A SMALL MACROECONOMETRIC MODEL FOR THE KHYBER PAKHTUNKHWA ECONOMY

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بسم الله الرحمن الرحيم

Dedicated to

Father of the Nation

Muhammad Ali Jinnah (R.A.)

A True Muslim and Soldier of Hazrat Muhammad (P.B.U.H.).

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With the name of Allah who is the most merciful and kind who gives us the opportunity to complete this research work successfully.

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ZAHID RAUF

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Chapter 1
INTRODUCTION

1.1 Macroeconomic Model

Macroeconomic model is a quantitative analyses of an economy through computation and estimation of an interrelated system of equations using economic theory, data and good knowledge of econometrics to achieve three objectives, *viz.* structural analyses, forecasting and policy evaluation [Fukac and Pagan (2010)]. Macroeconomic modelling have served as important tools of analysis for macroeconomic forecasting and policy assessment [Herve, *et al.* (2010)].

Macroeconomic modelling has a long and interesting history. Tinbergen is regarded as a pioneer of macroeconomic modelling as he formulated the first model for the Dutch economy prior to World War II to assist the Dutch Central Planning Bureau in implementing their economic policies [Khan and Din (2011)]. Capros *et al.* (1990) have classified macroeconomic models into two broad groups: macroeconometric models (MEMs) and computable general equilibrium models (CGEMs).

Fukac and Pagan (2010) review the evolution of macroeconomic modelling in a policy environment that took place over the past sixty years. They identify and characterize four generations of macro models. In their paper they pay particular attention to the fourth generation i.e. dynamic stochastic general equilibrium (DSGE) models. They also discuss some of the problems in how these models are implemented and quantified.

Choudhury (2012) says that the choice of what type of model to develop is based on its intended use, considering available data and important criterion is that the model should be useful in preparing the national budgets. Diebold (1998) reports that the use of macroeconomic models for policy analysis and forecasting has a unrestrained history since 1940 when Jacob Marschak (1898-1977) known as the father of econometrics, organised a special team at the Cowles Commission by inviting luminaries such as Tjalling Koopmans, Kenneth Arrow, Trygve Haavelmo, T.W. Anderson, Lawrence R. Klein, G. Debreu, Leonid Hurwitz, Harry Markowitz, and Franco Modigliani.

1.2 **Macroeconometric Models (MEMs)**

MEMs provide a useful understanding of structural relationship among different key macroeconomic variables. It also provides cause and effect relationship between policy and target variables and helps in generating forecasts which are important for policy formulation [Bhanumurthy and Kumawat (2009)]. MEMs also provide a useful means of tracking the implications of a variety of shocks, both exogenous and policy driven within and between economies and regions [Herve, *et al.* (2010)].

Challen and Hagger (1983) classifies five varieties of MEMs in the literature: the KK (Keynes-Klein) model, the PB (Phillips-Bergstrom) model, the WJ (Walras-Johansen) model, the WL (Walras-Leontief) model, and finally the MS (Muth-Sargent) model. Macroeconometric modelling in developing countries has also a relatively long history. The first MEM for a developing country was constructed by Narasimham (1956) for India under the supervision of Tinbergen.

The earliest models for developing countries were mainly small versions of the KK model capturing the demand side of the economy [Valadkhani (2005)].

In fact, the persistent economic difficulties in many developing countries such as stagflation, trade and budget deficits, and massive debt burdens led a significant number of developing countries to use MEMs for economic problems [Valadkhani (2003)]. Adams and Vial (1991) report that in the past the majority of MEMs suffered from excessive "Keynesianism", which means the modelers gave insufficient attention to the role of the supply side in the long run.

Studies by carry out by Herve (2010) and Valadkhani (2005) put forward that economic development obstacles in most developing countries are not due to having adequate effective demand, but are associated with the supply constraints. He argues that the analysis of the economy will be more difficult when there are numerous equations in the model, thus advocates of small scale modelling suggest that the small model can explain the economy more efficiently. Macroeconometric model is a set of behavioural equations, as well as institutional and definitional relationships, representing the structure and operations of an economy, in principle based upon the behaviour of individual economic agents.

Gurara (2013) develop a macroeconometric model for Rwandan economy. What he finds were close to the actual behavior of the macro behavior of the economy. He reports that Rwandan economy is enjoying macroeconomic stability for the last more than ten years. Arabi and Abdalla (2013) give a brief macroeconomic model for the Sudan economy. It was a first-hand evidence from error correction context for main economic factors of growth with time series of 54 years from 1956 to 2010. Jose and Rica (2007) presented a macroeconomic model for analyzing and forecasting the effects of external shocks to the collective economies of Central America and the Dominican Republic. Based on assumptions and on data associated

with the model's exogenous variables, it projects a slowdown in the region's economic growth for 2007 and 2008.

Schneider *et al.* (2007) apply the modeling strategy contains a set of structural relations with long run behavior of German economy. These statistical relations were suggested by economic theory and unrestricted vector autoregressive mechanism. Bagnai and Ospina (2007) presents a medium-size structural macroeconometric model of the Chinese economy. This model consists of 54 equations estimated with annual data from 1978 to 2006. The estimation methodology accounts for structural breaks of unknown date in the long run parameters. Côté *et al.* (2003) examine and compare twelve private and public sector ope economy models of the Canadian economy in Philips curve paradigm and money matters paradigm. Garrot *et al.* (2003) incorporate long run structural relationship in unrestricted VAR model for UK economy. They construct a small quarterly macroeconometric model with a transparent and theoretically coherent foundations.

For about 40 developing countries two major relief organizations United Nations Conference on Trade and Development (UNCTD) and Economic and Social Commission for Asia and the Pacific (ECAFE) constructed series of macroeconometric models under the supervision of John Tinbergen with the aims to forecast the foreign aid in the shape of financial capital and needs of poor nations [Valadkhani (2004)].

Mallik and Chowdhury (2001) examined the association between growth of gross domestic product and rate of inflation for Pakistan, India Bangladesh and Sri Lanka, four important South Asian countries. A long run positive association is observed between growth rates in gross domestic product with rate of inflation.

In Pakistan macroeconomic modeling is being practiced since 1983 when first macro model was presented by Naqvi (1983) and then few more attempts were made by Haider and Khan (2008), Hanif, *et al* (2010), Akbar and Aitazaz (2011) and Khan and Din (2011).

1.3 Regional Studies

Bassiliere *et al.* (2007) says that a regional macroeconomic model can support the decision making process at the regional level. Information about government at sub-national level that is provincial, region or state level is needed to compare the influence of transactions of federal, province and local establishments and of social safety schemes on the economic state of sub-national small economies [Franchet (2000)].

There is remarkable economic growth seen in China during the last three decades. The inland western provinces in China are progressively lead the coastal area to lead the recent economic growth which points out the consequence of policies affecting the development tracks and inter-regional disparity [Sun (2013)].

The primary sources of economic progression in China differed significantly across sub periods as an outcome of main shifts in the economic policy regimes. International trade became the key driver for the growth of economy in the late 1980's, and the coastline provinces outperformed the interior regions [Demerger *et al.* (2000)].

In India a marked difference can be observed in the economic performances among the states. There is a slight indication of comparable convergence in income among Indian states. Geographical disparities across provinces appears to slow or block the convergence of incomes [Sachs *et al.* (2002)].

In transitional and developing countries there is an alarming situation that regional, spatial and income inequality of economic activity is on the upturn [Jamal and Khan (2003)]. Pakistan had traditionally followed a top-down approach for the analyses and evaluation of economic development. This strategy is so ingrained and unfruitful that the official authorities do not produce official statistics of Provincial Gross Domestic Product (PGDP), investment, consumptions and savings even after more than 60 years of the independence [Ikram (2009)].

In Pakistan regions differ in their output and incomes, one may have predominantly agro based economy the other primarily manufacturing and industry based [Bengali and Sadaqat (2006)]. For the first time Bengali (1995) made a pioneering effort for the construction of PGDPs for the four provinces of Pakistan. And this effort was extended in Bengali and Sadaqat (2006). After that a sequence of strives were made by different renowned economic researchers including Jamal and Amir (2003) and Jamal and Khan (2003) for the analyses of provincial development Issues [Ikram (2009)]. Tariq and Shah (2003) report that Khyber Pakhtunkhwa (KP) is the smallest province in terms of area and the third largest in terms of population.

Khan (2012) reports that agricultural sector is the key source of living and income in KP, but its organizational structure is weak and thin. The major challenge within the area tackled by farmer communities are ownership of irrigated land assets by landlords and subsequent destruction of land into uneconomical and small assets. The input of manufacturing sector towards the social and economic growth and social prosperity of the area is not noteworthy. It is depressing to observe that more than 1150 small and medium manufacturing units have been sick or closed which makes about 62% of the total strength [Tariq and Shah, 2003]

Hussain and Mahmood (2001) find the use of revenues through income tax as a gauge of regional progress in Pakistan. According to the findings province Punjab appears with a faster economically growing province during the decade, second is province Sindh, third is province Khyber Pakhtunkhwa and the most laggard province is found to be Baluchistan. According to Ikram (2009) between 1980-81 and 2004-05 the per capita income of Pakistan is estimated to have grown at annual average rate of 2.6 percent. The growth rates for the provinces are: the Punjab 2.8, Sindh and Khyber Pakhtunkhwa 2.3 and Baluchistan 2.1 percent per annum each. Khan (2012) reports that the province KP is the third largest economy of the country. The province works with 25 district units as local governments. It is bordered by seven federally administered agencies (FATA) governed under political system and five frontier regions (FR). KP is mainly a mountainous province with large and enormous variations in the topography as one move from one land area to hilly areas through the province.

Allah Dad (2009) reports that the climate and physical conditions of the province KP has a wide and varied range. Although it is situated in a temperate zone, but there is a visible and immense variation in the climate of the province. Shah (1995) says that the province KP is naturally blessed with the most exquisite areas in the world, where the beauty of the natural environment, the abundance of scenic spots, and a host of recreational outlets attract an ever-increasing number of tourists.

Allah Dad (2009) reports that the third largest economy of Pakistan is Khyber Pakhtunkhwa (KP). KP's share of Pakistan's gross domestic product has factually comprised 10.5% in history of more than 60 years on the average. Although the population of the province accounts for 12% of total population. The share of the national economy that KP leads is mainly forestry where its share significantly

participate in national economy. It has historically ranged from a little of 35% to an extraordinary high level of 81%, agreed with an average of 62%. Currently KP financial records for 10% of Pakistan's GDP, 20% of output from mining sector of Pakistan. During last four decades it has perceived its economic growth in size by 3.6 times more.

Home to 22.2 million people the province of Khyber Pakhtunkhwa is blessed with immense wealth of natural possessions in natural gas, oil, gem stones, minerals, forests and better in touristic assets. It possesses a wealth of untapped economic potential but unfortunately a higher rate of poverty as compared to national poverty line. The pace of economic progress is slower than the national pace. Provincial estimates for both poverty and economic growth are not available because provincial design of poverty line has never been officially carried out in Pakistan [Burki (2010)].

The strategic geographical location is the biggest exogenous constraint to economic growth because the province has been disbursing the cost of conflicts in cross boarders countries in Afghanistan since Russia invaded Afghanistan in 1979. In all over the world the province KP is bitterly affected region after 9/11 attacks trade center in USA. The province leftovers pierced with the sever problems of military aggressiveness since attack of Western forces in Afghanistan in 2002 [Burki (2010)].

