{3,t-k} + \sum_{i=0}^{k-1} d_{6,i}\, \Delta Y_{4,t-k} + \sum_{i=0}^{k-1} \gamma_{6,i}\, \Delta Y_{5,t-k} + \sum_{i=1}^{k-1} \delta_{6,i}\, \Delta Y_{6,t-k} + e_{6t} \quad (4.14.6)$$

Now we evaluate the short run multivariate causality by testing the null hypothesis that $\alpha_i = b_i = c_i = d_i = \gamma_i = \delta_i = 0$ using a standard F-test.

Chapter 5
Data Description and Time Series Properties

In this chapter we analyze the data. Section 5.1 gives data sources. Descriptive properties of the data are in section 5.2. Section 5.3 gives the time series properties for which we have used the HEGY seasonal unit root test. Section 5.4 concludes the whole chapter.

5.1 Data sources

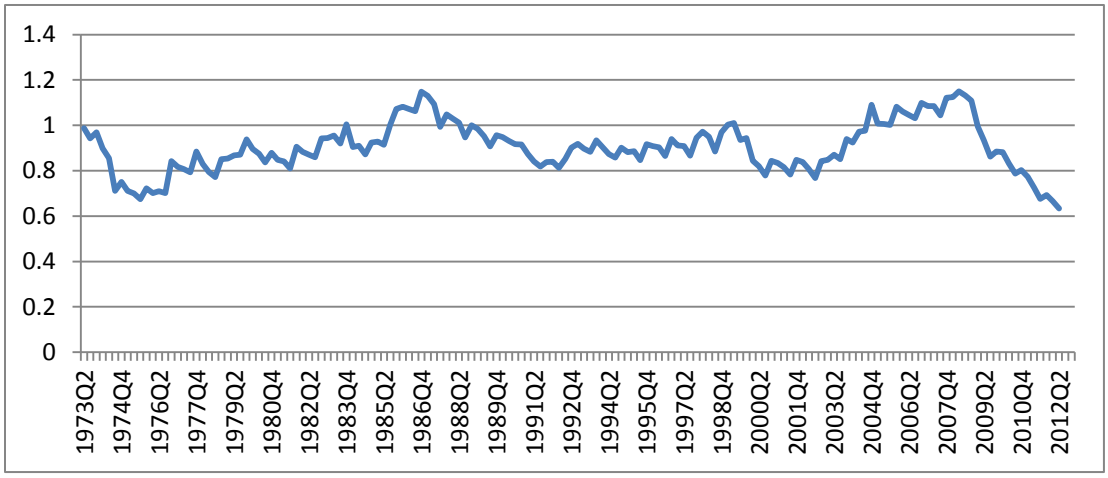
The Quarterly data was used in this study which is from 1973Q2 to 2012 Q2. All the data is taken from international financial statistics CD-ROM. The quarterly data on GDP, government consumption expenditure and gross capital formation are not available hence we interpolated quarterly series of GDP, government consumption expenditure and gross capital formation from annual series following Goldstein and Khan (1976) methodology. We have used two proxies of financial development: credit to private sector and liquid liabilities. Credit to private sector is generated by dividing credit to private sector on nominal GDP and is denoted by FDPS, it measures the credit provided to the private sector by deposit money banks and by other financial institutions. Financial development by liquid liabilities is generated by dividing liquid liabilities on nominal GDP and is termed as FDLL; FDLL is an extensive indicator of financial intermediation because it includes all those authorities that provide financial intermediation i.e. monetary authority, deposit money banks and other financial institutions. All these authorities were a source of providing financial intermediation in the economy in different ways. By using these two proxies we measure the level of financial development in the country .Openness is measured by adding imports and exports and dividing it with nominal GDP and is termed as OPEN. Fiscal policy is proxied by ratio of government consumption expenditure to nominal GDP and is termed as G. The level of investment is proxied by gross capital formation relative to

nominal GDP and denoted by PINV. Real GDP is calculated as nominal GDP divided by consumer price index (CPI) with 2000=100 as base year and is denoted by Y. To calculate real interest rate we have used two measures of interest rates that includes money market rate and bond yield. Real interest rate based on money market rate is the difference of money market rate and inflation rate, where inflation rate is calculated as first difference of log CPI and is termed as RIMMR. Real bond rate is the difference of bond yield and inflation rate and is termed as RIBR.

5.2 Descriptive Analysis

This section analyzes the descriptive statistics of data and examines the pattern of data. To understand the descriptive properties we plot the data in terms of graphs. Figure 5.1 depicts the pattern of credit to private sector.

Figure 5.1: Financial Development: Credit to Private Sector

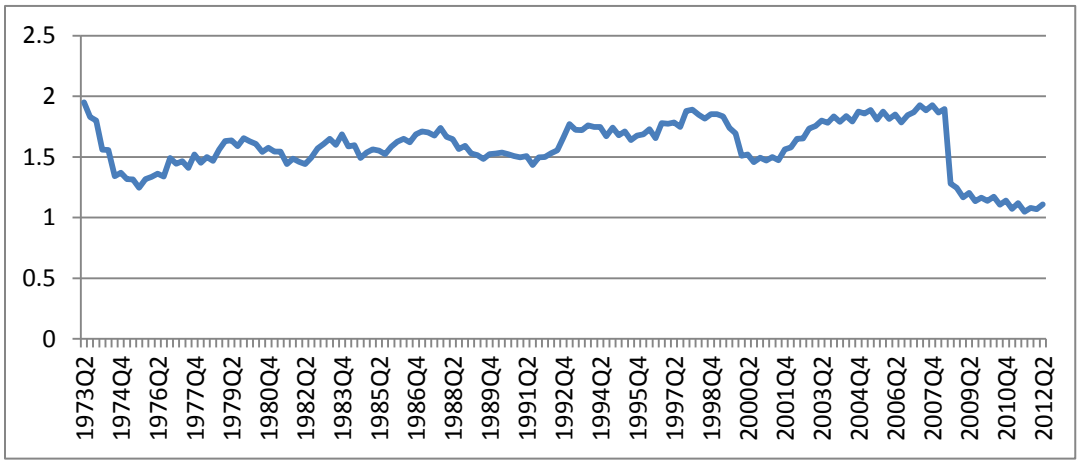


Source: IFS CD-ROM 2012

Figure 5.1 show that the pattern of financial development (credit to private sector) which is random but on average it remains at 0.8. This pattern of private sector credit implies that credit to private sector increases specially after 1991, it increases at a fast rate but the ratio remains low

because GDP also increases at a faster rate than credit to private sector hence the private sector credit is actually increased but it does not increase relative to GDP therefore its ratio remains low. Credit to private sector shows the efficiency of private sector in providing credit in the economy. Credit to private sector is increased from 17% to 27% from 1996 to 2006 which shows that private sector is developed in that time but not developed at the desired level. The second measure of financial development we consider is the liquid liabilities relative to GDP. Trends of this measure are depicted in Figure 5.2.

Figure 5.2: Financial Development: Liquid Liabilities

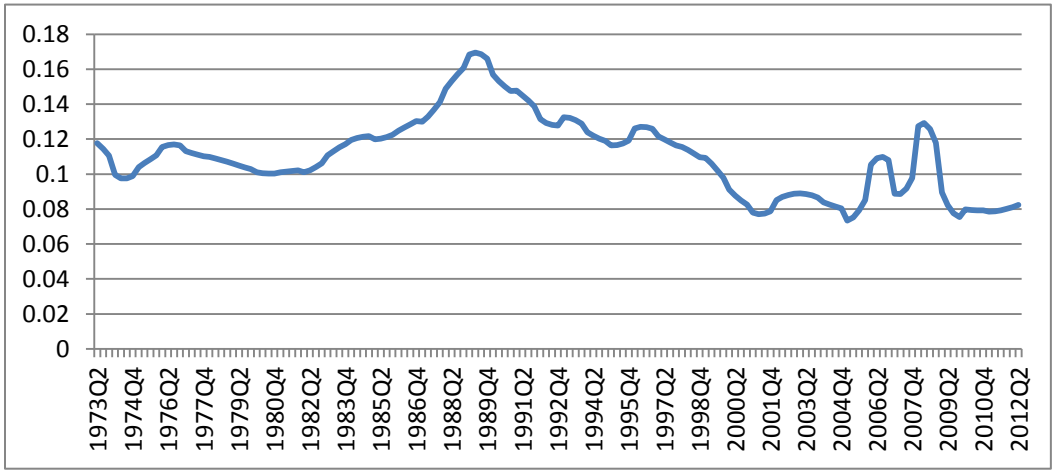


Source: IFS CD-ROM 2012

Figure 5.2 shows that liquid liability relative to GDP (FDLL), on average it remains at 1.5. Liquid liabilities show the investment perspective of financial development because the more amounts of liquid liabilities means that more amount is held in the banks in form of savings. Level of financial deepening and intermediation can also be shown by liquid liabilities, financial deepening shows that to which extent financial sector is penetrated in the economy and financial intermediation shows the intermediation services provided by the banking sector. Financial deepening and intermediation is improved after 1990, this can be seen from the graph of liquid liabilities relative to GDP that after 1990 it remains higher than 1.5, however it decreased substantially in 2008 this could be due to the global financial crises. The liquid liability growth is

also good as compared to private sector credit which shows that especially the banks have developed in that era in Pakistan. We have taken fiscal policy measures in terms of government expenditures relative to GDP and its pattern can be depicted in Figure 5.3.

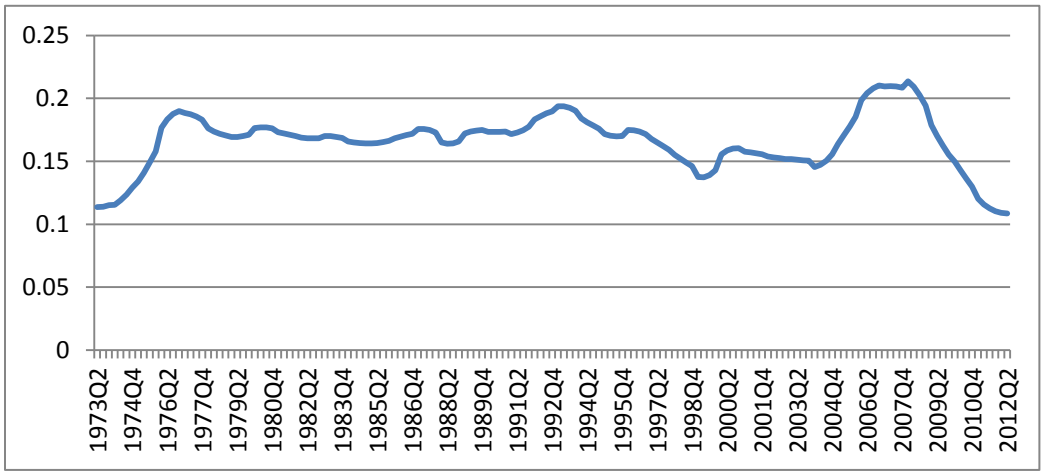
Figure 5.3: Government Consumption Expenditure Relative to GDP



Source: IFS CD-ROM 2012

It can be seen from the Figure 5.3 that the ratio of government consumption expenditure relative to GDP increases steadily and peaked in 1990-Q1. This could be due to the fact that at that time government consumption expenditure is increased because government has provided funds to the inefficient industries. The government consumption expenditure relative to GDP showing declining trend since 1990-Q1 to 2001-Q1 and reached to 0.8. This declining trend could be the result of the privatization of sick industries. Afterwards government expenditure again jumps which shows that government policy is not consistent. This could be due to the effect of global financial crises. The level of investment is measured by gross capital formation relative to GDP and it is depicted in figure 5.4.