This study aims to develop a macro-econometric model for the economy of the province KP. What is the trend of main macro variables? Whether long-run and short-run relationship exists among macroeconomic variables of different sectors of the provincial economy. How better different economic predictors predict the predictants. In this study the provincial economy as a part of the national economy is observed.

1.4 Objectives of the Study

The objectives of the study are two-fold: at first; to develop a macroeconometric model of the provincial economy of KP for the selected sectors and at second; to observe the structural behaviour of supply side, Demand Side and the fiscal quarter. The detail of objectives is summarized as follows;

- To assess the impact of key production factor of agriculture sector
- To assess the impact key production factor of Manufacturing Sector
- To assess the role of public and private consumptions on services value-added
- To determine the marginal propensity to consume
- How real interest rate drive the private consumption and investment
- How public and private investments react to rate of inflation
- What is the impact of nominal income and rate of inflation on tax revenues
- How current expenditure behave with the total economic activity

1.5 Significance of the Study

The present study is a struggle to model the economy of the province KP. It is the first ever study made to capture the provincial level economy. It is an important contribution to the applied macroeconometric literature on regional/sub-national level.

The model based on the small open economy framework. The developed model contains 18 functional equalities with 12 behavioral equations and 6 are economic identities. The objective is to capture the nexus among supply, demand and provincial government revenues and expenditure. The production function for supply side is disaggregated into agriculture, manufacturing and services sectors to get a thorough insight into the primary, secondary and tertiary sectors of the economy.

The production function for demand side is disaggregated into Consumption, investment and Change in Capital stock sectors. Due to no availability of data on change in capital stock this important economic factor is not incorporated into the model. The fiscal sector has structural distribution into overlapping quarters of revenue and expenditure. Further classification is made for private and public sectors.

The model can be used to evaluate the effects of local, national and international shocks. The behavior of main economic factors including public and private sector investment, consumption and the relation among different economic variables. Some national economic factors are used in the provincial economic evaluation including rate of inflation, real and nominal rates of interest, weighted average lending and borrowing rates etc.

To the best of my knowledge for Pakistan's economy no regional, provincial or sub-national level macroeconometric modeling is practiced. National level studies are frequently made after the pioneer effort of Naqvi (1983 and 1986b) known as PIDE model. The second significant effort is made by Qureshi (1996) known as PSLM model. Usually macroeconometric models depend on Keynesian context emphasizing only the demand sector of the economy. Pakistan, like other developing countries, has a supply sector constraints as one of the major problems, hence the situation exists in the province KP likewise. Following Gurara (2013), Rahman and Khatoon (2011), Khan and Din (2011), Akber and Eatzaz (2011) and Hanif, *et al.*(2010) the present study will cover both supply and demand sides of the provincial economy.

1.6 Limitations of the study

The present study is a theoretical applied study that, definitely, faces many problems to attempt, mainly the data for the estimation purposes. These hurdles to carry the study researchers use some proxies and dummy variables to have verifiable and applicable results. Data, a crucial requirement for a quantitative research, are the backbone of a study, we interpolate and extrapolate some some of the very important variables not available with data banks and/or official departments concern. Following are the limitations of the study;

1. Due to short data span, structural break and data with low frequency, the available methods of estimation is limited. Therefore, we have employed a single -equation method and all the estimated single equations have been seen in the light of the objectives of building a model for provincial economies.
2. The data are mainly obtained through national sources, detail given in *Table – 2* of Appendix. There is observed some visible difference between provincial and federal sources that are covered with most possibly accurate figure.
3. We use real economic time series that overcome the problem of inflation present in many nominal/actual time series.
4. We use estimated provincial gross domestic products as proxy for provincial nominal incomes.

1.7 Scheme of Study

The study is organized as; chapter 2 contains the review of the literature with subunits describe topics including macroeconomic modeling, macroeconometric modelling, history of development and change in economic environments and different generations of economic modelling and the last subsections describes a detailed literature review on regional and sub national level macroeconomic modelling. Chapter 3 describes the theoretical framework and construction of the model and the development of the stochastic or behavioral equations and description

of economic identities. Data and its sources, list of endogenous and exogenous key variables of the provincial economy with their units and definitions are elaborated in Table - 1 and Table – 2 I *Appendix A*. The last subsection of section 3 elaborates the estimation methodology. Chapter 4 contains the results of estimation and brief description on different stochastic models, their parameters with description. The test results and results of different diagnostic statistical measures is also given in the same section. Chapter 5 explains the summary of the results, brief discussion and policy recommendation. The last section contains selected references for the study. Different appendices are given in the last.

Chapter 2
LITERATURE REVIEW

2.1 Macroeconomic Modelling

A macroeconomic model is a collection of equations defined on relation of different economic factors to clarify, illustrate, test, compare and quantify theoretical relationships among them. These models have been used to produce scenarios and compare possible alternative policies as well as evaluate possible effects of changes in macroeconomic policies and forecast major variables (Mordi *et al.*, 2010; Khan and Din, 2011; Valadkhani, 2013)

Fukac and Pagan (2010) explain the basic ideas of macroeconomic modelling that can be characterized as responses to four issues; first, the design of model to be used in a policy environment, secondly, estimation of the parameters in these models, thirdly, match of these models to the data i.e. how to evaluate their ability to adequately represent the outcomes from an actual economy, fourthly, prediction and policy analyses with the models.

Khan and Din (2011) say that for the last four decades macroeconomic modelling have been aided to the economic behavioural studies as a worthy tool for the macroeconomic policy evaluations and predicting the long run and short run effects of macroeconomic policies. Operational relationships among key macroeconomic dynamics can be observed very significantly through these models. It provides cause and effect relationship between policy and target economic factors. A salient feature of the macroeconomic modelling is that it depicts the temporal

behaviour as well as structure of the economy to path the implication and detection of sudden and unexpected economic shocks within an economy or region.

Choudhury (2012) says that the choice of what type of model to develop is based on its intended use, considering available data and important criterion is that the model should be useful in preparing the national budgets. As Malawi has undergone international monetary fund IMF programmes for a long time, one of the design criterion is to make the model useful for forecasts and analyses related to such programmes.

Macroeconomic modelling has a long and interesting history. For nearly two hundred years between 1776 and 1936 the classical framework of demand and supply as core forces of economic determination and of price as arbiter dominated economic thinking. The classical model largely assumes the existence of an equilibrium point where product, labour and factor markets clear. Such an equilibrium point is assumed to involve the full employment of factor and production; particularly labour and capital. the development and widespread use of large-scale empirical macroeconomic models began with the Keynesian revolution in 1936 coinciding with the publication of Tinbergen's classical model the same year). This is not surprising given that the classical model is self-regulating, self-sufficient and wholly dependent on market forces, with little provision for policy input. On the contrary, Keynes analyses of the Great depression of 1930s provided for possible disequilibrium in the goods and factor markets, necessitating intervention by the third arm of aggregate demand (government) to correct such distortions or disequilibrium conditions. In effect, while classical economics was mainly supply driven, Keynes emphasised the place of demand (Mordi *et al.* ,2010).

Shortly after Keynes, Neo-Keynesians like Hicks (1937), Modigliani (1944) among others tried to link the demand and supply sides of the economy. The SI-LL curve (now IS-LM curve), which tried to simultaneously solve the product (real) and money markets and showed income and interest rates as linking variables in the two markets, was one of such efforts. Over time, these simple representations have had profound impact on theory and policy. Multitudes of efforts have since gone into formalising these relationships as well as linking the major postulations of Keynes to the workings of the price mechanism.

Tinbergen (1936) is regarded as a pioneer of macroeconometric modelling as he formulated the first model for the Dutch economy prior to World War II to assist the Dutch Central Planning Bureau in implementing their economic policies. Later on same exercise is applied to the economies of USA and UK. In his work on macroeconomic modelling and economic policy implementation and evaluation he classify economic agents into two broad categories; first, targets and second, instruments. Targets are those factors of the economy that policy makers wishes to influence whereas instruments are that economic agents policy maker can control directly. It is proposed that to tune the target variables one should control an equal number of instruments. Central bank even today follows Tinbergen (1936) classification underlying the theory of monetary policy. It is practiced in routine that central bank authorities deal with the rate of inflation as their target variable and the short-term rate of interest as instrument (Khan and Din, 2011).

Klein (1940) argues for large scale econometric models. He adds that a researcher should choose the largest possible system of equations for which a good data base exists, that is manageable with prevailing human resources and that can project the principal macroeconomic magnitude as well as the best models of any size

can i.e. there should be no significant loss of forecast accuracy as a result of adopting a large scale system of equations. The motivation behind the choice of a large scale system is that one gain information about so many other magnitudes besides those in the list of the principal magnitudes and can be ready for immediate response to a wide variety of what-if or actual events. Such events are droughts, price freezes, tariffs, quotas, financial crises, new tax laws, energy programmes, etc.

Capros *et al.* (1990) have classified macroeconomic models into two broad groups: macroeconometric models (MEMs) and computable general equilibrium models (CGEMs). The MEMs and CGEMs can be considered the cornerstones of the spectrum of quantitative models used today for macroeconomic policy analysis. In their paper they design two small-scale models an MEM and a CGE model in such a manner that they are representative of their large-scale counterparts, estimate them on a common database, and attempt a systematic comparative assessment of their simulation properties. They suggest various possibilities for use in policy analysis that explore and combine the results of both models.

Mordi *et al.* (2019) adds that model structures have historically followed developments in the theory and methodology outlined above. Generally, macroeconomic models could be grouped into three: simple theoretical models, empirical forecasting models and dynamic stochastic general equilibrium models. The simple macroeconomic models are static and in some cases dynamic macroeconomic models that follow the IS-LM model and Mundell-Fleming model of Keynesian macroeconomics, and the Solow model of neo-classical growth theory. Based on few structural equations and few variables, they represent macroeconomic aggregates rather than individual choice variables. Though, the equations relating these variables are intended to describe economic decisions, they are not usually derived directly by

aggregating models of individual choices. Empirical forecasting models became popular in the 1940s and 1950s and are meant to capture and provide future forecasts of macroeconomic variables which significance in economic policymaking was rising astronomically within the period. Variables to be included are, however, guided by economic theory. Dynamic stochastic general equilibrium models are more or less products of the Lucas critique of 1979. They were developed mainly to capture structural relationships among various economic agents and micro foundations of macroeconomic relationships based on rational choice. Some variants of DSGE include computable general equilibrium (CGE), dynamic stochastic general equilibrium (DSGE), and Agent-based computational equilibrium (ACE) models. Within the broad group of dynamic macroeconomic and stochastic general equilibrium models there are also unique class of models including The Traditional structure Models (TSM), Rational Expectations Structure Models (RESM), Equilibrium Business-Cycle Models (EBCM), Vector Autoregressive Models (VARM). Each class shares common characteristics such as theoretical and/or methodological similarities.

Fucak and Pagan (2010) review the evolutionary period that was observed, since 1960 and onward, in developing the macroeconomic model for structural relations in a policy strategic environment. They recognize and describe four peers of macroeconomic relations in equational form. Precise courtesy is paid to the fourth group that is dynamic stochastic general equilibrium (DSGE) models. They deliberately discuss some snag problems in implementing and quantifying these statistical models. The people those who effort with them see that they continually need to think about the next group in order to retort to developments and advancements in the macro state of the economy. New ideas, attitudes and

philosophies about the interface and interactions of the mediators within the economy were observed during this period. It was an era of developing new and more reliable data sources and methods of analyzing them.

2.2 MEMs for Policy Evaluation

Valadkhani (2005) adds that MEMs are set of behavioural equations, as well as institutional and definitional relationships, representing the structure and operations of an economy, in principle based upon the behaviour of individual economic agent. In fact it is a quantitative analysis of an economy through computation or estimation of an interrelated system of equations using economic theory, data and a good knowledge of econometrics to achieve three objectives, *viz.* structural analyses, forecasting and policy evaluation. These three purposes correspond, respectively, to the descriptive, predictive and prescriptive uses of econometrics.

Diebold (1998) reports that the use of MEMs for policy analysis and forecasting has a unrestrained history since 1940 when Jacob Marschak (1898-1977) known as the father of econometrics, organised a special team at the Cowles Commission by inviting luminaries such as Tjalling Koopmans, Kenneth Arrow, Trygve Haavelmo, T.W. Anderson, Lawrence R. Klein, G. Debreu, Leonid Hurwitz, Harry Markowitz, and Franco Modigliani.

Challen and Hagger (1983) classify five varieties of MEMs in the literature: the KK (Keynes-Klein) model, the PB (Phillips-Bergstrom) model, the WJ (Walras-Johansen) model, the WL (Walras-Leontief) model, and finally the MS (Muth-Sargent) model.

Valadkhani (2005) reports that the KK model is mainly used by model builders in developing countries to explain the Keynesian demand-oriented model of macroeconomic fluctuations. They deal with the problems of short-run instability of

output and employment using mainly stabilization policies. The basic Keynesian model has been criticised as it does not consider the supply side and the incorporation of production relations. Furthermore, this modelling approach does not adequately capture the role of the money market, relative prices and expectations. As a response to the shortcomings associated with the KK model, the St Louis model is constructed by the monetarist critics famous work is by Anderson and Carlson (1970) in order to highlight the undeniable impacts of money on the real variables in the economy.

Philips (1954, 1957) give the second type of MEMs based on the literature when he combines both the Neoclassical and Keynesian theories within a demand oriented and dynamic model. He uses difference or differential equations to estimate stochastic structural parameters. These type of models are found very useful and applicable for large scale models. A continuous time framework is used to evaluate the asymptotic properties and the steady state of the model. These type are known as Philip-Bergstrom (P-B) model in economic literature.

The Walras-Johansen (W-J) model developed by – is a multi-sector model. These models disaggregate the total economy into various interdependent and overlapping markets. Each market is supposed to attain equilibrium state by the profit maximising actions of consumers in competitive markets. This approach has similarity with input-output approach because it incorporates different quarters are linked together via their sales and purchases from each other. But this approach uses logarithmic differentiation and equations are observed highly non-linear, opposite to Input-output approach.

The fourth type of MEMs, known as the Walras-Leontief (W-L) model, has been widely considered as the more relevant MEM for developing countries (Challen and Hagger, 1983). The WL model incorporates an IO table into the Walrasian

general equilibrium system, enabling analysts to obtain the sectoral output, value added or employment given the values of the sectoral or aggregate final demand components.

Finally, the foundations of the Muth-Sargent (M-S) model are based on the evolution of the theory of rational expectations. The MS model is similar to the KK model in that they both are dynamic, non-linear, stochastic and discrete. But in this model the formation of expectations is no longer a function of previous values of dependent variables. The forward looking expectation variables can be obtained only through solving the complete model. The New Classical School demonstrated the role of the supply side and expectations in a MEM with the aim of highlighting the inadequacy of demand management policies. To this end, Sargent (1976) formulated forward-looking variants of this model which suggest no trade-off between inflation and unemployment in the short term, which is in sharp contrast to both the Keynesian and Monetarist modelling perspectives. The subsequent advances in the WJ and WL models resulted in the formulation of the Neoclassical CGE models which are based on the optimising behaviour of economic agents. CGE models are used to conduct policy analysis on resource economics, international trade, efficient sectoral production and income distribution.

In the following lines a survey of macroeconomic models in some selected developed and developing countries is given;

Gurara (2013) develop a macroeconometric model for Rwandan economy. He applies a sophisticated method among MEMs known as error correction mechanism to capture long-run as well as short-run behavior of the economy. He finds this approach very fruitful to picture a growing economy slowly and smoothly. What he finds are very close to the actual performance and trend of the Rwandan economy's

key variable. He reports that Rwanda is enjoying a macroeconomic steadiness and stability for the last two decades. The economy observes a satisfactorily high growth rates in economic activity, single digit rate of inflation that economist feel good for steady state pace of economic growth. These are the relative gains for the long-run policy. International assets believed to be at comfortable levels. The economic growth rate is 7.43 percent/per annum on the average, during the period 2000-2011. The economic gauge that is the growth in the real per capita income is about 4.72 percent/per annum. All above there is no framework in government bodies for macroeconomic policy analysis and evaluation through empirical examination and statistical analyses. It is argued that the deficiency of such contextual framework would make policy analysis difficult when the effects of proposed policies are not manageable by simple perceptive reasoning alone. After this strive by the author the gap is covered and a rational macroeconometric model is shaped for policy making and evaluation.

Khan and Din (2011) develop a brief macroeconomic model for the aggregate economy of Pakistan. This structural model is a dynamic macroeconomic relation for total economy. The study aims to observe main macro factors of the economy such as investment, consumption, money, expenditure, Prices, rate of interest, Imports and exports. 21 equations in the model were explained, of which 8 were identities and 13 were behavioral or stochastic equations. To develop the long run and short run resistance and elasticity for the time series ranged from FY1972 to FY2009 the cointegration procedure developed by Engle and Granger (1976) was used. The long run estimated economic parameters were focused to achieve replication statistics to define the capability of the model. Historic facts and performance of main factors of macro economy, indicated that the majority of macroeconomic variables followed a

growing drift over the period of simulation that is 2009 to 2013. Two distinguishing features of the model that point to significant influences to the field of applied literature of macroeconomic behavior in Pakistan are; at first , many macroeconomic models depend on Keynesian context this school of economic thought focuses only on the demand sector of the aggregate economy while for Pakistan the major problem is supply side restriction. At second, authors determine that an economy with supply side problems the inflation may create hurdles in economic growth instead of reduction in unemployment because with this policy public expenditure are increased to stimulate and excite actual demand.

Rahman and Khatoon (2011) describes a macroeconometric model of the Bangladesh econ- omy using annual time series data from FY-1980 to FY-2006. The model is constructed with seven macroeconomic blocks, consumption, investment, production, government, trade, money, and price, capturing transmission among blocks. Structural equations under each block are estimated using short-run error correction model, where long-run equations into error correction terms represent economic theory. Hendry's general to a specific procedure is followed to get final short-run error correction equations. Validity of the model is checked both within the sample and out of sample cases. Results from validity study mark that the model is reasonably useful for forecasting and policy analysis.

Benedictove (2008) give the model of the US economy is made with the intention to operate it with FRISBEE, a model of the international oil market. The aim is to facilitate simulation of interaction between the international oil market and the surrounding macro environment – where the US model is supposed to be one among several models covering the major regions of the world economy - both for forecasting purposes and to be able to compare different historical (counterfactual)

and future scenarios. Other macro models are developed or under development for the same purpose. The oil market is of importance for macroeconomic developments and vice versa, and a unified model framework should therefore be a useful contribution to understand relationships between the different markets and regions. Independent of FRISBEE, the US model makes possible analyses of, among other things, effects of changes in interest rates, government expenditure, international demand and prices – including the oil price – on the US economy. The model can also be used for forecasting purposes. The estimated equations satisfy standard statistical tests of residual properties and parameter stability. The model is evaluated by simulating the model and comparing with historical data. Most variables are explained fairly well by the model. However, exports and the unemployment rate fit historical data relatively poorly, and therefore cause some concern.

External Shocks in Indian economy were analyzed with the help of a structural-small-scale model of quarterly macroeconomic time-series data by Bhanumurthy and Kumawat (2009). They argued that although many structural macroeconomic models had been formulated and assessed for India but the in fact all those were constructed on annual time-series data. This gap limit their practicality and usefulness for medium and short term policy investigations, mainly in instable and volatile time-spans. Therefore they tried to build up, using quarterly data, a short term macroeconomic relation for Indian economy. The presented model has rationally better in evaluating in-sample performance. One significant feature of their blend of model was use of quadratic type mathematical relation between private sector credit and government expenditure which noticed the presence of both crowding in and crowding out properties, the former is dominated by the later one when very high expenditures were observed. For precise estimation purposes few

simulations were also conceded out to examine the influence of current external sever shocks such as global financial meltdown and alarming rise in global fuel and food prices, on the economy of India. The outcomes exposed that the current go-slow in the economic growth of India precedes the worldwide price shocks and the worldwide financial calamity. The worldwide economic progresses only added a economic slowdown and delay in the economic divergence recovery.

A quarterly macroeconomic relational model for the economy of people republic of China was developed by Due-Qin (2006). The model comprised investment, trade balance, household consumption, government revenue, production, monetary effects, prices employment sectors of the national economy. Correction of equilibrium-form strategy was practiced for all interactive stochastic equations. A general to specific and simple active dynamic description approach was implemented. The model was the finest combination of standard long run economic theories, country definite and institutional-specific structures and short run economic dynamics in time series data for India. It is really a model framework to picture such a huge and diversified economy like India.

Bhanumurthy and Kumawat (2009) build up a short-term macroeconometric model for India using quarterly data. Though a large number of structural macroeconometric models have been estimated for India, the fact that all these are based on annual data limit their usefulness for short-term policy analysis, particularly in volatile periods of the type seen during last few quarters.The model has reasonably good in-sample performance. One important feature of the model is use of quadratic relation between government expenditure and credit to private sector, which shows presence of both crowding in and crowding out effects, the latter dominating the former when expenditure is high enough. Some simulations are also carried out to

analyse the impact of recent external shocks such as rise in global food and fuel prices and the global financial meltdown, on the Indian economy. The results show that the current slowdown in India's growth predates the global price shock and the global financial crisis, and is more of a regular cyclical downturn. The global developments only further deepen the slowdown and prolong the recovery.

Jonse and Rica (2007) presented a macroeconomic model for analyzing and forecasting the effects of external shocks to the collective economies of Central America and the Dominican Republic. The approach adopted is Keynesian and emphasizes modeling the real sector of the economy. The model is demand oriented without constraints on the domestically produced supply. It draws on the analytical techniques of cointegration and error correction. Based on assumptions and on data associated with the model's exogenous variables, it projects a slowdown in the region's economic growth for 2007 and 2008. Considering the principal elements of consumer prices in the region, it projects decreasing inflation in 2007 and a slight uptick in 2008.