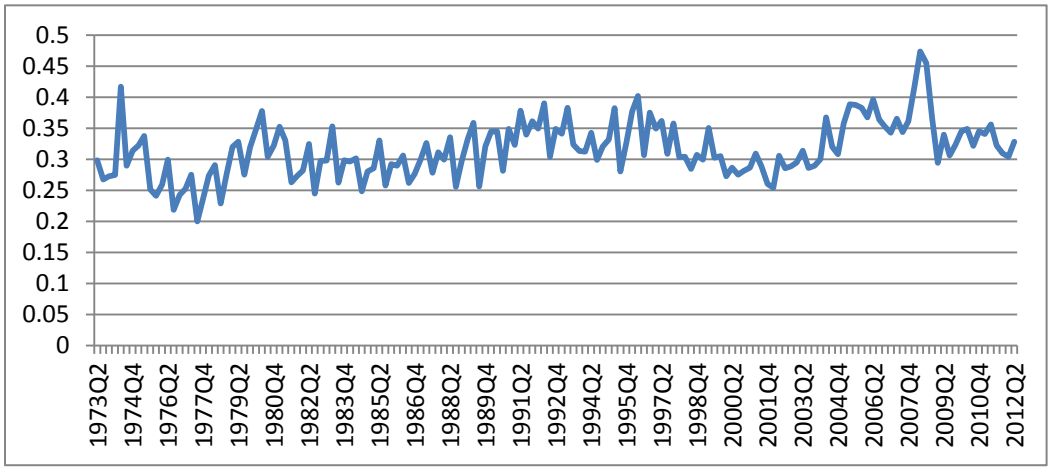
Figure 5.4: Investment Relative to GDP



Source: IFS CD-ROM 2012

It is evident from Figure 5.4 that ratio of gross capital formation relative to GDP increases sharply at the beginning and is at peak in 1975-Q2. Thereafter, it remains same until 2003-Q4, after that it starts increasing and reached to 0.23 in 2008-Q2. After 2008 it decreases sharply, the reason could be poor law and order situation, global financial crises, energy crises etc. We have measured the level of trade by adding exports and imports relative to GDP. Its pattern is depicted in figure 5.5.

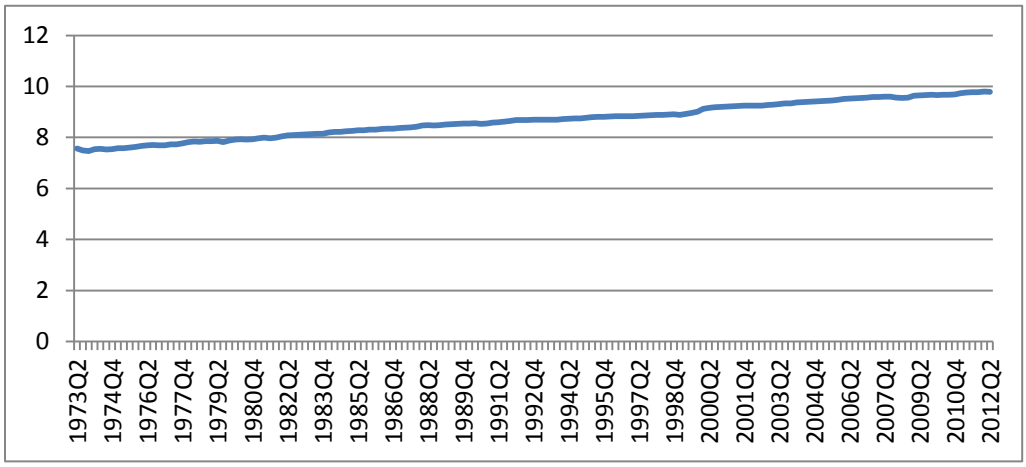
Figure 5.5: Trade Openness



Source: IFS CD-ROM 2012

It can be seen from Figure 5.5 that trade Openness is averaged 30% of GDP this variable fluctuates about 10% around 0.3 line however, it remains almost constant in that time period. In 2008 it jumped and reached to 0.46 the reason could be that government has increased the consumption expenditure in 2008 which could have a positive impact on exports. Pattern of real GDP is depicted in figure 5.6.

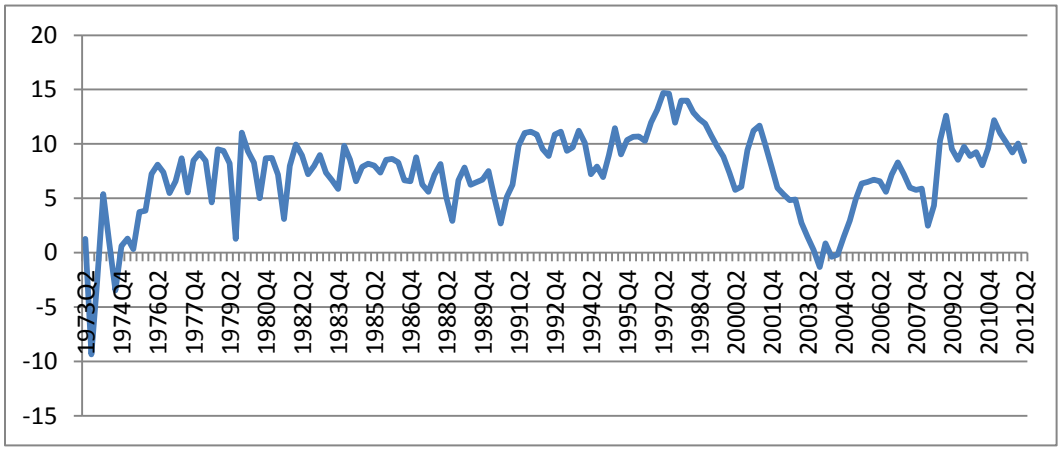
Figure 5.6: Real GDP



Source: IFS CD-ROM 2012

Figure 5.6 shows the real GDP that increases throughout the time period which implies that the GDP is positively trended in Pakistan throughout from 1973 to 2012. It shows that real sector of Pakistan has a positive growth rate but the rate is low.

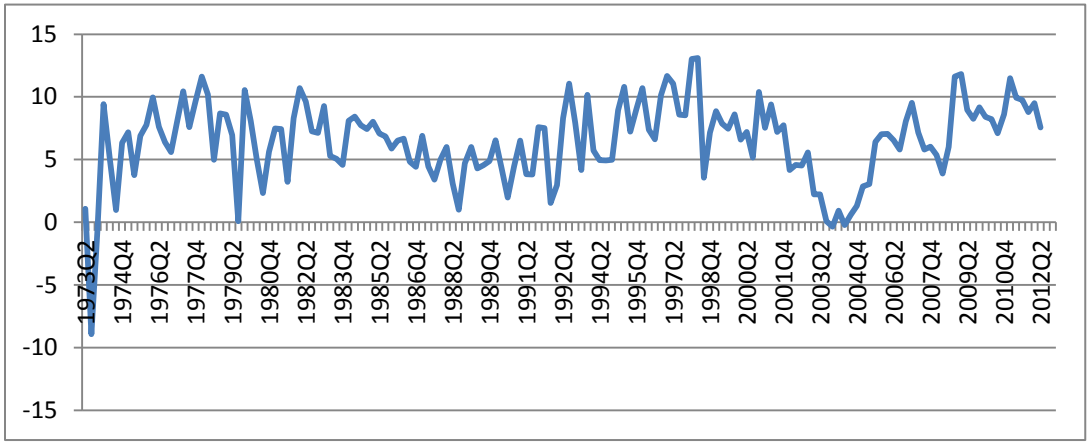
Figure 5.7: Real Interest Rate (Government Bond Rate)



Source: IFS CD-ROM 2012

Figure 5.7 shows that the real interest rate is negative before 1974 due to high inflation rates however after this it becomes positive except between 2002-2003 because of the energy crises and wheat crises, etc.

Figure 5.8: Real Interest Rate (Money Market Rate)



Source: IFS CD-ROM 2012

It is evident from Figure 5.8 that the Real interest rate (Money market rate) has the same pattern as the real interest rate (Government Bond yield). Descriptive statistics of the data are depicted in table 5.1.

Table 5.1 Descriptive statistics (1973-2012)

Statistics	FDPS	FDLL	G	INV	Y	OPEN	RIBR	RIMMR
Mean	-.11	.45	-2.22	-1.80	8.67	-1.16	7.32	6.49
Median	-.10	.46	-2.20	-1.77	8.69	-1.17	7.96	7.02
Maximum	.14	.67	-1.77	-1.54	9.79	-.75	14.7	13.09
Minimum	-.45	.05	-2.61	-2.22	7.47	-1.61	-9.34	-8.93
Std.Dev.	.12	.14	.20	.14	.67	.14	3.68	3.15
Skewness	-.28	-.96	-.01	-.99	-.03	-.05	-1.06	-.93
Kurtosis	3.04	3.52	2.37	4.16	1.86	3.35	5.3	5.67
Jerque-Bera	2.04	25.98	2.62	34.72	8.49	.87	64.13	69.58
Probability	.36	.00	.27	.00	.01	.64	.00	.00
Observations	157	157	157	157	157	157	157	157

Source: IFS CD-ROM 2012

Table 5.1 shows the descriptive statistics. Credit to private sector relative to GDP has a mean value of -0.11 with a standard deviation of 0.12. Liquid Liabilities relative to GDP has a mean value of 0.45 with a standard deviation of 0.14. Government Expenditure relative to GDP has a mean value of -2.22 with a standard deviation of 0.20. Gross capital formation relative to GDP has a mean value of -1.80 with a standard deviation of 0.14. Y has a mean value of 8.67 with a standard deviation of 0.67. Trade Openness has a mean value of -1.16 with a standard deviation of 0.14. Real interest rate (Government Bond yield) has a mean value of 7.32 with a standard deviation of 3.68. Real interest rate (Money Market Rate) has a mean value of 6.49 with a standard deviation of 3.15. the variables FDPS, FDLL, PINV and OPEN has the standard deviation equal to or less than 0.14 which shows that these variables are not much volatile , Y

has the standard deviation of 0.67 which shows that it is a volatile variable and RIBR, RIMMR has the standard deviation of more than 3 which means that these variables are highly volatile.