Schneider *et al.* (2007) used the technique developed in Garratt, et al. (2000) to shape a structural economic macro model for the national economy of Germany with a theoretically coherent and transparent underpinning. Their modeling tactics contains a set of long run structural associations advocated by the conventional economic theory and an unrestricted vector autoregressive econometric model. It cracks out that they can restructure the assembly of the model in Garratt et al. (2003b) for German economic data. Five long run relations including purchasing power parity (PPP), production function, UIP, real money balances and trade balance describe the equilibrium economic state of Germany as an open economy in their structural economic model.

Tanuwidjaja and Choy (2007) developed small-scale macroeconomic model (SSMM) of a forward-looking nature that captures the dynamics of the Indonesian economy. The model was designed to carry out policy analysis and to analyse the effects of policy shocks on the Indonesia economy. Batini and Haldane (1999) model was employed as theoretical underpinnings. Based on this Indonesian SSMM, the study conducted deterministic and stochastic econometric simulation exercises to capture the essence of monetary policy transmission mechanism in the economy. The study specifically examined the role of the central bank's credibility in ensuring the achievement of the inflation target. The findings from the study showed the absence of credibility for the Bank of Indonesia.

Matlanyane (2005) identified 6 major macroeconomic models in Lesotho; 3 of which were used by the Central Bank of Lesotho. A prevalent feature of the models, according to Matlanyane, is their focus on specific areas of the economy, with the monetary sector and monetary policy forming the crux of two of the central bank's models. Some of the major shortcomings of macroeconometric models built in Lesotho were their obsoleteness due to the non-availability of high frequency data, and hence their failure in policy analysis and forecasting; the inadequate recognition of the critical role of the supply side of the economy in their models; the high aggregation and the inability of the models to forecast key economic variables like unemployment rates and others. The Central Bank of Lesotho used two models that mirror the economy. The first was the core framework used by the IMF in the implementation of the country's stabilisation programme, constructed by the Central Bank in conjunction with the IMF following the Polak (1997) model. The model consisted of four endogenous and three exogenous variables namely money stock, nominal income, imports of goods and services, net foreign assets, exports of goods

and services, net capital inflows and net domestic credit. While two of the equations were identities, others related money stock to incomes and imports. These models were used to derive the reduced form of equations. Though the models had several advantages, they were, however, not without limitations, especially the disregard of the real sector of the economy.

In developing countries the model construction has also a comparatively long historical background. Narasimham (1956) constructed the foremost macro-econometric model for Indian economy. In late sixties Economic Cooperation for Asia and Pacific (ECAFE) and then a complex econometric model in early seventies by United Nations Commission for Trade and (UNCTAD) were developed for the poor nations. It was a sequence of macro-econometric models for more than forty poor nations under the supervision of Tinbergen with the aim of predicting the external capital requirements of poor countries (Valadkhani, 2004).

Garrot *et al.* (2003) develop a new modelling strategy for the economy of United Kingdom that provides a practical approach to incorporating long-run structural relationships suggested by economic theory. They use an unrestricted VAR model to construct a small quarterly macroeconometric model of the UK, estimated over 1965ql-1999q4 in nine variables: domestic and foreign outputs, prices and interest rates, oil prices, the nominal effective exchange rate, and real money balances. The aim is to develop a model with a transparent and theoretically coherent foundation. Tests of restrictions on the long-run relations of the model are presented. The dynamic properties of the model are discussed and monetary policy shocks identified.

Different attempts were made to design macroeconomic models for South

Africa. Between 1972 and 1994, 75 studies were conducted. Of these 33 reflected the monetary sector. Most of them made use of quarterly data, while the methodology adopted in these models ranged from Computable General Equilibrium (CGE), Revised Minimum Standard Model (RMSM), and FPS (IMF). The study conducted by De Wet et al (1994) appeared to be the most relevant for a developing economy, like Nigeria, for three reasons: firstly, they incorporated the monetary sector into their models; secondly, they employed high frequency data (quarterly time series data), which had made the application to monetary policy relevant; and lastly, the study reflected the reform programmes in South Africa.

It has been suggested by Valadkhani (2004) that econometricians should have an adequate know-how of economic and estimation theories and methodology, before they work on econometric modeling. This "know-how" supports model-builders to evaluate and combine the theory of economics, econometrics and statistical data to obtain a parsimonious mathematical relation for macroeconomic factors. He also reported that obstacles in the economic development of the developing countries are due to supply constraints. The implementation of an Input-Output table is very important where transitional burdens among several sectors of the aggregate economy are of a great size. In fact the supply side has not been neglected in an Input-Output table criterion in developing a macroeconomic model. This method helps in incorporating equally final and intermediate demands for capital possessions and other elements of production.

Valadkhani (2004) recommended, while constructing reasonable macro-econometric models for developing countries, that attention should be given to two main economic matters: the first narrates to the financial segment that it should be modeled, the second point concerns how investment equations should be modeled.

It has been observed that rate of interest is not always a suitable adaptable variable to linkage the financial sector to real sector. It is suggested that the use of some other variables as proxies like output, banking credit or inflation is useful. He argued that in a macro-econometric model for an under developing or developing country considerable care should be given to investment and on capital formation because these two have a vigorous impact on both the demand and supply sides.

Deibold (1998) reports that the most important contribution of Box and Jenkins, however, is their sweeping vision, articulation, and illustration of an operational framework for applied nonstructural forecasting, consisting of iterative cycles of model formulation, estimation, diagnostic checking, and forecasting. Autoregressive moving average (ARMA) models are the centerpiece of the Box-Jenkins framework. ARMA models are combinations of the autoregressive and moving average models of Slutsky and Yule, and they have the potential to approximate dynamics more parsimoniously than purely autoregressive or moving average models.

2.3 Regional Studies

Klein (1989), a strong advocate for macroeconometric modelling for policy formulation and analyses, advises macromodelling at regional or sub-national level. He says that regional modelling may be less ambitious than at the state level. Models by census regions, federal reserve districts, or some smaller groupings are also useful, but state and municipal model building has been successfully carried out, and much more will be done along these lines. Studies of individual regions as partial systems are not especially difficult, and that kind of econometric research will continue to flourish but the attempts to build the whole from the parts is very fundamental and

poses many challenges for econometricians not the least of which is the development of a suitable data base.

According to Sun (2013) China experienced fast economic progress during last thirty years with 35 times more per capita GDP in 2011 than of 1978. It experienced, during three decades, about 9 percent average growth rate. Seven coastal regions become the entire leaders of this economic development with average progress figure of 11%. A quicker glance at the provincial economic growth by different time spans reveals that inland regions of western side are steadily exceeding coastal provinces to primly lead the current economic evolution. The situation differs in time period from 1980 to 1990 at that time coastal regions get benefits of their greater positions and favored economic policies beneath strategies of the openness to attain reckless growth. While interior provinces got evolutions from planning through center to market economy by which it attained a growing rates of about 7%.

Démurger *et al.* (2002) observed that the primary sources of economic development in China differed significantly across sub periods as an outcome of main shifts in the economic policy regimes. The first phase of market reforms by the Chinese government during the period 1978 to 1984, the disassembling of the communes and the limited liberalization of food production gave an overall increase to main food producing provinces. International trade became the key factor for the growth of economy in the late 1980's, and the coastline provinces outperformed the interior regions. Indian economic growth is also greatly affected by policy regimes. International trade performed only a slight role in the state planning era up to 1991 while state investment plans greatly affected industrialization, which struggled at least slightly to stimulate the slowcoach states. The Green Mutiny steered to visible

increases in grain productivity in states such as Haryana and Punjab, which introduced amazing yield grain crops to India.

Regional accounts necessitate the use of uniform conceptions, classification and definitions in statistical arrangements and formation of accounting agreements for local income investigation. A provincial accounts context has also to be adapted to the structure, conditions and requirements of a specific province, i.e., the size of the region, the extent of devolution of power and functions, etc. The system of accounting can be sort from systems based on single gauges of the smooth of activity, i.e. provincial product, to more comprehensive and multifaceted systems based on numerous alliances of economic factors with different combinations of economic purposes. The elementary motive in any system is to achieve provincial allocations of national economic aggregates. This necessitates distribution quantities that can be used for division the constituents of the national total accounts by province or, in other words, decentralize the national total accounts. The query also arises here as to what objects of expenditure and national income are to be debited or credited to the province's sub-account. One standard in this deference is to account as receipts of the province all drifts flows founding the national earnings coming from the province and to account as expenditures of the province all flows founding the national total expenditures profiting the province. Most suggestively and significantly the estimating technique or process has to come to relations with the availability of rich time series economic data. To do so the economic decision bodies have two choices: effort for a conceptually comprehensive and sound description of the economic variable used for regionalization at the price of roughly data availability or decide for decent economic data at the price of conceptual accuracy and precision. The second option would be a better measure of the erroneous variable (Bengali 1995).

Ikram (2009) reports that Pakistan have had traditionally followed a top-down approach for the analyses and evaluation of economic development. This strategy is so ingrained and unfruitful that the official authorities do not produce official statistics of Provincial Gross Domestic Productions (PGDP), investment and savings even after more than 60 years. The author argued that the separation of Pakistan in 1971 was in fact the issue income distribution between east and West Pakistan. The author tried to provide a frame work for thinking about the development of Pakistan's provinces. The author emphatically argues the growth of lagging regions can only be identified if the development of provinces is evaluated and studied. He uses bottom-up approach for the analyses of development in Pakistan.

Bengali and Sadaqat (1997) say that for a country the output of goods and services are recorded in the shape of national Income Accounts. For a country, these accounts are in fact a time series of main macroeconomic database for some specific period of time. As far as Pakistan is concerned these time series are compiled and published on annually basis. An aggregate for macro factor is the estimate aggregate of the output in different parts of the country. Here one thing is to be noted that regions or provinces do differ in their output and incomes, one province may have predominantly agro based economy the other primarily manufacturing and industry.

Jan and Choudhary (2011) study the regional imbalances through convergence framework as it was implied in Solow's growth model, a neo-classical economist. Authors stated the hypothesis of unconditional convergence for the provinces of Pakistan by assuming that the fundamental factors of economic progress and growth are same across the countries or regions (provinces) of the same country. According to author regions of the same country have identical determinants of long-run economic progress followed by Barro (1991) and Barro and Sala-i (2003) and

Coulombe and Lee (1991). They find no unconditional convergence across the provinces of Pakistan that reveals a heterogeneity in the economic determinants of the long-run economic growth.

Khan (2012) reports that the province KP is the third largest economy of the country. The province constituted by 25 districts work as local bodies. It is bordered by seven federally administered areas (FATA) governed as political identity governed by political agent recognized as agencies and a line of adjacent clamp of five frontier regions (FR) work under provincial governments. KP is mainly a mountainous province with large visible variations in the topography. The geographical distribution can be divided into three divisions: one is the Indus division of Hazara, second is the moderately narrow band between the hills and Indus valley, constitute the settled partitions of Mardan, Peshawar, Kohat, Dera Ismail Khan and Bannu and the third is the rugged and rough mountainous area that is situated between the Afghanistan border and these divisions this line is the longest boundary that Pakistan has with any neighboring country known as Durand line.