5.3 HEGY Unit Root Test

The commonly used test for testing the time series properties of the data is augmented Dickey-Fuller test (Dickey and Fuller, 1981; said and Dickey, 1984). However, ADF test examines unit root only at zero frequency but there are many series which contain seasonal components due to the presence of systematic component in the data. These systematic components may be regular or irregular and they have a significant effect on the behavior of economic agents. Despite the importance of seasonal changes, it received less attention in economic analysis.

This study uses Hylleberg et al (1990) seasonal unit root test (HEGY) to examine the time series properties of the data. This test is more applicable because this study uses the Quarterly data and HEGY test examines unit root at zero as well at seasonal frequencies. Hence, before testing cointegration we apply the seasonal unit root test. First we transform our data in to logarithmic form except for the interest rates and then test the seasonal unit root by HEGY test methodology. (Khan, 2007)

To perform HEGGY unit root test we consider a fourth order autoregressive (AR) model

$$\psi(L)y_t = e_t \qquad (5.1)$$

Where L is the back shift operator such that $Ly_t = y_{t-1}$ and $\psi(L)$ is the fourth order polynomial of L. HEGGY observed the identity

$$\psi(L) = \pi_1 L(1+L+L^2+L^3) - \pi_2(1-L+L^2+L^3) - \pi_3 L(1-L^2) - \pi_4 L^2(1-L) \qquad (5.2)$$

Where π_i are determined from $\psi(L)$ the π_i determines the seasonal components of the data y_t. If all π_i are zero then $\psi(L)=(1-L^4)$ and y_t satisfies $(1-L^4)y_t=e_t$ and furthermore in the above equation $(1-L^4)=(1-L)(1+L)(1+L^2)$ which shows four seasonal unit roots. If all π_i are zero it shows the presence of all factors i.e. $(1-L),(1+L),(1+L^2)$. Now If $\pi_1 \neq 0$ it shows that $\psi(L)=(1-L)$ which means that the pattern of series is random walk, If $\pi_2 \neq 0$ it shows that $\psi(L)=(1+L)$ which reveals that the series oscillate two times per year between a random walk and if $\pi_3=\pi_4 \neq 0$ it shows that $\psi(L)=(1+L^2)$ which means that series oscillate once per year and its negative image. When $\psi(L)$ has seasonal unit root at more than one frequency than the series shows a combined fluctuation pattern. (Shin and So, 2000). Using equation 5.1 we reparametrize equation 5.2 into the following equation.

$$\Delta_4 y_t = \pi_1 y_{1t-1} + \pi_2 y_{2t-1} + \pi_3 y_{3t-2} + \pi_4 y_{3t-1} + e_t \qquad (5.3)$$

Where $\Delta_4 y_t = (1-L^4)y_t$

Furthermore, $y_{1t}=(1+L+L^2+L^3)y_t$ is a seasonal filter that eliminate unit roots at all frequencies and keep zero frequency unchanged, whereas $y_{2t}=-(1-L+L^2-L^3)y_t$ removes unit root at seasonal frequency zero annual and leaves the biannual seasonal frequency intact. $y_{3t}=-(1-L^2)y_t$ removes unit root at zero and biannual seasonal frequencies and leaves the annual frequency unchanged.

The testable form of HEGGY regression equation includes the deterministic components and it becomes

$$\Delta_4 y_t = \mu_t + \pi_1 y_{1t-1} + \pi_2 y_{2t-1} + \pi_3 y_{3t-2} + \pi_4 y_{3t-1} + \sum_{i=1}^{k} \theta_i \Delta_4 y_{t-i} + e_t \quad (5.4)$$

Where $y_{1t} = (1 + L + L^2 + L^3) y_t$

$y_{2t} = -(1 - L + L^2 - L^3) y_t$

. $y_{3t} = -(1 - L^2) y_t$

$\mu_t = \alpha_0 + \gamma D_i + \phi T$

Here μ_t contains the deterministic components, i.e. constant term (α_0), vector of three dummies (D_i) orthogonal to the constant term and the trend component (T). The null hypothesis of the seasonally unadjusted data is:

$\pi_1 = 0$: Unit root at zero frequency;

$\pi_2 = 0$: Unit root at bi-annual frequency;

$\pi_3 = \pi_4 = 0$: Unit root at annual frequency;

The test statistics are the t ratios for π_1, π_2 and F statistics for $\pi_3 = \pi_4 = 0$.if the null hypothesis $\pi_1 = 0$ is accepted it means that series contain seasonal unit root at zero frequency (i.e. $y_t \sim (1,0)$). Similarly if $\pi_2 = 0$ means seasonal unit root at bi-annual frequency (i.e. $y_t \sim (0,1)$) and if $\pi_3 = \pi_4 = 0$, the series contain unit root at annual frequency. Hylleberg et al (1990) proposed one sided t-statistics for the two hypothesis (i.e. $\pi_1 = 0,\ \pi_2 = 0$)with alternative are $\pi_1 < 0,\ \pi_2 < 0$. F-Test is recommended for the third hypothesis $(i.e. \pi_3 = \pi_4 = 0)$ against the alternative $\pi_3 \neq 0$ and/or $\pi_4 \neq 0$. The critical values of these tests statistics are given in Hylleberg et al. (1990). The estimated results of HEGGY test in terms of t-test at zero and annual frequency and F-test at

biannual frequency are $[t(\pi_1 = 0), t(\pi_2 = 0)]$ and $[F(\pi_3 = \pi_4 = 0)]$ respectively reported in Table 4.2 and 4.3 with level filter and first difference filter. The lag structure and deterministic components of each equation is determined using Lagrange Multiplier test for residual autocorrelation up to order four in each regression equation to make the residuals white noise.

Table 5.2: Hylleberg-Engle-Granger-Yoo (HEGY) Seasonal Unit Root Test (Level Filter)

Series	Lag	MODEL	$t(\pi_1 = 0)$	$t(\pi_2 = 0)$	$F(\pi_3 \cap \pi_4)$	LM(4)	Conclusion
FDPS	7	C	-2.6200	-1.279401	2.390124	7.2	I(1,1,1)
	1	C,SD	-2.5200	-4.200093*	36.96733*	6.83	I(1,0,0)
	1	C,SD,T	-2.2600	-4.192183*	36.78042*	7.5	I(1,0,0)
FDLL	1	C	-2.929906*	-2.950710*	26.04898*	3.830312	I(0,0,0)
	0	C,SD	-2.274029	-6.243131*	137.7018*	4.016	I(1,0,0)
	0	C,SD,T	-2.209255	-6.215477*	136.5115*	4.246466	I(1,0,0)
G	6	C	-1.526271	-8.749226*	83.37326*	6.128803	I(1,0,0)
	6	C,SD	-1.517647	-8.690283*	82.24856*	6.877054	I(1,0,0)
	6	C,SD,T	-2.096383	-8.667455*	81.06569*	6.878968	I(1,0,0)
PINV	4	C	-3.641170*	-5.693420*	42.05150*	9.313645	I(0,0,0)
	4	C,SD	-3.601669*	-5.630025*	41.16629*	9.402514	I(0,0,0)
	4	C,SD,T	-3.628203*	-5.580216*	41.08940*	8.348543	I(0,0,0)
OPEN	9	C	-2.690428	-1.046812	3.431117*	3.380137	I(1,1,0)
	2	C,SD	-2.637990	-4.023348*	21.44056*	4.286246	I(1,0,0)
	2	C,SD,T	-3.313708	-4.033753*	20.24730*	4.386919	I(1,0,0)
Y	0	C	-0.558027	-8.832158*	55.20674*	6.656071	I(1,0,0)
	0	C,SD	-0.558659	-7.464824*	75.75405*	5.458077	I(1,0,0)
	0	C,SD,T	-2.882324	-7.646225*	77.72352*	6.593617	I(1,0,0)
RIBR	1	C	-3.565962*	-4.332460*	22.92931*	4.100612	I(0,0,0)
	1	C,SD	-3.390816*	-4.662254*	32.29886*	4.438738	I(0,0,0)
	1	C,SD,T	-3.313499	-4.645245*	32.07167*	4.443940	I(1,0,0)
RIMMR	1	C	-3.469020*	-4.417982*	20.10275*	3.051277	I(0,0,0)
	0	C,SD	-3.131642*	-6.574484*	45.35770*	3.108325	I(0,0,0)
	0	C,SD,T	-3.109922	-6.551422*	44.89380*	3.110750	I(1,0,0)

Note: C, SD and T refer to intercept, seasonal and trend models described in the text. Lag length for all the specifications were determined on the basis of LM test for serial correlation as guide. LM (4) refers to Lagrange Multiplier test for fourth order serial correlation, distributed as F-stat. The critical values are taken from HEGY (1990) for observation greater than 100. * represent significance at 5% level of significance.

Table 5.3: Hylleberg-Engle-Granger-Yoo (HEGY) Seasonal Unit Root Test (First Difference Filter)

Series	Lag	MODEL	$t(\pi_1 = 0)$	$t(\pi_2 = 0)$	$F(\pi_3 \cap \pi_4)$	LM(4)	Conclusion
FDPS	2	C	-5.371818*	-2.368588*	4.937853*	8.792977	I(0,0,0)
	1	C,SD	-5.059114*	-4.225544*	35.31401*	1.896607	I(0,0,0)
	1	C,SD,T	-5.303834*	-4.241651	35.38691*	1.439214	I(0,0,0)
FDLL	6	C	-3.896600*	-1.560499	8.426882*	7.515617	I(0,1,0)
	1	C,SD	-5.345743*	-4.775549*	42.23610*	0.854598	I(0,0,0)
	1	C,SD,T	-5.501324*	-4.759568*	41.71244*	1.023782	I(0,0,0)
G	5	C	-3.610473*	-8.669726*	83.92908*	6.812527	I(0,0,0)
	5	C,SD	-3.565534*	-8.611123*	82.78176*	7.595592	I(0,0,0)
	5	C,SD,T	-3.617458*	-8.550198*	81.91581*	7.622121	I(0,0,0)
PINV	5	C	-3.511174*	-6.566380*	48.56353*	5.271671	I(0,0,0)
	5	C,SD	-3.475935*	-6.493402*	47.54341*	5.236622	I(0,0,0)
	5	C,SD,T	-3.574647*	-6.435781*	47.05945*	4.967164	I(0,0,0)
OPEN	8	C	-3.827397*	-1.067651*	3.368911*	2.871319	I(0,0,0)
	2	C,SD	-6.788423*	-4.392399*	16.80866*	4.759504	I(0,0,0)
	1	C,SD,T	-6.676454*	-3.923985*	23.50256*	5.631536	I(0,0,0)
Y	1	C	-6.385399*	-4.831900*	30.02022*	3.054184	I(0,0,0)
	1	C,SD	-6.509407*	-5.245513*	46.43084*	2.280700	I(0,0,0)
	1	C,SD,T	-6.526618*	-5.234182*	46.38975*	2.470877	I(0,0,0)
RIBR	1	C	-6.534032*	-3.528648*	22.09093*	1.289393	I(0,0,0)
	0	C,SD	-6.428243*	-4.834634*	34.53143*	4.402245	I(0,0,0)
	0	C,SD,T	-6.446795*	-4.823617*	34.17881*	3.805428	I(0,0,0)
RIMMR	0	C	-7.527504*	-4.605967*	20.93109*	6.990244	I(0,0,0)
	0	C,SD	-7.547418*	-5.150660*	33.46390*	5.328121	I(0,0,0)
	0	C,SD,T	-7.517503*	-5.134028*	33.15998*	5.302009	I(0,0,0)

See note on table 5.2

Critical values at 1% significant level				Critical values at 5% significant level		
Model	$t(\pi_1)$	$t(\pi_2)$	$F(\pi_3 \cap \pi_4)$	$t(\pi_1)$	$t(\pi_2)$	$F(\pi_3 \cap \pi_4)$
C	-3.47	-2.61	4.77	-2.88	-1.95	3.08
C, SD	-3.55	-3.60	8.74	-2.95	-2.94	6.57
C, SD, T	-4.09	-3.60	8.79	-3.52	-2.94	6.60

The results presented in Table 5.2 shows the results of HEGY test at level filter. The results suggest that investment, real interest rate (Government bond yield) and real interest rate (money market rate) are stationary at level therefore; these variables are short memory series and cannot be included in cointegration analysis. The remaining variables that are OPEN, FDPS, FDLL, G and Y contain unit root at zero frequency and rejects the null of unit root at the bi-annual and annual frequency for all specifications. From these results we can deduce that cointegration may exist in the series which contain unit root at zero frequency but not at bi-annual and annual frequency.

The F-statistics for $\pi_3 = \pi_4 = 0$ are rejected at 5% level of significance. The null hypothesis of unit root at bi-annual frequency $(\pi_2 = 0)$ is also rejected for all series. The existence of unit root at zero frequency cannot be rejected for all series. Now it can be argued that the existence of stochastic seasonality at all seasonal frequencies is rejected for all variables during the period 1973Q2 to 2012Q2.

Table 5.3 reports the results of HEGY test with First difference. These results suggest that all series are stationary at first difference filter for all specifications. Therefore no series is integrated at order more than one i.e. I(2). Except for PINV, RIBR, RIMMR all other series are integrated at order one that is $FDPS \sim \mathrm{I}(1), \mathrm{FDLL} \sim \mathrm{I}(1), \mathrm{OPEN} \sim \mathrm{I}(1), \mathrm{G} \sim \mathrm{I}(1)$ and $Y \sim \mathrm{I}(1)$. The existence of unit root at zero frequency suggests that these series have a long memory and may be cointegrated which is examined by using the tests of cointegration. None of the series contain unit root at bi-annual and annual frequencies suggest that non-stationary stochastic seasonality is not an a significant feature of the variables for the sample 1973Q2 to 2012Q2

5.4 Conclusion

In this chapter we have examined the time series properties of the data in terms of graphic plots to examine the pattern of each series against time after that we analyzed the descriptive statistics of each variables which tell us the statistical properties of the series . HEGY test is performed to check the unit root properties of the data. The results of HEGY test suggest that 3 series are stationary(PINV, RIBR, RIMMR) at level, while 5 series are stationary at first difference (FDPS, FDLL, OPEN, G, Y) these findings suggest that ordinary least square (OLS) cannot be used to estimate that model because a basic assumption of OLS that is stationarty of variables is violated.

Chapter 6
Empirical Analysis

6.1 Introduction

This study is based on the quarterly data from 1973Q2 to 2012Q2 on real GDP, credit to private sector, liquid liabilities, trade openness, private investment, government consumption expenditure and real interest rate. The main objective of this study is to perform super exogeneity test on the finance-growth nexus. Following section deals with the analysis of finance-growth relation.

6.2 Empirical findings: Finance-Growth Nexus

At the beginning we check unit root properties using HEGY test which captures the seasonality effects given the empirical model of finance-growth (equation 4.6) which includes real GDP, financial development, trade openness and government expenditure. In the first stage of estimation we estimate the unrestricted vector autoregressive model (VAR) for each specification. The optimal lag order is picked up by using Akaike information criteria (AIC). The results for lag selection criteria are reported in table 6.1 (panel A and B).

Table 6.1: Lag Length Criteria of VAR

Financial Development Indicator	Panel A			
	Lag	AIC	SC	HQ
Credit To Private Sector	0	-1.56	-1.48	-1.52
	1	-13.18	-12.79	-13.02
	2	-13.64	-12.93*	-13.35
	3	-13.79	-12.76	-13.37
	4	-14.14*	-12.79	-13.59*
Liquid Liabilities	Panel B			
	0	-1.06	-.98	-1.02
	1	-13.39	-12.99	-13.23
	2	-13.56	-12.85	-13.27
	3	-14.05	-13.02*	-13.63
	4	-14.33*	-12.98	-13.78*

Note: Where In panel A model includes real GDP, Credit to Private Sector, government expenditure and trade openness. In panel B model includes real GDP, Liquid Liabilities, government consumption expenditure and trade openness.

AIC: Akaike Information Criterion SC: Schwarz Information Criterion

HQ: Hannan-Quinn Information Criterion

The results reported in Table 6.1 (panel A and B) suggest that AIC has picked 4 lags for each model. Therefore, optimal lag length four is selected for finance-growth model. In the next step, we perform trace test and Max-Eigen value cointegration tests, these tests are employed to

determine the existence of cointegrating vector between the variables included in the model The results are reported in Table 6.2 (panel A and B) and 6.3 (panel C and D).

Table 6.2: Multivariate Cointegration Test

Panel A				
Trace Test	Null Hypothesis	Alternative Hypothesis	Trace statistics	5% Critical value
	r=0	r>0	41.49	47.85
	r<1	r≥1	18.42	29.79
	r<2	r≥2	6.90	15.49
	r<3	r≥3	.20	3.84
Panel B				
Maximum Eigenvalue Test	r=0	r>0	23.07	27.58
	r<1	r≥1	11.52	21.13
	r<2	r≥2	6.70	14.26
	r<3	r≥3	.20	3.84

Note: In Table 6.2 cointegration test is performed on the model which includes real GDP, Credit to Private Sector relative to GDP, Government Expenditure relative to GDP and Trade Openness. Panel A gives the result of Trace test and panel B gives the results of Maximum Eigen Value Test. r = number of cointegrating vectors.

Table 6.3: Multivariate Cointegration Test

Panel C				
Trace Test	Null Hypothesis	Alternative Hypothesis	Trace statistics	5% Critical value
	r<0	r>0	37.63	47.86
	r<1	r≥1	16.30	29.79
	r<2	r≥2	7.44	15.49
	r<3	r≥3	.10	3.84
Panel D				
Maximum Eigenvalue Test	r<0	r>0	21.33	27.58
	r<1	r≥1	8.85	21.13
	r<2	r≥2	7.33	14.26
	r<3	r≥3	.10	3.84

Note: Table 6.2 examines the results of cointegration test performed on the model which includes real GDP, Liquid Liabilities relative to GDP, Government Expenditure relative to GDP and Trade Openness. Panel A gives the result of Trace test and panel B gives the results of Maximum Eigen Value Test. r = number of cointegrating vectors

The results reported in Table 6.2 suggest that there is no long run relationship between the variables based on the trace test and maximum Eigen value test at the 5% level of significance. Similarly, results reported in Table 6.3 give the same results as we obtained in table 6.2 that there is no long run relationship exists in the variables when we include liquid liabilities as a measure of financial development. In summary we obtain no cointegration between the variables under consideration, either credit to private sector or liquid liabilities is incorporated as financial development indicator. This implies that error correction form is not applicable, an alternative is to check the short run multivariate causality between finance and growth by controlling all other variables The reasons for absence of cointegration between finance and growth are explained by many authors for example, Lucas (1988) argued that economists have overstressed the importance of financial development as a determinant of growth. Due to the absence of

cointegration between finance and growth we change our estimation methodology and switch from superexogeneity test to multivariate Granger causality test to examine the growth-finance nexus. The results of multivariate causality are discussed in section 6.4. However, to study the patterns of superexogeneity test we take the trade-growth nexus while omitting the financial development variable. Section 6.3 reports the results of superexogeneity test with reference to trade-growth model.

6.3 Trade-Growth Nexus: Superexogeneity Test

In absence of cointegration between financial development and economic growth we cannot employ the test of exogeneity. To study the implications of superexogeneity test we consider an alternative model of trade and growth while controlling other variables. We examine the cointegration between trade openness and economic growth. For the purpose of cointegration we select the optimal lag length by using Akaike information criteria (AIC) and the results are reported in table 6.4.

Table 6.4: Lag Length Criteria of VAR

Lag	AIC	SC	HQ
0	-0.107129	-0.046646	-0.082556
1	-9.998872	-9.756944	-9.900581
2	-10.17190	-9.748529	-9.999894
3	-10.20633	-9.601505	-9.960597
4	-10.52107	-9.734798	-10.20162
5	-11.38800	-10.42028	-10.99483
6	-11.74201*	-10.59285*	-11.27512*
7	-11.71937	-10.38876	-11.17877

Note: The model includes real GDP, government expenditure and trade openness.

AIC: Akaike Information Criterion SC: Schwarz Information Criterion

HQ: Hannan-Quinn Information Criterion

The results show that optimal lag length six is selected for trade-growth model. In the next step, we perform trace and Max-Eigenvalue tests to examine the long-run relationship between trade openness and growth. The results are reported in table 6.5

Table 6.5: Multivariate Cointegration Test

Panel A				
Trace Test	Null Hypothesis	Alternative Hypothesis	Trace statistics	5% Critical value
	r=0	r>0	33.79619	29.79707
	r<1	r≥1	10.79897	15.49471
	r<2	r≥2	0.254580	3.841466
Panel B				
Maximum Eigenvalue Test	r=0	r>0	22.99722	21.13162
	r<1	r≥1	10.54439	14.26460
	r<2	r≥2	0.254580	3.841466

Note: In Table cointegration test is performed on the model which includes real GDP, Government Expenditure relative to GDP and Trade Openness. Panel A gives the result of Trace test and panel B gives the results of Maximum Eigen Value Test.