Allah Dad (2009) reports that the climatic and physical conditions of the province KP has a wide and varied range. Although it is located in a temperate zone but there is an immense variation in the climate from region to region within the province. Some areas lie in moon soon zone have heavy rains and face foods during moon soon season with an average annual rainfall of 58 inches and some face usual drought with an average rainfall of 25 inches. In the Chitral division and valleys of Kaghan and Naran feels heavy snowfall during winter season. Large clamp of glacier is a feature blatantly occurs in this naturally blessed landscape. Chitral is cut down by snow from the rest of the world for maximum time of the winter. Similarly the divisions Hazara and Dir (upper and lower) are observed among the wettest seats in

throughout Pakistan. The southern region of the province is covered by the hilly series of Hindu Kush and Himalayas. In summer with an unbearable high temperature these foothills has a dry and hot climate. This area is both drier and generally warmer than the rest of the province. KP is a hilly area with steep region intermixed with southern dry plains and fertile green valleys of Sawabi, Mardan, Charsadda and Peshawar in the center.

In the market restructuring period in 1990s, international trade and market forces performed a greater role in economic progression of India. After 1991 the coastal provinces in China have an advantage over the interior provinces because they face much lower businesses costs in contributing in global investment and trade. Many profound studies were performed in early 1990s for high-income market economies like Japan, USA and counties within Western Europe. These studies observed sign for durable convergence in income among different areas. Little indication of equivalent convergence among Indian states were found similar to the findings for China. Geographical differences across states of India and China seems to slow or block the income convergence (Sachs *et al.*,2002).

For the first time Bengali (1995) made a pioneering effort for the construction of PGDP's for the four provinces of Pakistan. And this effort was extended in Bengali and Sadaqat (2006). After that a series of strives were made by different renowned economic researchers including Ikram (2009), Jamal and Amir (2003) and Jamal and Khan (2003) for the analyses of provincial development Issues. Social Policy and Development Centre (SPDC) a National research institution issued reports on sub-national level economic development issues that includes SDPC (2001) and SDCP (2004).

International organizations also worked with the collaboration of local bodies for example World Bank (2005a, 2005b, 2007a, 2007b), Asian Development Bank (2005) and UNDP (2003). The Department of International Development of United Kingdom (UK) prepared reports with the provincial governments represent an important step in analyzing critical issues regarding national economic variables and recommended national policies. However at times the non-availability of survey data urges the unofficial estimates to rely on some assumed relationship between different variables. Data for some key economic indicators such as public and private investment at provincial level or sub-national level and provincial savings could not be calculated According to the researcher between 1980-81 and 2004-05 the per capita income of Pakistan is estimated to have grown at annual average rate of 2.6 percent. The growth rates for the provinces are: the Punjab 2.8, Sindh and Khyber Pakhtunkhwa 2.3 and Baluchistan 2.1 percent per annum each. Over the three decades from 1972-73, the structure of the provincial GDP's changed. The broad movement was towards a relative reduction in the share of agriculture and an increase in the share of value-added contributed by manufacturing and services. The change was more pronounced in Sindh and the least in Baluchistan. The cumulative effect of GDP growth, population growth and structural changes in the economy created significant differences in the per capita incomes of the provinces. According the World Bank Atlas methodology GDP per capita in 2004 amounted to $600 for Pakistan, $410 for Baluchistan, $480 for KP, $580 for Punjab and $760 for Sindh. The high value of per capita income for Sindh is much of due to the contribution of Karachi (Ikram, 2009).

In Pakistan services sector share is gradually increasing as compared to other sectors of the economy over the study period. In fact, the rate of growth of this sector is higher than the rate of growth of manufacturing and agriculture sectors. More than

50% of the national GDP has covered by services sector and a little over 30% of total employment. The sector has resilient and important linkages with other sectors of economy; it delivers essential and vital inputs to industrial and agriculture sector. Authors analyse the importance and increasing structural transformation of services sector in the national economy and healthier understanding about the services sector of Pakistan. They also discover the relative recital and performance of the sector and its influence in the growth of the trade, employment generation and economic growth. Services sector contributes the major share in the economic activity of Pakistan. For the last four decades, the structure and construction of the economy has experienced noteworthy and meaningful changes. The good sector indications reveal a visible share of agriculture has been decreasing slowly and gradually over time from 44% in 1960 to 21% of gross domestic product in 2010, and share of manufacturing has increased from 16% 1960 to 25% of GDP in 2010. Whereas the services sector share observes an increase from 40% of GDP in 1960 to 53% of GDP in 2010. Hence, service sector is the main and productive contributor in the Pakistan's GDP. The sector got growth very fast and visible part in the economy from 1975b to 2010. The rate of growth in service sector is 5.5% .While the goods sector is growing with a rate about 5% percent and manufacturing sector is 5.7% which is still more than services sector (Ahmad and Ahsan, 2011).

Jalil (2011) observes the causes of manufacturing sector backwardness in Pakistan. She claims that these causes are complex and varied in nature. The Government has been trying its best to develop industrial sector since 1947 and substructure facilities for the better growth of industries yet it has not attained achievement to the wanted extent. During last three decades since 1980 the main problems which have decelerated and slowed industrial growth in Pakistan are lack of

financial and physical capital, political instability, limited market, less skilled labor and underutilization of labor's potential, transportation and communication , technical knowledge, economic restrictions, energy crisis, lack of modern technology, strong and determined neighboring competitors, high rate of interest and low foreign investment.

Hussain and Rana (2009) find that public revenue through income tax is a gauge of provincial growth in Pakistan. They find a dramatic trends provinces between 1992 to 2006. They argue that this period was a regime of economic change. Political governments, although with immature suspensions time of their usual period of 5 years, try their best to strengthen the public bodies and government departments. The model developed by the authors estimates the effect of growth in income tax revenue upon the Gross Regional Product. According the findings province Punjab appears with a faster economically growing province during the decade.

As of economic review of year 2009, province Baluchistan is the smallest share to national GDP with 3% of the share and province Punjab is the leading economy contributing about 57% to the GDP OF Pakistan, tracked by province Sindh with the share of 27.5%. The province Khyber Pakhtunkhwa has less share of 8% as compared with historical average of 11%. The capital city, Islamabad, adds about 1% while the untrustworthy numeral for FATA is rate roughly 1.5% of the National GDP (Burki, 2010).

The essay by Chen and Feng (2000) inspect the causes of cross provincial disparities of economic progress in China. A statistical investigation of economic time series data for 29 provinces, autonomous areas and cities from 1978 through 1989 ratifies the results in the theoretical economic literature of empirically observed research studies of economic development. This important research uncovers some

physical appearance unique to China. They discover that semi private and private enterprises, international cross-border trade and higher education all principally lead to an upsurge in economic development in China. The high rate of inflation, high rate of fertility and the existence of state owned enterprises (SOE) lessen rates of economic growth among different provinces, have geographical differences. Finally, evidence shows that for China the well-known hypothesis of economic convergence holds. For the period of observation marketization is found to be the main reason of open period and the Reform.

It is evident from the studies of Gurara (2013), Khan and Din (2011), Buhn and Schneider (2008) etc that importance of data is unavoidable for effective planning, formulation of policies, planes execution of programs, monitoring of projects and its impact evaluation, etc. Without valid information, efficient analysis and precise inferences are not possible. To construct and compute relevant indicators for assessing and diagnosing the real situation of economic progress one requires valid and rich data.

Bodkin (1991) point out that in model structuring three noticeable facts should be focused. First; cyclical shifts that occur in the economy due to economic and business cycles. It is observed that they are occasional but linearity is the finest assessment of a system of relational structural equations. At second, an ideal, comprehensive and complete model should grip three sub models including input-output, flow of capital and national income. At third, a frequent transitional alteration from theoretical principles to practical stipulations is inevitable in macroeconometric model building. It is to gain theoretically reliable results and healthier estimations. The severe problems in emerging economies such as budget and trade shortfalls, high

inflation and huge debt loads did appeal a number of developing countries to path their economies and policies by using macro-econometric models.

According to Bardsen and Nymoen (2008) trend in economic time series takes dissimilar forms, with different suggestions for macroeconomic forecasting, modeling and inferencing. A trend or mathematically speaking a unit roots occurs in a process due to structural pauses and breaks. They verified and established that macroeconomic models can be established empirically and theoretically that are consistent and reliable with a unit root postulation. At the modeling, assessment and stage of estimation , non-stationarity due to unit roots can be controlled by method of cointegration. On the dissimilar way, for example, for linear combinations and rate of growth can be corrected through unit root assumption that can help in focused on probable functions of the like variables.

Granger and Newbold (1974) found that a misspecified regression is a result if the equation is found to have toughly time-correlated errors concerning economic time series. This phenomenon can be mathematically judged through the statistic value of a low Durbin-Watson value. Here one thing is important to note that in the situation whatever the value of R^2 observed but mislead the researcher.

A very valued addition is edited to the applied theory of economics by Inder (1993) in economic model building. He argues that by comparing different assessment and statistical methodologies economist can pursue the effects of economic policies and to capture the economic shocks. He further adds that the economists do require a precise estimator or analytical tool for the parameters and a grasping procedure for analyzing a theory which is consistent and strongly reliable in modeling long-run relationships between cointegrated variables of order one. The author advises it is imprudent to practice ordinary least square (OLS) regression if

there is slightly prospect that the factual association includes lagged quantities of the variables, The substitute sponsored in the study includes using the unrestricted error correction mechanism (ECM) estimates. The evident sign proposes that this method provides exact estimates and nearest values of t-statistics, and it is found even in the regressors of endogenous type economic factors. By using the instrumental variables the economic parameters of long run relationship and their statistically precise standard errors can be assessed.

2.4 Macroeconomic Theoretical Underpinnings

In neoclassical growth models, such as Solow (1956), Cass (1965), and Koopmans (1965), a country's per capita growth rate tends to be inversely related to its starting level of income per person. In particular, if countries are similar with respect to structural parameters for preferences and technology, then poor countries tend to grow faster than rich countries. Thus, there is a force that promotes convergence in levels of per capita income across countries. The main element behind the convergence result in neoclassical growth models is diminishing returns to reproducible capital. Poor countries, with low ratios of capital to labor, have high marginal products of capital and thereby tend to grow at high rates.' This tendency for low-income countries to grow at high rates is reinforced in extensions of the neoclassical models that allow for international mobility of capital and technology.

Becker *et al.*(1990) assume that the rate of return on human capital increases over some range, an effect that could arise because of the spillover benefits from human capital that Lucas [19881 stresses. As an example, the return to some kinds of ability, such as talent in communications, is higher if other people are also more able. In this setting, increases in the quantity of human capital per person tend to lead to higher rates of investment in human and physical capital, and hence, to higher per

capita growth. A supporting force is that more human capital per person reduces fertility rates, because human capital is more productive in producing goods and additional human capital rather than more children. In growth models with endogenous fertility, such as Barro and Becker (I989) and Becker *et al.* (1990), per capita growth and net fertility tend to move inversely.

Immervoll (2000), Samimi and Jamshidbaygi (2011), Samimi *et al.* (2012), Tafti (2012) had used CPI values as a measure of inflation. There are certainly some indices used to measure inflation in Pakistan are CPI, WPI, SPI, and the GDP deflator. The more commonly adopted measure is Consumer Price Index (CPI) which covers major portion of the items (375 items) with their retail prices while estimating the cost of living in the urban areas. The researcher here preferred to use CPI as an inflation measure to analyze a relative change in taxes. Victor (1996) and Gerald & Carroll 1999) state three effects that inflation may have on real tax liability and requires understandings for an adjustment are erosion of amounts expressed in national currency, erosion of the value of tax obligations, and other effects on the measurement of the tax base. The techniques for compensating for each of these effects are different. All, some, or none of these may apply to a particular tax. An ad valorem excise tax is said to be an example which implies no consideration for or not affected from above three affects because of immediate collection. Therefore it requires no adjustment for inflation. On contrary, income tax is noticeably complicated for the effects of inflation in terms of all three effects are present.

Khan and Din (2011) observe that labour force engaged in agriculture and industrial sector, infrastructure and water availability play a major role in the long-run as well as short-run productivity in agriculture sector. They find a negative impact by credit disbursed to agro-sector in the long-run which is due to misuse and

misallocation of the agro-credit. In short-run agro-credit has positive and significant impact. For industrial sector capital stock is found insignificant and nonproductive. Industrial credit influence the manufacturing value added negatively and significantly both in long and short runs.

Mallik and Chowdhury (2001) examined the liaison association between growth in gross domestic product and rate of inflation for four economically important countries of South Asia including Pakistan, Bangladesh, Sri Lanka and India. An evolutional comparison of empirical indications was observed from the two-stage econometric process of error correction mechanism and cointegration using annual data collected from International Financial Statistics of the international monetary fund (IMF). The researchers found indication of a strong positive and long run association between two economic factors understudied. There were also noteworthy responses between regional economic growth and rate of inflation. These outcomes have significant economic policy inferences. It is concluded that moderate inflationary policy is supportive for economic stable growth, but quicker economic progression suckles back into high inflation. Thus according to the study these countries are on a crux of economic problem .

The contribution of the services sector has a major share in the macroeconomic movement of the Pakistan economy for last four or five decades. The constructional structure of the economy of Pakistan has seen important variations over the previous few decades since 1980. The share of agriculture sector in the production block of Pakistan has been falling progressively over time from 44% in 1960 to 22% of GDP during the year 2010, stake of manufacturing has improved up to 25 % during 2010 from 16% during 1960. A salient change is increase is observed for services sector with 39% of GDP in 1960 to 53% of GDP in 2010, therefore this

sector of the economy is principally contributing in the GDP of Pakistan, and this fashion is observed for many agrarian economies including China, India and Australia. As far as Pakistani economy concerns, it has experienced single stage conversion, i.e. from agrarian to the sector of services. The growth of the services sector occurred very speedily, during last four decades from 1975 to 2010. The national economic survey reported about 5.5% rate of growth in service sector, which is quite noticeable. While the rate of growth manufacturing sector is just 5% but the same is 5.8% for industrial sector which is satisfactorily high (Ahmad and Ahsan, 2011).

The monetary policy has a general effect on aggregate economy and particular for inflation. That's why all over the world central banks always like to recognize the impacts of changes in the monetarist strategy. Occasionally subjective approach is used to derive these forecasts if they find no sound procedure for forecasts of monetary policy impacts. The derived function for the Consumption side of demand sector shows a positive dependence of current consumption on existing income, the opportunity cost of consumption has an opposite impacts , directly related to broad money which is used as the proxy of 'financial wealth'. The accomplishment of active dynamic macroeconomic model for the economy of United States of America urged the curiosity of the federal reserves (FedRes) and central banks of advanced countries in late 1960s to advance large scale macroeconomic relational, structural, computable and simultaneous type models for policy construction and implication. However, the operational experiences of advanced economies about the practicality of large-scale macroeconomic models in policy construction moved the stress to small and medium scale structural and computable models. Investment is the second mutually exclusive component of aggregate demand

and it is the key factor for obtaining and sustaining stable and positive economic growth. Private sector investment is an important economic growth accelerator because although public investment provides infrastructure facilities and has a strong role in economic and social activities, hence public sector investment should induct private sector investment (Hanif *et a.*, 2008).

Investment is an important factor of growth. According to Khan and Din (2011) and Jongwanich and Kohpaiboon (2008), availability of credit to private sector is another important determinant of private investment and influences the investment behaviour positively. Jongwanich and Kohpaiboon (2008) further add that government investment is included in the model specification of investment to capture the 'crowding-out' or 'crowding-in' effects. Following McKinnon (1973) and Shaw (1973), Khan and Khan (2007) argue that interest rate could exert positive impact on the level of investment because real interest rate could increase savings, which led to increase investment. The accelerator theory suggests that as income increases, investment is also increases. Therefore, real income is included to capture the effect of accelerator principle. The real interest rate is another important variable determining the level of private investment. The neoclassical theory predicts negative relationship between interest rate and investment. However,. Furthermore, interest rate can also be used as a measure of cost of borrowings that may affect the cost of capital and debt-equity ratio [Guru-Gharsns (2000)]. It also provides a link between real and monetary sectors [Guru-Gharsns (2000)]. Furthermore, government investment, which concentrates mostly on infrastructure, exerts an important influence on private investment. It is often suggested that government investment complements private investment instead of crowding-out in developing countries (Hossain and Razzaque, 2003).

The specification of real private consumption function is based on an optimising model of life -cycle behaviour. The main variables explaining the real private consumption are the real disposable income and real interest rate [Tjipe, *et al.* (2004)]. To capture the wealth effect, real money balances is included in the real private consumption function (Khan and din, 2011 ; Rehman and Khatoon, 2011; Elliott *et al.*, 1986, Rashid, 1981 and Rankaduwa, *et al.* (1995)]. While explain the driver of public consumption Khan and Din (2011) and Haneef *et al.* (2008) The real government consumption depends on the development expenditure relative to GDP, government revenues and inflation.

Kuznuts (1957) and Fuchs (1980) observe that shifting the population or structure changes from agriculture to manufacturing and from manufacturing to services in the course of economic development. Kongsamut *et al.* (2001) estimates for 123 countries from 1970-80 that with increase in services raises the per capita GDP of these economies. These economies move from agriculture sector to more in services sector and less in industrial sector. Rath, *et al.* (2006) analyses that higher growth in services sector leads to India's economic growth. They argue that service sector not only provides more job opportunities but also is widening the tax base and the buoyancy of taxes. Ahmad and Ahsan (2011) reports that in Pakistan the shares of services are increasing in all sectors of economy over the period of last three decades. In fact, the growth rate of services sector is higher than the growth rate of agriculture and industrial sector. Services sector accounts for 54 percent of GDP and little over one-third of total employment. Services sector has strong linkages with other sectors of economy; it provides essential inputs to agriculture sector and manufacturing sector. The objective of this paper is to analyse the importance of services sector in an economy and better understanding about Pakistan services sector. The study also

explores the relative performance of services sector and its contribution in the economic growth, trade and employment generation.

Chapter 3
DATA, METHODOLOGY AND THEORETICAL FRAMEWORK

3.1 Data

The methodology for estimation and the applicability of research has often seen with the available data. For the present study annual time-series data from fiscal year 1973-74 to 2013-14 are used. The construction of the variables and their details are described in *Appendix table-4 and Table-5*. All, except rate of interest, variables are in logarithm form and are shown in small italic case instead of capital case. The time-series data has been taken from different sources. Lists of all sources including international national and provincial departments for data collection and their publications are given in *Appendix Table-6* and *Table-7* respectively.

3.2 Estimation Methodology

The available data has worth importance in the estimation methodology and applicability of the predictions. Due to short time-series of 42 years, limited estimation methods are used. Engle-Granger two-step procedure is used in developing single equations for different economic relations.

Theil's inequality[1] coefficient (U) is used to check the model fit. The coefficient always lies between 0 and 1. Thiel's coefficient equals 0, one has a perfect fit; the closer to one, the worse the fit.

All equations are tested for serial correlation using the Lagrange Multiplier test. They are also tested for heteroscedasticity by White's heteroscedasticity test. If necessary, corrections are made.

[1] The description of the statistical technique is given in *appendix B*

Mean absolute percentage error (*MAPE*) are implemented to evaluate the performance of all estimated equations.

Recent applied work by Gurara (2013), Khan and Din (2011), Rahman and Khatoon (2011) reveals that the problem of non-stationarity persists in most of the macroeconomic time series. According to Rehman (2011) the presence or otherwise of unit root in a time series plays a very important role in determining statistical and economical properties of the economic time series. Study by Philips (1986) and Granger and Newbold (1974) indicate that spurious and misleading results may be obtained by ordinary least squares (OLS) method if two series have unit root processes, although the estimated constants are highly statistically significant.

Engle and Granger (1987) propose a two-step process for estimation of cointegration relationship: at first step, determine a static regression through ordinary least square estimation technique. For the estimated relation find the residuals, at second, stationarity test is employed to resulting residuals if one finds stationary residuals then it can be predicted good to have error correction model good to study long-run relation on equilibrium path.

Augmented Dickey-Fuller[2] t-statistics is applied to examine trend in a time-series, it tells us when to difference time series data. In our study we have all the three situations that can be faced in a time series modeling. All the three cases with formulated hypotheses and the testing procedure are discussed in *Appendix B section iii.* Here we have exponentially trended time-series so we take the log and then the series is differenced.

[2] The critical values for different level of significance are given *appendix A Table-8*

Granger (1986) gave 'representation theorem', the presence of linear cointegration can be characterized as an equation that is the error correction model (ECM). The short run and long run properties of the economic relations can be estimated at the same time through error correction mechanism. Now to represent the dynamicity of the economic variables we use ECM as bellow;

$$\Delta y_t = \alpha - \rho\, v_{t-1} + \sum_{i=1}^{n1} \beta i\, \Delta y_{t-i} + \sum_{i=1}^{n2} \gamma_i\, \Delta x_{t-i} + v_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (23)$$

Where x_t is a set of regressors and y_t is the regressand. The lag length of n_1 and n_2 will be chosen for which the Shewhart criterion or Akaike criterion has minimum value.

If the mechanism of error correction works then the value for long-run relational coefficient ρ will be negative and statistically important otherwise the correction to attain an equilibrium path will not be possible. The γ is the impact multipliers it will measure the direct influence that a variation in X_t will impose an adjustment in Y_t [Asterios *et.al* (2005)].

In the model we have narrated 18 equational relationships among which 6 are identities and rest are behavioral equations. This is sound acknowledged in topical theory that usually the macro time-series trended and behave non-stationarity. Philips *et al.* (1986) found that if two series follow a trend, increasing or decreasing, then OLS method gives spurious estimates for the unknowns even though the estimated constants are highly statistically noteworthy.

3.3 Specification of the Structural Model

This part of the study contains outline of hypothetical framework of the macroeconomic model. The present model includes both supply and demand sides of

the provincial economy. For the supply side stochastic functions constructed for three disaggregated sectors i.e. agriculture (primary), manufacturing (secondary) and services (territory) sectors. The resultant relational model mainly emphases on performance of consumption and investment for private and public sectors for the demand side. The third considered block is fiscal area of the provincial economy that includes stochastic relations developed for revenues through direct and indirect taxes and the public expenditure of the fiscal sector. The structural specification of each block is outlined in the following lines;

3.3.1 Supply Block

Gurara (2013), Khan and Din (2011), Akber (2011) and Rahman and Khatoon (2011) while describing the econometric models for Rwanda, Pakistan and Bangladesh, respectively, disaggregated the production sector into agricultural and non-agricultural sectors, in modeling the supply side. To have a thorough insight, here, the production block is partitioned into three segments (i) primary (agriculture) sector, (ii) secondary (manufacturing) sector, and (iii) territory (services) sector. At first, the structure of the provincial economy urges principally to select these sectors and secondly the data obtainability restraints have a significant role to select the certain sectors.