The results of the table suggest that both tests support the presence of one cointegrating vector between trade and growth. This implies that there is a long run relationship between trade and growth therefore; we are able to employ the exogeneity test on the trade-growth nexus which will determine that either trade is exogenous or endogenous variable in the trade-growth nexus. Following superexogeneity modeling framework we specify the conditional and marginal model of trade and economic growth as follows

$$D_C(Y_t / OPEN_t, Z_{1t}) = \Delta Y_t = \alpha + \sum_i \beta_i \Delta OPEN_{t-i} + \sum_i \gamma_i \Delta Y_{t-i} + dY_{t-1} + eOPEN_{t-1} + \sum_i g_i \Delta G_{t-i} + e_t \quad (6.1)$$

$$D_M(OPEN_t / Z_{2t}) = \Delta OPEN_t = \alpha + \sum_i b_i \Delta OPEN_{t-i} + cOPEN_{t-1} + \sum_i k_i PINV_{t-i} + u_t \quad (6.2)$$

Equation (6.1) shows the conditional model of the trade-growth nexus in which Y shows economic growth and OPEN indicates trade openness and government consumption expenditure (G) is used as an additional control variable. Equation (6.2) shows the marginal model in which private investment (PINV) is included in the trade openness equation. In both equations the variables Y and OPEN are introduced in levels as well as in the first difference form in error correction model to capture for short-run and long-run effects. The results of equations (6.1) and (6.2) are shown in the table 6.6.

Table 6.6: Regression results of Conditional and Marginal Models

$$\Delta Y_t = -.023 + .028^{***}\Delta OPEN_{t-4} - .029^{***}\Delta OPEN_{t-6} + .176^{**}\Delta Y_{t-1} - .146^{**}\Delta Y_{t-5} - .112*\Delta Y_{t-6}$$
$$(-0.598) \quad (0.01) \quad (0.01) \quad (0.087) \quad (0.063) \quad (0.064)$$
$$-.014^{***}OPEN_{t-1} - .09^{**}\Delta G_{t-2} + .097^{***}\Delta G_{t-4} - .068^{*}\Delta G_{t-6} \quad \text{.....} \quad (6.3)$$
$$(0.00) \quad (0.04) \quad (0.032) \quad (0.04)$$
$$R^2 = .29,\ LM(2) = 0.68[0.71]$$

$$\Delta OPEN_t = .079 - .22^{***}OPEN_{t-1} - .29^{***}\Delta OPEN_{t-1} - .24^{***}\Delta OPEN_{t-2} - .25^{***}\Delta OPEN_{t-3}$$
$$(0.15) \quad (0.05) \quad (0.07) \quad (0.08) \quad (.08)$$
$$+.42^{***}\Delta OPEN_{t-4} - .43^{**}PINV_{t-4} + .57^{***}PINV_{t-6} + .05^{***}D_1 - .01^{**}D_2$$
$$(0.07) \quad (0.18) \quad (0.18) \quad (0.01) \quad (0.04) \quad \text{.....(6.4)}$$
$$R^2 = 0.66,\ LM = 3.25[0.19]$$

Note:* shows 10% significance level; ** shows 5% significance level; *** shows 1% significance level. ( ) shows Heteroskedasticity and serial correlation consistent standard errors. LM: Breusch-Godfrey Serial correlation test statistic with two lags. [ ] p-value.

Conditional and marginal equations reported in (6.3) and (6.4) are first estimated by allowing for six lagged terms for all variables. The final equation(s) derived from equation (6.1) and (6.2) are reconstructed and re-estimated by choosing the significant terms following Hendry and Richard's (1982) general to specific approach.

In examining the conditional equation for economic growth, we have noted that the coefficient of OPEN at fourth lag is positive and significant, while at sixth lag its impact is negative and significant also. Impact of Y's lagged values on its current value also has different coefficients. Impact of first lag is positive while the impact of fifth and sixth lag is negative and significant. Similarly, the lagged coefficient of OPEN in level impacted economic growth negatively and significant. The Breusch-Godfrey Serial correlation test shows no serial correlation for the conditional equation. CUSUM and CUSUM of squares test is also performed to examine the stability of conditional equation which are shown in figure 6.1 and 6.2.

Figure 6.1:

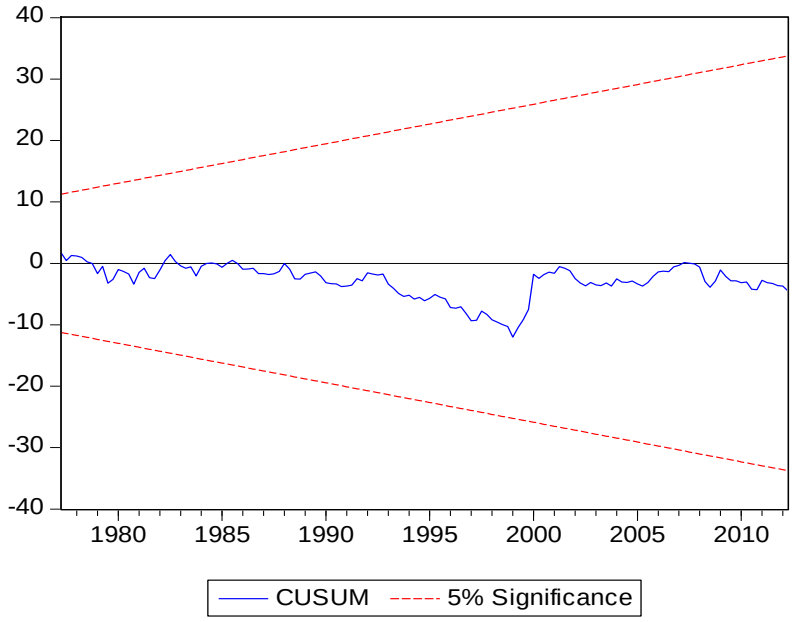
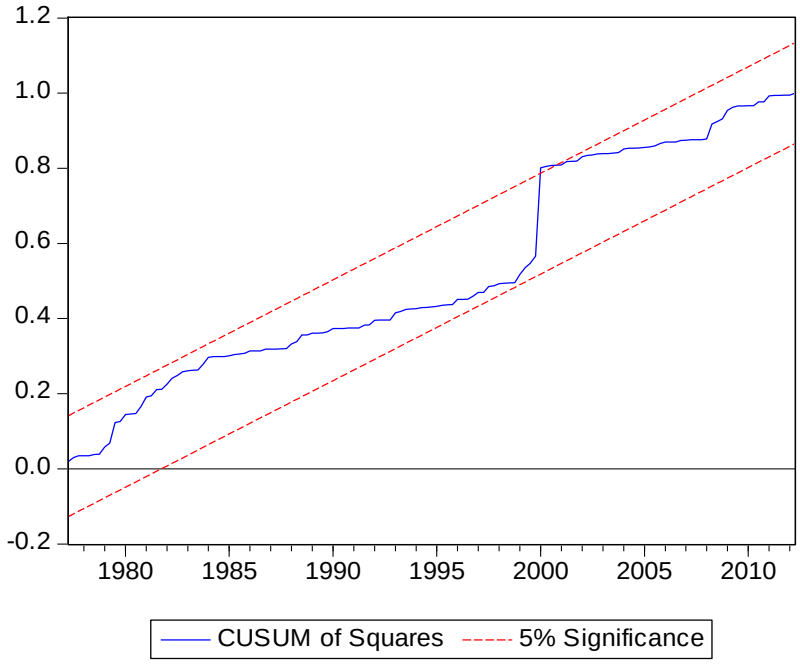


Figure 6.2



Both these tests shows that conditional equation remains stable during the period of 1972-2012. In marginal equation we include two dummy variables to account for major shifts in the trade policy, where D_1 =1 if year $\geq$ 2001, D_2 = 1 if year $\geq$ 2008. The D_1 is included to capture the impact of the WTO trade liberalization policies as its impact on trade is actually shown in 2001 (Khan and Ayaz, 2012) and D_2 is included to capture the impact of international financial crises. Both of these dummied are included because these two factors has major impact on the Pakistan's trade. Next section reports the results of superexogeneity test with reference to trade-growth nexus

6.3.1 Test of superexogeneity

To test the superexogeneity we insert $\hat{u}_t$ and $\hat{u}_t^2$ in the conditional equation where $\hat{u}_t$ and $\hat{u}_t^2$ are derived from marginal equation and the results are shown in table 6.7.

Table 6.7: Test of superexogeneity

Regressor	Coefficient	Standard error	p-value
Intercept	-.007	0.012	0.553
$\Delta OPEN_{t-4}$	.027	0.010	0.009
$\Delta OPEN_{t-6}$	-.029	0.009	0.003
ΔY_{t-1}	0.169	0.074	0.024
ΔY_{t-5}	-0.131	0.072	0.073
ΔY_{t-6}	-0.118	0.075	.1145
$OPEN_{t-1}$	-0.194	0.010	0.058
ΔG_{t-2}	-0.082	0.038	0.034
ΔG_{t-4}	0.089	0.032	0.006
ΔG_{t-6}	-0.068	0.038	0.081
$u_t^{\wedge}$	-0.014	0.019	0.460
$u_t^{\wedge 2}$	0.117	0.172	0.498
$joint\ F = 0.65[0.53], R^2 = 0.30$			

The results show that the estimated coefficients of $\hat{u}_t$ and $\hat{u}_t^2$ are both insignificant and the p-value for the joint F-test of excluding $\hat{u}_t$ and $\hat{u}_t^2$ is 0.53. This result implies that trade openness is superexogeneous for the parameters of conditional equation of economic growth. As the CUSUM and CUSUM of square test shows that conditional equation is stable, therefore, it can be inferred from the results that trade openness control causes economic growth.

Since the main objective of the study is to examine the link between finance and growth therefore now in the following section we test the short run multivariate Granger causality between financial development and economic growth using Granger causality/Block Exogeneity test.

6.4 Multivariate Short Run Analysis

The literature on financial development and growth shows that different economists found mixed results when analyzing the relationship of finance and growth. In Pakistan Khan et al. (2005) found that there is a long run relationship between financial development and economic growth whereas Sidra (2011) found that financial development is not affecting output in Pakistan. Our cointegration results also supports Sidra's (2011) findings for Pakistan that, there is no long run relationship between financial development and economic growth, the reason could be that the financial sector of Pakistan is not working efficiently and is unable to provide the required amount of funds to the real sector. The absence of long run relationship takes the analysis toward short run estimation, now we examine the short run relationship between financial development and economic growth using the Granger causality/Block Exogeneity test.

6.4.1 Multivariate Causality Analysis between Finance and Growth

Table 6.8 reports the results of finance-growth model which includes real GDP, trade Openness, government expenditure and financial development measured by liquid liabilities. Liquid liabilities are used as measure of financial intermediary services provided by the financial sector.