3.3.1.1 Agriculture Sector

Gurara (2013), Khan and Din (2011) and Rahman and Khatoon (2011) expect that the value added of the agriculture sector is regressed on labor power, capital (agriculture machinery including tractor, wheat threshers, rice husking machines, maize sheller and wheat harvester), quantity of fertilizer, credit disbursed to agro-sector, water availability, cultivated land area. Due to non-availability of data factors

that are not encompassed in the functional form of the model but may affect agricultural production, are good seed and insect pesticides, advance agricultural technology and seeds of good variety. Biological inputs and land are purchased using credit in Pakistan, so agricultural loans have importance in agro-output.

The impact of substructure like 'roads from market to farm' and 'the agriculture output effected by electricity' are important to consider. Khan and Din (2011) assume that organizational structure and water availability influence agriculture output meaningfully. In the present study we include the cultivated land ($LAND^a$) that is a totality of current follow and net area sown and amount of fertilizer (*FERT*). The concluding functional arrangement of the relation is given as;

$$Y^a = f(L^a, K^a, LAND^a, CRED^a, WAT^a, FERT, INFS^a) \ldots\ldots\ldots \quad \ldots\ldots\ldots\ldots\ldots (1)$$

It is the significance of the study that dummy variables are not used while proxy are very rare. Khan and Din (2011) uses the total cultivated area for Pakistan. In present study culturable waist is also included in agricultural land. In many studies available water for agriculture purposes is proxy by number of tube wells like Khan and Din (2011), in present study we take the canal water in its actual unit of description that is million acre feet (MAF) which is the biggest source of water in province as more than 78 percent of land is irrigated by canals. Agriculture Credit is an important production factor. Khan and Din (2011) say that this factor is proved to be insignificant at national level because people usually spend borrowed money on purposes other than agriculture. We consider only Zarai Taraqiati Bank Limited (ZTBL) which is the biggest source of credit disbursed to the agriculture sector in Pakistan. The province KP on the average takes about 5.8 percent annually from ZTBL. The production factor of infrastructure is proxy by road length. We included

A type and B type road lengths that is the black top concrete roads and cemented or paved roads in kilo meters.

3.3.1.2 Manufacturing Sector

Base for the manufacturing sector is the Cobb-Douglas Production function. Small-scale and large-scale industries are included in the study. Electricity, gas, construction, and export-processing industries are sub-sectors. Capital stock and labor force are also included in the manufacturing sector as important factors of production. Following Khan and Din (2011) besides labor (L) and capital (K) other factors such as , availability of infrastructure *(INFS)*, disbursed credit *(CRED)*, import of equipment and machinery *(MACH)* and raw material are expected to affect the production capacity of manufacturing area. Due to non-availability of data the regressor *MACH* is not included in the equation. The manufacturing area production function is formulated as:

$$Y^m = f(L^m, K^m, INFS, CRED^m, RAW^m) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

For the above behavioral relation it has been hypothesized that all the regressors have positive impact on manufacturing sector value added.

3.3.1.3 Services Sector

Share of services subdivision of the economy is increasing in Pakistan's economy over the period 1975 to 2010. The services sector growth rate is greater than the rate of growth in manufacture and agriculture value added. The services sectors financial proportion is more than 50% of gross domestic product and little over 33% of entire employ. There is a strong association between services sector and other segments of the national economy, in fact this factor of PGDP provides important and

crucial feedbacks to industrial and agriculture segments. This sector is extremely expanded that contains four key sectors in the economic set up of Pakistan that is; producer, distributer, social and personal services. Distributer sector is more divided into trade, transport and communication sectors [Ahmad and Ahsan (2011)].

All the disaggregated quarters of services sector are accomplished in real aggregate demand (RD^s). The value added of the services sector is taken as function of domestic absorption which is measured by real aggregate demand.

$$Y^s = f(RD^s) \quad \ldots\ldots (3)$$

Where Y^s *is the* value added by Services sector, RD^s is the real total demand. Here domestically given consumption is the total amount of public and private sector consumptions. So the sectorial value added by services sector is supposed to be explained by public and private consumptions and a ratio of investment to consumer price index (CPI) in the following function this ratio is presented by ' γ^s ' (Khan and Din, 2011).

Thus for services side the resultant behavioral functional form can be quantified bellow;

$$Y^s = f(CONS^p, CONS^g, \gamma^s) \quad \ldots\ldots (4)$$

While KPK has been an agrarian province, but because of urbanization the portion of agriculture employment is falling and part of the working community is trying to join other fields of opportunity in the economic set up for healthier and profitable jobs. The services portion deliver jobs varied in nature. These jobs include high skilled, semi-skilled and unskilled types [Ahmad and Ahsan (2011)].

According to Lord (2002) *GDP* is the amount of the value added of agriculture, manufacturing and the service area sectors.

$$GDP = Y^m + Y^a + Y^s \quad \ldots\ldots(5)$$

3.3.2 Aggregate Demand Block

According to, Gurara (2013), Khan and Din (2011), Rahman and Khatoon (2011) Hanif *et al.* (2008) , the collective demand for services and goods is the amount of 'domestic-absorption' and the ' balance of trade'. Now the definitional form of the national income as:

$$Y_t = CONS_t + INVS_t + EXP^g_t + (X_t - M_t) \quad \ldots\ldots(6)$$

Where consumption ($CONS_t$), investment ($INVS_t$) and government expenditures (EXP_t) are the constituents of the domestic absorption at year 't'. Whereas exports and imports of goods and services at time 't' are presented by X_t and M_t respectively

This relational equation is an identity. The consumption and investment are the sub-sectors of the aggregate demand.

3.3.2.1 Consumption Sub –block

There is a further decomposition of Consumption into Private and Public consumptions;

3.3.2.1.1 Private Consumption

According to Khan and Din (2011), Hanif et al (2008) and Tjipe et al. (2004) an optimizing model of life-cycle behavior is the basis for specification of real private consumption and the life-cycle behavior depends upon the real disposable income (Y^d) and real interest rate (r^l) which is obtained from weighted average lending rate and rate of inflation. To assess the wealth impact we include 'real money balances' M_2

definition. The resultant functional form of the real private consumption. The equation becomes;

$$CONS^P = f(Y^d, r^l, M2) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(7)}$$

Following Gurara (2013), Iqbal, et al (2012) and Khan and Din (2011) we define real disposable income as a ratio of disposable income to that of Consumer Price Index (CPI);

$$Y^d = [(PGDP + CRED^P + WREM) - (DTR + ITR)] / CPI \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(8)}$$

Where *DTR* denote revenues through direct taxes and *ITR* is the sum of revenues through indirect taxes. Credit to private sector $CRED^P$ this is the part of the economy which is run for private business profit and is not controlled by the state, it includes the majors sectors like Agriculture, Manufacturing etc. *and WREM* worker's remittances made by overseas workers *CPI* is consumer price index respectively. The purpose of inclusion of remittances made by overseas workers community is to observe the influence on the private consumption by this regressor.

Iqbal et al (2012) observe that private sector credit play a vital role in the development and growth of economy. They evaluate that increase in real gross domestic product has significantly defined by percent increase in private sector credit. The assumption of absolute-income tells us that real disposable income puts a direct impact on private consumption adjusted for inflation [Khan and Din (2011), Rahman and Khatoon (2011) and Odada *et al.* (2000)]. The permanent income hypothesis and life-cycle introduce inflation rate and real interest rate as an explanatory variables whose impacts are supposed to be positive on private consumption.

3.3.2.1.2 Government Consumption

The government consumption in real sense depends on the government tax revenues, ratio of development expenditure to PGDP and rate of inflation [Khan and Din (2011)].

$$CONS^g = f(REV, \beta, \pi_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Where $CONS^g$ is the Government Consumption, REV is the sum of Government Revenues, β is the Ratio of Development Expenditure to $PGDP$ and π_t is the rate of Inflation. It is assumed that all the right hand variables have a positive relation to real government consumption.

3.3.2.2 Investment Sub-block

It is an established fact that investment and economic growth have a positive and strong relationship but no consensus has been developed on the type of investment. Empirical studies have used various approaches to investigate the role of public investment in the process of economic growth. Using a production function approach, Ebert (1986), Costa, *et al.* (1987) and Deno (1988) find public investment to be a significant input in the production process and private and public investments to be complementary, rather than substitutes.

A study by Fizza (2010), investigate the relationship of public sector development projects, foreign direct investment and private investment for Pakistan's economy. Results by Fizza (2010) and Ghani and Din (2006) reveal that all the three forms have a long positive relation with economic growth where private investment has a strongest impact among all. The complementary mutually exclusive and major element of aggregate demand is investment that plays as key factor for obtaining and supporting a positive economic development. Ajaz and Ellahi (2012) report that

investment plays as a significant factor of demand and a foremost cause of economic development. Variation in investment not only disturb demand but also augment the dynamic volume of an economy. Although government has an active and dominant role in providing social, economic and infrastructure facilities but private sector investment is likely to be induced in public sector investment. So, the present investment function is a composition of government investment ($INVS^g$), private investment ($INVS^p$) and rise in stocks (ΔS_t). Rise in stocks is a significant constituent of business-cycle [Khan and Din (2011)] but due to data non-availability at provincial level this variable is not included in the behavioral relation. It can be thought that fluctuations in agricultural production heavily affects increase in stocks, which in turn affected by exogenous causes such as weather.

$$INVS = INVS^g + INVS^p + \Delta S_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(10)$$

3.3.2.2.1 Private Investment

Private investment and economic growth has a strong relationship. A study by Khan and Din (2011) reveal that continuity in the development process heavily depends upon private investment by promoting economic growth. Decisions by the Private investors depend on expectations about the future and the investment in long-lived capital assets. Study by Ghani and Din (2006) reveal that for Pakistan the economic growth is largely driven by private investment. Khan (1996) explores the relative importance of public and private investment in prompting economic growth for a large group of developing countries. The results of the study show that both investments have differential effect on economic growth with private investment having a much larger impact than public investment.. In this study we define private investment in terms of real income (Y^r), real interest rate (r^d) defined as weighted

average deposit rate minus the rate of inflation, government investment ($INVS^g$) and ratio of private sector credit to PGDP (σ);

$$INVS^p = f(Y^r, r^d, INVS^g, \sigma_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

3.3.2.2.2 Government Investment

The role of public investment in the process of economic growth has been the subject of enquiry of a growing body of both theoretical and empirical literature. The starting point for both strands of literature is the notion that actions taken by governments have considerable effect on macroeconomic performance. For example, the level of public investment may affect both private investment and the long-term rate of growth.

Ghani and Din (2006) explores the role of public investment in the process of economic growth in the context of Pakistan's economy. The results show that growth is largely driven by private investment and that no strong inference can be drawn from the effects of public investment and public consumption on economic growth.