Table 6.8: Multivariate Causality Analysis (Liquid Liabilities as an indicator of Financial Development)

Dependent Variables	Independent Variables			
	$\sum \Delta Y$ $\sum \alpha_i = 0$	$\sum \Delta OPEN$ $\sum b_i = 0$	$\sum \Delta FDLL$ $\sum c_i = 0$	$\sum \Delta G$ $\sum d_i = 0$
ΔY	–	12.54 [0.013]***	7.57 [0.108]*	4.00 [0.405]
ΔOPEN	13.23 [0.010]***	–	23.57 [0.000]***	11.96 [0.017]***
ΔFDLL	15.27 [0.004]***	23.61 [0.000]***	–	34.17 [0.000]***
ΔG	7.22 [0.124]	2.55 [0.634]	10.83 [0.028]**	–

Notes:*, ** and *** represent significance at 10%, 5% and 1% levels where figures in parentheses represent the probabilities

The results suggest that financial development (Liquid Liabilities) significantly causes economic growth the reason could be that the expansion of the level of financial intermediation affects growth through mobilizing saving, provides finance to the firms and enhances the level of investment, which will in turn improve growth. Similar results are found by Khan et al. (2005) in case of Pakistan. The effect of Y is also significant on liquid liabilities. This means that there is a bi-directional causality in these variables. In the short-run this implies that as real sector expands the financial sector diverts its resources to enhance the level of investment, as a result the financial sector grows with the growth in real sector. These results are similar to Demetriades and Luintel (2001) who found a bi-directional causality between financial development and

economic growth for a sample of ten countries. Results are also consistent with the findings of Shan and Morris (2002) and Luintel and Khan (1999).

Openness significantly causes economic growth. This implies that trade liberalization have a positive impact on growth. Openness affects Growth through many channels such as the removal of trade barriers that creates competition in the local markets which improve production technology, as a result production level will increases which enhances economic growth. Trade openness also affects economic growth through economies of scale. We obtain bidirectional causality between openness and growth which implies that as the output increases the openness of local markets will also increase. Iqbal and Zahid (1998) found that Openness is beneficial for growth in case of Pakistan. Khan et al (1995) and Kemal.et al (2002) found similar results but they have used only exports as measure of openness. Our findings show that growth also affects openness which is consistent with the findings of Frankel and Romer (1999) and with those who say that those countries who achieve high growth with other factors except openness engage in more international trade. Ghani et al. (2003) also found a bi-directional relation between openness and growth in case of Pakistan.

Furthermore the impact of government expenditure on trade openness is positive which shows that high level of spending by the government is helpful for trade. The reason could be that when government increases its spending that will increase the overall production in the economy because government provides funds to the sick industries that will improve their output. Improvement in overall production will increase the volume of trade. These results were in line with Rodrick (1998).

The relationship between liquid liabilities and trade openness is bi-directional; both the variables cause each other positively. This could be due to the fact that high amount of liquid liabilities means higher savings which leads to high investment therefore, it affects the trade positively. Higher level of trade improves the capital inflows which will affect the liquid liabilities positively. Government expenditure causes liquid liabilities significantly because when government increases its spending, it will increase the income in the economy that will result in more deposits.

6.4.2 Multivariate Causality Analysis between Finance and Growth

Now we use credit to private sector as a measure of financial development and test the causality between GDP, trade openness, financial development (credit to private sector) and government expenditure. Results could be different because credit to private sector is purely a measure of financial depth whereas liquid liabilities are a measure of financial intermediation.

Table 6.9: Multivariate Causality Analysis (Credit to Private Sector as an indicator Financial Development)

Dependent Variables	Independent Variables			
	$\sum \Delta Y$ $\sum \alpha_i = 0$	$\sum \Delta OPEN$ $\sum b_i = 0$	$\sum \Delta FDPS$ $\sum c_i = 0$	$\sum \Delta G$ $\sum d_i = 0$
ΔY	–	8.72 [0.068]*	.88 [0.926]	5.89 [0.207]
ΔOPEN	6.15 [0.188]	–	14.93 [0.004]***	20.60 [0.000]***
ΔFDPS	25.87 [0.000]***	19.13 [0.000]***	–	4.29 [0.368]
ΔG	4.56 [0.334]	3.22 [0.520]	4.14 [0.387]	–

Notes:*, ** and *** represent significance at 10%, 5% and 1% levels where figures in parentheses represent the probabilities

It can be seen from the results that financial development does not causes economic growth similar results were found by Lucas (1988). Many factors are responsible for this result, For example financial institutions were ineligible to provide the required services to the real sector, the role of financial sector in agriculture output is not significant (Sidra, 2011), reason could be that financial literacy is very weak; farmers don't know how to get finance from financial institutions. Furthermore, banking rules are ineffective which discourage the bankers to provide loans to the farmers. The agriculture sector is a main component of GDP in Pakistan and if it isn't improving by financial development it means that financial sector is not supporting the real sector growth. Similar results were also found by Hanif (2008). However, the results are inconsistent with the findings of Khan et al. (2005) and Jalil and Ma (2008).

The results suggest that real GDP significantly causes financial development, this result supports growth-led finance hypothesis. This result is consistent with Robinson (1952) view: that finance follows growth. This behavior could be due to the fact that when real output increases, it needs a better financial system. So the financial sector diverts their funds for their business expansion. This result is consistent with Hassan et al. (2011), Handa and Khan (2008), Abu-Badar and Abu-Qaran (2008). These studies have found uni-directional causality in the finance growth nexus and the causality runs from growth to financial development. The results are inconsistent with the findings of Jamil (2010) and Khan (2008) who found a bi-directional causality in the finance growth nexus.

The results show uni-directional causality running from openness to growth. This result supports the trade-led growth hypothesis, which has important implications for developing countries. These findings are consistent with the earlier. (Ahmed, Yusuf, and Anoruo Emmanuel, 2000,

Harrison, 1996 and Yanikkaya Halit, 2003) these authors have also found that trade openness has a positive impact on economic growth. Private sector credit causes trade openness significantly which implies that an expansion of banking activities will help the countries to approach the international markets, thus enhancing the level of trade. Government expenditure also causes trade openness significantly which is the same result we found earlier.

6.4.3 Multivariate Causality considering Investment, Real Interest

Now we introduce some more variables that are important but are level stationary and we have not used these level stationary variables in testing cointegration but now included for short run causality analysis. These variables are;

PINV = Private investment

RIBR = Real interest rate (Government Bond yield)

RIMMR = Real interest rate (Money Market rate)

By including these level stationary variables we examine causality between financial development and economic growth.

6.4.4 Multivariate Causality Analysis with Liquid Liabilities, Investment and Real Interest Rate (Government Bond Yield)

Table 6.10 shows the results of the model that includes real GDP, trade openness, liquid liabilities, government expenditure, private investment and real interest rate (Government Bond Yield). The additional variable included here is investment and real interest rate.

Table 6.10: Multivariate Causality Analysis

Dependent Variables	Independent Variables					
	$\sum \Delta Y$ $\sum \alpha_i = 0$	$\sum \Delta OPEN$ $\sum b_i = 0$	$\sum \Delta FDLL$ $\sum c_i = 0$	$\sum \Delta G$ $\sum d_i = 0$	$\sum PINV$ $\sum \gamma_i = 0$	$\sum RIBR$ $\sum \delta_i = 0$
ΔY	–	10.07 [0.039]**	4.51 [0.340]	7.95 [0.093]*	7.15 [0.127]	12.80 [0.012]***
ΔOPEN	7.33 [0.119]	–	29.73 [0.000]***	11.64 [0.020]**	6.35 [0.174]	9.7 [0.045]**
ΔFDLL	13.99 [0.007]***	21.68 [0.000]***	–	28.38 [0.000]***	2.53 [0.638]	8.64 [0.070]*
ΔG	1.77 [0.776]	4.75 [0.313]	11.74 [0.019]***	–	.59 [0.964]	6.78 [0.148]
PINV	1.63 [0.802]	4.65 [0.324]	6.15 [0.188]	4.68 [0.321]	–	5.98 [0.200]
RIBR	50.71 [0.000]***	10.25 [0.036]**	12.02 [0.017]***	3.42 [0.488]	2.68 [0.612]	–

Notes:*, ** and *** represent significance at 10%, 5% and 1% levels where figures in parentheses represent the probabilities

It can be seen from the results of Table 6.6 that trade openness, government expenditure and Real interest rate causes real GDP significantly. Trade openness and government expenditure are already discussed in previous section; we consider only real interest rate. Real interest rate encourages saving and enhances the financial activities, which will in turn, have a positive impact on growth. Asim et al. (2010) found similar results in case of Pakistan. Fry (1995) and Galbis (1995) argued that there is a positive relationship between real interest rate and growth. Similarly, De Gregorio and Guidotti (1995) also found that low value of real interest rate causes financial instability which hurts economic growth. Real interest rate causes trade openness significantly because it has a significant effect on growth and through that channel it affects openness. Real interest rate also causes financial development significantly because it is the

backbone of financial sector's efficiency that is greater the level of real interest rate, greater will be the level of saving that will provide finance to the real sector.

6.4.5 Multivariate Causality Analysis with Credit to Private Sector, Investment and Real Interest Rate (Government Bond Yield)

Now we use credit to private sector as the measure of financial development instead of liquid liabilities and incorporating real interest rate (Government Bond Yield) in causality analysis. The results are depicted in Table 6.11

Table 6.11: Multivariate Causality Analysis

Dependent Variables	Independent Variables					
	$\sum \Delta Y$ $\sum \alpha_i = 0$	$\sum \Delta OPEN$ $\sum b_i = 0$	$\sum \Delta FDPS$ $\sum c_i = 0$	$\sum \Delta G$ $\sum d_i = 0$	$\sum PINV$ $\sum \gamma_i = 0$	$\sum RIBR$ $\sum \delta_i = 0$
ΔY	–	9.02 [0.060]*	.019 [0.995]	9.28 [0.054]**	6.27 [0.179]	15.5 [0.003]***
ΔOPEN	5.70 [0.222]	–	14.88 [0.004]***	20.00 [0.000]***	3.60 [0.462]	4.93 [0.294]
ΔFDPS	24.04 [0.000]***	18.98 [0.000]***	–	5.45 [0.243]	3.79 [0.434]	6.48 [0.165]
ΔG	1.68 [0.794]	5.83 [0.212]	4.23 [0.375]	–	1.18 [0.881]	5.28 [0.259]
PINV	1.15 [0.885]	4.15 [0.386]	7.38 [0.117]	8.89 [0.063]*	–	4.76 [0.312]
RIBR	41.29 [0.000]***	4.94 [0.293]	4.25 [0.372]	5.64 [0.227]	2.22 [0.695]	–

Notes:*, ** and *** represent significance at 10%, 5% and 1% levels where figures in parentheses represent the probabilities.

When we included credit to private sector as measure of financial development it does not causes real GDP and the results are similar we found earlier. However, real interest rate now affects real GDP only. Government expenditure is affecting investment significantly. The reason could be

that when government increases the spending it will encourage and facilitate the private investment activities.

6.4.6 Multivariate Causality Analysis with Credit to Private Sector, Investment and Real Interest Rate (Money Market Rate)

Table 6.12 depicts the results by including real interest rate based on money market rate.

Table 6.12: Multivariate Causality Analysis

Dependent Variables	Independent Variables					
	$\sum \Delta Y$ $\sum \alpha_i = 0$	$\sum \Delta OPEN$ $\sum b_i = 0$	$\sum \Delta FDPS$ $\sum c_i = 0$	$\sum \Delta G$ $\sum d_i = 0$	$\sum PINV$ $\sum \gamma_i = 0$	$\sum RIMMR$ $\sum \delta_i = 0$
ΔY	–	10.13 [0.038]**	.99 [0.911]	7.44 [0.114]	6.63 [0.156]	5.57 [0.233]
ΔOPEN	4.52 [0.340]	–	11.76 [0.019]***	18.74 [0.000]***	2.69 [0.611]	4.73 [0.316]
ΔFDPS	10.17 [0.037]**	23.56 [0.000]***	–	3.20 [0.523]	5.73 [0.220]	13.39 [0.009]***
ΔG	2.81 [0.589]	3.78 [0.435]	3.29 [0.510]	–	2.64 [0.620]	.56 [0.966]
PINV	2.29 [0.681]	5.36 [0.251]	5.01 [0.286]	9.49 [0.049]**	–	9.33 [0.053]**
RIMMR	10.92 [0.027]**	4.10 [0.392]	6.69 [0.152]	2.31 [0.677]	1.06 [0.899]	–

Notes:*, ** and *** represent significance at 10%, 5% and 1% levels where figures in parentheses represent the probabilities

The results show that real interest causes only the financial development and private investment. The reason could be that positive real interest rate encourages investment and is beneficial for financial sector. it implies that real interest rate causes economic growth through private investment and financial development. The results suggest us that money market rate is not directly affecting growth however it affects growth indirectly through investment and financial

development. Real GDP is causing real interest rate significantly. The reason could be for example, when real sector expands the output will increase hence reducing the inflation in economy. Other results are already discussed in the previous sections.

6.4.7 Multivariate Causality Analysis with Liquid Liabilities, Investment and Real Interest Rate (Money Market Rate)

Now we use the liquid liabilities as an indicator of financial development instead of private sector credit and results are reported in table 6.13

Table 6.13: Multivariate Causality Analysis

Dependent Variables	Independent Variables					
	$\sum \Delta Y$ $\sum \alpha_i = 0$	$\sum \Delta OPEN$ $\sum b_i = 0$	$\sum \Delta FDLL$ $\sum c_i = 0$	$\sum \Delta G$ $\sum d_i = 0$	$\sum PINV$ $\sum \gamma_i = 0$	$\sum RIMMR$ $\sum \delta_i = 0$
ΔY	–	10.59 [0.031]**	8.23 [0.083]*	6.52 [0.163]	7.53 [0.110]	5.92 [0.205]
ΔOPEN	6.25 [0.187]	–	23.65 [0.000]***	11.82 [0.010]***	4.26 [0.372]	7.15 [0.127]
ΔFDLL	9.77 [0.044]**	16.77 [0.002]***	–	31.93 [0.000]***	3.39 [0.494]	2.23 [0.693]
ΔG	4.22 [0.376]	2.86 [0.580]	9.00 [0.061]*	–	2.08 [0.720]	.36 [0.985]
PINV	1.86 [0.761]	7.22 [0.124]	5.35 [0.253]	4.94 [0.293]	–	12.22 [0.015]***
RIMMR	12.55 [0.013]***	5.91 [0.205]	12.52 [0.013]***	.57 [0.966]	1.88 [0.756]	–

Notes:*, ** and *** represent significance at 10%, 5% and 1% levels where figures in parentheses represent the probabilities

The result shows that money market rate is not affecting GDP growth directly however, it is affecting investment and through this channel it affects real GDP. Other results are already discussed in previous section.

6.5 Conclusion

This chapter reports the empirical findings of the study. First, we examine the stationarty of variables. cointegration is tested among the variables by using both the indicators of financial development i.e. credit to private sector and liquid liabilities separately The cointegration test fails to support the existence of cointegration among the variables, lack of cointegration suggests that there is no long run relationship between finance and growth. Therefore, in order to employ the superexogeneity test we examined the trade-growth nexus and the results show that trade is superexogeneous in the trade-growth nexus.

The absence of cointegration motivates us to estimate short run relationship between finance and growth using Block exogeneity/Multivariate Granger causality test. The results of Granger causality analysis suggest that when liquid liabilities is considered as an indicator of financial development it supports the feedback hypothesis that there is bi-directional relationship between financial development and economic growth. However, when credit to private sector is used as an indicator of financial development it supports the demand following growth hypothesis that is finance follows growth. Real interest rate and investment is then introduced in the estimation. The effect of investment and real interest rate (Money Market rate) is insignificant, while the effect of Real interest rate (Government bond yield) is significant on growth.

Chapter 7
Conclusion and policy implication

7.1 Conclusion

The issue of the relationship between financial development and economic growth is not finalized till now because there is a lot of conflict among economists on that issue. If we take a look at the literature on that issue, there are four schools of thoughts about the relationship between financial development and economic growth which have found mixed results on this issue. Financial development is an important determinant of growth (Bagehot, 1873, Schumpeter, 1934, Shaw, 1973). Finance is harmful for growth (Levine, 2003). Economic growth causes financial development (Robinson, 1952). Financial development is nothing to do with growth Lucas, (1988).

Therefore that issue creates a lot of controversy among the economists and there is a need to resolve that issue because this relation behaves differently in different economies. In case of Pakistan different studies on this issue were done and these studies found different results. The present study uses the quarterly data from 1973Q2 to 2012Q2 and examines the relationship between financial development and economic growth by controlling other variables, trade openness, private investment, government consumption expenditure and real interest rate. First we check the unit root by using the seasonal unit root test developed by Hylleberg et al. (1990) the results show that the real interest rate and investment are stationary and the remaining series are integrated of order one. In the next step we estimate the existence of long run relationship between the long memory series by using the trace and maximum Eigen value cointegration test. Our result suggests that there is no linear combination between the variables under consideration.

Hence to employ the superexogeneity test empirically we consider the trade-growth nexus while omitting financial development as we find no long run relationship between financial development and economic growth. The results imply that there exists a long-run relationship between trade openness and economic growth which allow us to test the variant of exogeneity. The result of superexogeneity test suggests that trade openness is an exogenous variable in the growth-trade nexus which verifies trade-led growth hypothesis. Superexogeneity of trade openness suggests that openness can be used as a tool of trade policy in policy making to enhance economic growth.

The core objective of this study is to examine the impact of financial development on economic growth under the framework of superexogeneity test. However, the lack of long-run relationship between financial development and economic growth takes the estimation toward short run analysis. Therefore; the estimation is carried out using the Block exogeneity/multivariate Granger causality test to examine the causal relationship between financial development and economic growth. Following the standard literature we consider two measures of financial development, that is, liquid liabilities and credit to private sector. Liquid liabilities are the investment perspective of financial development and it shows the level of financial intermediary services and financial depth in the economy. In Pakistan liquid liabilities shows a major improvement after 1990 because of the up gradation of the financial sector by the GOP, before 90's the financial sector is very weak, public has no confidence on the banks and the services provided by banks were also vulnerable so the bank deposits were low therefore, the savings and investment is low. After the up gradation of financial sector in 90's, it got the public confidence and people find convince in moving towards banks as a result saving and investment increases. The results of this study show that liquid liabilities causes economic growth significantly. The

reason could be that financial services provided by the financial intermediaries facilitate saving and investment through various channels like making transactions easy, good financial services, attractive returns on deposits, providence of credit and finance to the firms. Higher level of savings and investment thus spurs economic growth.

The other measure of financial development is credit to private sector which is a measure of financial depth. The findings of the present study suggest that the effect of this variable is insignificant on economic growth. The reason could be that credit to private sector relative to GDP is weak in Pakistan, especially to the backbone of our economy the agriculture sector is deprived of that credit and this sector needs credit the most. Credit to agriculture sector is subsidized a little but it is not helpful for small farmers because credit is provided according to the value of land. The financial literacy among the farmers is weak due to which they do not approach the financial institutions and take loans from informal sources which charge them high interest rates. The farmers having the financial literacy go to the financial institutions but they don't find much finance for them, this could be a reason that agriculture output is not improving by the credit to private sector in Pakistan. In the summary, we can say that the financial needs of agriculture sector were not fulfilled up to the standard level. The credit to the other sectors is also not sufficient like for small scale businesses.

Trade openness causes economic growth significantly. This could be possible when trade increases, it creates competition between the local markets which improves the production level; therefore trade openness enhances economic growth through improvement in production. One the other hand, economic growth effects trade significantly. Therefore, trade and growth has a bidirectional causal relationship which implies that both of these factors support each other. Our results suggest that government expenditure causes trade significantly; this may be due to for

example, when government increases its expenditures it provides fund for the economy which enhances the production level and hence trade. The results also show that financial development and trade openness causes each other significantly; financial development causes trade through the channel of economic growth.

Real interest rate is affecting economic growth, investment and financial development significantly. Interest rate is a very crucial variable of the financial sector and financial sector development is positively correlated with the real interest rate. Since investment decisions are highly dependent on the real interest rate because every investor compares its investment returns with the real interest rate, therefore, real interest rate causes economic growth through investment and financial development because these variables have a significant effect on economic growth.

7.2 Policy Implication

The results of this study have many important implications for policy making. For example, liquid liabilities causes economic growth significantly in Pakistan which implies that financial services of intermediaries are playing their role in achieving economic growth, therefore, government has to develop and assist the banks and other financial intermediaries to spur economic growth. Credit to private sector is not affecting growth significantly because credit availability is less; sufficient credit is not available to the needy sectors. Therefore, there is a need to take appropriate measures to provide finance to the needy sectors of the economy, particularly to agriculture sector which is the backbone of Pakistan's economy. Super exogeneity test verifies that trade openness is superexogeneous; therefore more trade openness could enhance economic growth. To this end, there is a need to further reduce trade barriers to increase

the competition in the local markets. Reduction of trade barrier is also necessary to take the benefits of comparative advantage. Real interest rate has an important role in investment and financial development; hence the monetary authorities have to keep the real interest rate positive to enhance the level of investment and economic growth.

References

Abu-Bader, S. and A. S. Abu-Qarn (2007) "Financial Development and Economic Growth: The Egyptian experience", Journal of Policy Modeling, Vol. 39, pp. 887-898.

Adnan, Q. M. (2011) "Long Term Effect of Trade Openness on Economic Growth in Case of Pakistan", Springer Science, Vol. 46, pp. 1137-1149.

Ahmed, Y. and A. Emmanuel (1999-2000) "Openness and Economic Growth: Evidence from Selected Asian Countries", The Indian Economic Journal, Vol. 47, No. 3.

Al-Yousif, K (2002) "Financial Development and Economic Growth: Another look at the Evidence from Developing Countries", Journal of Review of Financial Economics, Vol. 11, No. 2, pp. 131-150.

Artestis, P. and P. Demetriades (2001) "Financial Development and Economic Growth: the role of Stock markets", Journal of money, Banking and Credit, Vol. 33, pp. 16-41.

Asim, M, F. Cheema. and S. Jilani (2010) "Exploring impact of Macro Economic variables on GDP of Pakistan", Journal of Management and Social Sciences, Vol. 6, pp. 65-73.

Akingunola, R. B. Olunwaseyi. and A. Olusegun. (2013) "The effect of the Financial Liberalization on Economic Growth", International Journal of Academic Research in Economics and Management Sciences, Vol. 2, No. 1, pp. 123-155.

Bagehot, W. (1873), Lombard Street, Homewood, IL: Richard D. Irwin, (1962 Edition).

Batool, S. S. (2011) "Financial Development and Agricultural Output in Pakistan" Unpublished M.Phil Thesis, Department of Economics, Pakistan institute of development economics, Islamabad.

Christopoulos, D. K. and G .T. Efthymios (2004) "Financial Development and Economic Growth: Evidence from panel unit root and cointegration tests", Journal of Development Economics, Vol. 73, pp. 55-74.

C, L. Yen. and M. Nair (2010) "The Impact of FDI and Financial Sector Development on Economic Growth: Empirical Evidence from Asia and Oceania", International Journal of Economics and Finance, Vol. 2, No. 2, pp. 107-118.

Din, M, E. Ghani. and O. Siddique (2003) "Openness and Economic Growth in Pakistan", The Pakistan Development Review, Vol. 42, No. 4, pp. 795-807.

Demetriades, P. O. and K. A. Hussein (1996) "Does Financial Development Cause Economic Growth? Time series Evidence from 16 Countries", Journal of Development Economics, Vol. 51, pp. 387-411.

Engle, R, D. F .Hendry. and J. F. Richard (1993**)** "Testing Superexogeneity and Invariance in Regression Models", Journal of Econometrics, Vol. 56, pp. 119-139.

Engle, R, D. F. Hendry. and J. F. Richard (1983) "Exogeniety", Econmetrica, Vol. 51, pp. 277-304.

Ericsson, N. R. (1991) "Cointegration, Exogeneity and Policy Analysis: An Overview", International Finance Discussion Paper No. 415.

Ericsson, N. R, D. F. Hendry. and G. E. Mizon (1998) "Cointegration, Exogeneity and Policy Analysis", Journal of Business and Economic Statistics, Vol. 16, No. 4, pp. 370-387.

Fry, M. J (1990) "Money, Interest, and Banking in Economic Development", The Journal of Development Economics, Vol. 32, No. 1, pp. 235-237.

Galbis, V (1995) "Financial Sector Reforms in Eight Countries: Issues and Results", IMF Working Paper No. 95/141.

Gregorio, D, Jose and P. E. Guidotti (1995) "Financial Development and Economic Growth", World Development, Vol. 23, No. 3, pp. 433-448.

Hanif, M. N (2008) "Financial Development and Economic Growth: Evidence from Heterogeneous Panel Data" Unpublished PhD Thesis Pakistan Institute of Development Economics, Islamabad.

Hanif, M. H. (2003) "Restructuring of Financial Sector in Pakistan", The Journal of Institute of Bankers in Pakistan, pp. 43-74.

Harrison, A (1996) "Openness and Growth: A Time Series, Cross-country Analysis for Developing Countries", Journal of Development Economics, Vol. 48, pp.419– 447.

Hassan, M. A, A. H. Khan. and S. S. Ali (1996) "Financial Sector Reform and its Impact on Investment and Economic Growth: An Econometric Approach" The Pakistan Development Review, Vol. 35, No. 4, pp. 885-895.

Hendry, D. F, and J.F.Richard (1982) "On the Formulation of Empirical Models in Dynamic Econometrics", Journal of Econometrics, Vol. 20, pp. 8-38.

Hendry, D. F and C. Santos (2010) "An Automatic Test of Superexogeneity", Department of Economics, University of Oxford, Discussion Paper No. 476.

Hussain, A, I. Lal, and D. Sulaiman (2009) "Effects of Financial Sector and Financial Development on Economic Growth: A case study of Pakistan", European Journal of Social Sciences, Vol. 11, No. 3. pp. 418-427.

Hussain, F. (2010) "Pakistan's Exports Demand: A Disaggregated Analysis", SBP Research Bulletin, Vol. 6, No-2.

Jalil, A. and Y. Ma. (2008). "Financial Development and Economic Growth: Time series Evidence from Pakistan and China", Journal of Economic Co-operation, Vol. 29, No. 2, pp. 29-68.

Javed, Z. H, I. Qaiser. and A. Mushtaq (2012). "Effects of International Trade on Economic Growth: The Case Study of Pakistan", International Journal of Academic Research in Progressive Education and Development, Vol. 1, No. 2, pp. 103-113.

Jude, C. E. (2008) "Financial Development, Financial Instability and Growth: A Reappraisal", Orleans University, the Faculty of Law, Economy and Gestion.

Kemal, A. R, A. Qayyum. and H. Muhammad (2004) "Financial Development and Economic Growth: Evidence From Hetrogenous panel of High Income Countries", Munich personal Archive (MPRA), Paper No. 10198.

Khan, M. A. (2007) "Testing the Monetary Approach to Exchange Rate Determination: The case of Pakistan", Unpublished PHD Thesis, Department of Economics, Pakistan Institute of Development Economics, Islamabad.

Khan, M. A, A. Qayyum. and S.A sheikh (2005) "Financial Development and Economic Growth: The case of Pakistan", The Pakistan Development Review, Vol. 44, part. 2, pp. 819-837.

Khan, M. A. and S. Khan (2007) "Financial restructuring in Pakistan" Lahore journal of Economics. Special edition, 2007, pp. 98-125.

Khan, M. A. and A. Qayyum (2006) "Trade Liberalization, Financial Sector Reforms and Growth", The Pakistan Development Review, Vol. 45, No. 4, pp. 711-731.

Khan, M. A. and A. Qayyum (2007) "Trade, Financial and Growth Nexus in Pakistan", Economic Analysis Working Paper, Vol. 6, No. 14, pp. 1-24.

Khan, M. A. and A. Ahmed (2012) "Modeling Trade, Investment, Growth and Liberalization: Case study of Pakistan", The Pakistan Development Review, Pakistan Institute of Development Economics, Vol. 51, N0. 4, pp. 187-208.

Khan, M. S and A. S Senhadji (2000). "Financial Development and Economic Growth: An Overview", International Monetary Fund Working Paper No. 209.

King, R. G. and R. Levine (1993) **"**Finance and Growth: Schumpeter might be Right", Quarterly journal of Economics, pp. 718-736.

Kiran, B .N, C. Yavuz. and B. Guris (2009) "Financial Development and Economic growth: A panel data analysis of Emerging countries", International Research Journal of Finance and Economics, Vol. 30, pp. 88-94.

Levine, R. (1997) "Financial Development and Economic Growth: views and agenda" Journal of Economic literature, Vol. 35, pp. 688- 726.

Lucas, R. E. (1988) "On the Mechanics of Economic Development" Journal of Monetary Economics, Vol. 22, No. 1.

Luintel, K. B. and M. Khan (1999) "A Quantitative Reassessment of Finance Growth nexus: evidence from multivariate VAR", Journal of Development Economics, Vol. 60, No. 2, pp. 381-405.

Mckinnon, R. I (1973) "Money and Capital in Economic Development", The Brooking Institution, Washington, D.C.

Murty, K. S, K. Sailaja and W. M. Demissie (2012) "The Long-Run Impact of Bank Credit on Economic Growth in Ethopia: Evidence from the Johansen's Multivariate Cointegration Approach", European Journal of Business and Management, Vol. 4, No. 14, pp. 20-33.

Nazir, M. S. and A. Aslam. (2010) "The Impact of Financial Restructuring on the Performance of Pakistani Banks", The IUP journal of Applied Finance, Vol. 16, pp. 71-86.

Patrick, H. T (1993) "Financial Development and Economic Growth in Underdeveloped Countries", Economic Development and Cultural Change, Vol. 14, No. 1.

Qayyum, A (2005) "Modelling the Demand for Money in Pakistan" The Pakistan Development Review, Vol. 44, No. 3, pp. 233-252.

Rahman, M. M. and M. Salahuddin (2010) "The Determinants of Economic Growth in Pakistan: Does Stock market Development play a major role?" Journal of Economic issues, Vol. 15, No. 2, pp. 69-86.

Rahman, A and A. Raza. (2012) "Financial development and Real sector Growth in Pakistan" Interdisciplinary Journal of Contemporary Research in Business, Vol 5, No. 1, pp. 618-636.

Robinson, J. (1952) "The Rate of Interest and other Essays". Macmillan, London.

Schumpeter, J.A (1911) "The Theory of Economic Development", Harvard University Press, Cambridge.

Aamir, S. H. and J. Iqbal (2005) "Impact of Trade Openness on Output Growth for Pakistan: An Empirical Investigation" Market Forces April 2005, Vol. 1, No. 1.

Shahbaz, M, Ahmed. K and Chaudhary. A. R (2008) "Economic Growth and its Determinants in Pakistan", The Pakistan Development Review, Vol. 47, No. 4, pp. 471-486.

Tahir, M (2008) "An Investigation of the Effectiveness of Financial Development in Pakistan" The Lahore Journal of Economics, Vol. 13, No. 2, pp. 27-44.

Wadud, M. D. (2009) "Financial Development and Economic Growth: A Cointegration and Error-correction Modeling Approach for South Asian Countries", Economics Bulletin, Access Econ, Vol. 29, No. 3, pp. 1670-1677.

Watchel, paul and P. Rousseau. (1995), "Financial Intermediation and Economic Growth: A historical comparison of the U.S., U.K., and Canada in Anlo-American Financial systems: Institutions and Markets in Twentieth-century North America and the United Kingdom", Micheal, D. Bordo and R. Sylla, Homewood, IL, Business one Irwin, pp. 329-382.

Yang, Y. Y. and M. H. Yi (2008**)** "Does Financial Development causes Economic Growth? Implication for policy in Korea" Journal of policy modelling, Vol. 30, pp. 827-840.

Yanikkaya, H. (2003) "Trade Openness and Economic Growth: A Cross Country Empirical Investigation", Journal of Development Economics, Vol. 72, pp. 57-89.