Following Mahiuddin and Aziz (2014) and Ajaz and Ellahi (2012) government revenue and foreign aid are the main determinants of public investment. PGDP and inflation rate also affect the public investment but the former has positive while the later has a negative impact. So the functional form becomes;

Ellahi and Kiani (2011) conduct and empirical study relationship between public investment and economic growth. A disaggregated analyses of public sector spending has been carried out and show that there is a positive impact of public sector spending on economic growth of Pakistani short-run as well as long-run economic growth.

Following Khan and Din (2011) government investment in the public works is an instrument known as fiscal policy and it is determined exogenously. The expenditures on capital disbursement (EXP^K) includes infrastructure and innovations are the government investment in the public sector; so the final functional form becomes;

$$INVS_t^g = f(Y_t^n, REV_t^G, INF_t, EXP_t^k) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

3.3.3 Fiscal Block

The fiscal sector can be analyzed by provincial government expenditures and its revenue. The budget deficit (BD) is defined when provincial government revenues are less than the provincial government spending. To finance the budget deficit domestic and external resources are used by the government. Symbolically, if BD_t is the budget deficit, EXP_t is the public expenditure and REV_t is the collected revenue at time 't', we have the identity;

$$BD_t = EXP_t - REV_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

Mukhtar and Zakaria (2008) empirically examined long-run relationship between nominal rate of interest and budget deficits for Pakistan using quarterly time-series data for the period 1960 to 2005. They examine the conventional crowding-out view against the Ricardian deficit neutrality alternative. They found an insignificant regression relation between budget deficit and nominal interest rate. They determined the existence of the Ricardian deficit neutrality in Pakistan, while the ratio of budget deficit to GDP had proven a positive explanatory stimulant for nominal rate of interest. the conventional wisdom of crowding-out is supported by their findings.

Revenues through direct taxes (DTR_t), revenues through indirect taxes (ITR_t) and non-tax revenues (NTR_t) are sources of provincial government revenues;

$$REV_t = DTR_t + ITR_t + NTR_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

Revenues through direct taxes and indirect mode of taxes are treated as endogenously while revenue made through non tax provincial government modes is taken as exogenously acted source of provincial earning. By khan and Din (2011) charges like fees and social charges, these are relative to collective economic actions are classified as non-tax revenues. We will model two different revenues in two different relational ways because they have different nature and they response differently to change in income. Revenues can be raised from direct taxes by increasing the nominal income which is the tax-base.

3.3.3.1 Revenues through direct taxes

Direct tax is a natural or juristic tax that is obligatory upon a specific person or group of individuals' personal or real property, livestock earning, profits through rental objects, wages, crops etc. Following Khan and Din (2011), Patoli, *et al.* (2012) and Zerfu (2013) and Rahman and Khatoon (2011) (that average direct tax rate , the activity level of the economy and the rate of inflation collectively influence the Revenues through direct taxes. Patoli, *et al* (2012) determine the impact of unit change in rate of inflation on direct, indirect and total taxes. The ϵ is the proportion of direct taxes and nominal income Y^n and π_t is the rate of inflation. Therefore the functional form becomes;

$$DTR_t = f(Y_t^n, \epsilon_t, \pi_t) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (15)$$

Patoli, *et al.* (2012), Khan and Din (2011), Hanif, *et al.* (2008) and Tjipe, *et al.* (2004) reported that nominal income and rate of inflation are the regressands for revenues through direct taxes and have a positive impact on it. The channel of relation is explained as nominal income increases, average tax rate rises and inflation rate rises then revenues through direct taxes will go up.

Channel

It is also assumed that direct taxes and rate of inflation are directly related to each other because every year private and public sector workers payments are corrected for cost of living and taxation is made on these additional compensations.

3.3.3.2 Revenues through indirect taxes

Taxes imposed through indirect modes such as goods and services tax, a value added tax and sales tax and alike are obligatory only if a transactional business is made that is taxable. People have the freedom to engage in or refrain from such transactions; whereas a direct tax (in the general sense) is imposed upon a person, typically in an unconditional manner. Indirect taxation is policy often used to generate tax revenue. The revenues through indirect taxes are mainly subjective to nominal output (Y^n), the average rate of indirect-tax (£) and inflation rate (π), hence the relational form becomes;

$$ITR_t = f(Y_t^n, £_t, \pi_t) \quad \ldots\ldots (16)$$

Patoli, *et al.* (2012), Khan and Din (2011), Hanif, *et al.* (2008) and Tjipe, *et al.* (2004) reported that nominal income and rate of inflation are the regressands for revenues

through indirect taxes and have a positive impact on it. The channel of relation is explained as nominal income increases, average indirect tax rate rises and inflation rate rises then revenues through indirect taxes will go up.

Custom duties, sales tax, etc are the major sources of indirect taxes. Khan and Din (2011) argued that higher revenues through indirect taxes can be made by having a higher price level. Revenues can also be increased from indirect taxes due to higher spending which is a response of higher level of output. So they predicted a progressive direct association between average tax rate, taxes through indirect mode, rate of inflation and nominal income. By following Khan and Din (2011) and Elliott *et al.* (1986), we have assumed a unit elasticity taxes with respect to income.

Channel - 1

Channel – 2

3.3.3.3 Revenues through non-taxes

Revenues through non-taxes or non-tax receipts are government revenues not generated from taxes. For example foreign aid, loans or other borrowing from international monetary funds, world bank and/or other governments. Revenue from investment funds in the shape of interest or profit, fines collected and for-featured assets as a penalty for example parking violation fines, fines levied

on criminal offenders, fees for the granting or issuance of permits or licenses etc. All forms of non-tax revenues are taking as exogenous factor of variation.

3.3.3.4 Government Expenditure

Provincial government expenditures (*EXP*) comprises all public investments and consumptions but not the provincial government transfer payments. For current use, public purchases of goods and services straightly gratify specific person or joint essentials of the adherents of the community. It consists of development expenditures (EXP^d), current expenditures (EXP^c) and capital disbursement expenditures (EXP^k). So the identity for total provincial government expenditures is given by;

$$EXP^g_t = EXP^d_t + EXP^c_t + EXP^k_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (17)$$

Here spending on provincial developmental works and provincial capital disbursement are being treated as exogenous variables following Khan and Din (2011), while endogenously treated the current expenses on services and goods. Here we assume that nominal income Y_t and rate of inflation π_t are affecting the provincial government current expenditures. The relation is directly proportional because the spending on development schemes probable to grow as nominal income rises and/or rate of inflation increases [Khan and Din, (2011)]. Rizvi et al. (2010) observe a positive and strong relationship between public development expenditure and PGDP for the province of Sindh. They find that economic growth and development expenditure have a long-run relationship. Hence, following is the function specification for expenditures of the provincial government;

$$EXP^c_t = f(Y^n_t, \pi_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (18)$$

Channel -1

Channel – 2

Following Elliot *et al.* (1986) the elastic resistance of taxes is expected to one (unity) as to compare with nominal income.

Chapter 4
ESTIMATION RESULTS OF THE STRUCTURAL MODEL

We have a time series data of 42 years which is a small sample at hand. The observed period for the study and estimation is FY 1973-74 to FY 2013-14. For the long run behavior of the economy we try to estimate the stochastic equations using error correction model. We have used E-Views V.8 to get the estimation results.

Iqbal et al (2012), Ajaz and Ellahi (2012) and Khan and din (2011) a severe problem occurs, in making econometric modeling, when time series usually have acute drifts. To solve this difficulty, or at-least to comprehend its likely consequence, it is usually in use to test whether a particular auto-series follow a trend or not. Usually known as statistical non-stationarity. To check trend in the time-series we apply the unit root test given by Dickey and Fuller (1979); Augmented Dickey and Fuller unit root test. Outcomes for the time series properties for economic macro factors are reported in Table 6 (appendix). No dummy or proxy variables are introduced into the stochastic equations that lesson the efficiency and efficacy of statistical models. It is supposed that structural breaks will be observed without making the use of dummy variables. To overcome the problem of heteroscedasticity we take the log of time series.

For the short-run and long-run behavioral relations values for t-statistics are given in brackets. For each relation a couple of precision measures for estimated results including the adjusted coefficient of multiple determination R^2, residual sum of squares and standard deviation for the dependent variable are also accompanied by

the equations. The ADF-cointegration statistic is accomplished on the residuals gained from the long-run comparisons and stated bellow each relation.

A class of diagnostic statistics is employed to examine different problems related to regression analyses. These statistics include auto-regressive-conditional-heteroscedasticity *ARCH** to check the presence of heteroscedasticity, to check the normality of residuals we use Jarque-Berra *JB**, for the functional specification and for serial correlation Lagrange Multiplier *LM**[3] is observed. For the structural stability and to observe the sudden visible changes cumulative sum control chart *CUSUM** and *CUSUM for Squares* are checked.

4.1 Supply Block

Production block is disaggregated for agriculture, manufacturing and services value added. Long and short run estimates for parameters of relationship between predictors and predictants are given. All the variables are in log form, just to remove the trend in the time series.

4.1.1 Agriculture Sector

Agriculture sector value added estimated long and short-run equations are explained with necessary remedial measurements in *equations (24) and (25);*

The long run relation reported in equation (24) suggests that agricultural capital, labor, water, infrastructure, and amount of fertilizer play a vital role for the agriculture sector productivity. Labour force with the marginal product in the sector is about 87% and agricultural capital with a marginal product in agricultural sector is about 47%

[3] * all are statistical tools for statistical model related problems, described in *Appendix B*

Long-run estimates

y^a = 2.11 +0 .81 l^a + 0.47 k^a + 0.76 wat_t +0.46 $land^a$ – 0.16 $cred^a$ + 0.13 fer^a + 0.42 $infs^a$ ... 24

(5.46) (4.43) (6.78) (7.23) (-2.45) (5.12) (10.23)

Adj.R-Sq = 0.97 *RSS= 0.079* *S.D.(y^a)= 0.71* *ADF = -6.34**

Normality statistic = 2.65[0.672] *L-M-Statistic = 0.19 [86.1%]* *ARCH-statistic = .44[98.25%]*

Short-run estimation

Δy_t^a = 0.47Δl_{t-1}^a + 0.07 C k_{t-1}^a + 0.32 Δwat_t 0.32 $\Delta land_{t-1}^a$ - 0.02 $\Delta cred_t^a$ + 0.17 Δfer_t^a + 0.65 $\Delta infs_{t-1}^a$ - 0.62 v_{t-1}^a ... 25

Adj-R-Sq = 0.12 *S.D.(Δy^a)= 0.009* *RSS = 0.04*

Norm-statistic= 2 43[0.892] *LM-Statistic = 0.11[99.6%]* *ARCH-Statistic = .34 [76.9%]*

has more importance. Moreover, Credit has a diverse and significant effect on agricultural value added, it is due to miss use and for other purposes used of the agricultural loan . The data is fitted with a best blend in the estimated relation as showed by the investigative statistics. To investigate the stationarity we use ADF test statistic that confirms the long-run interaction among the variables.

Estimates for the economic behavior in short run for agricultural value-added is narrated in equation (25). All the regressors are integrated of order one that I(1). In the short-run the impact of infrastructure dominates all other explanatory variables with a strong impact on explained variable. Agricultural loan once again has a negative but significant impact on agricultural value-added. The error correction term is significantly signed that indicates the presence of long-run relationship. The coefficient indicates that the process will take less than two years to correct all the

deviations from the equilibrium steady state path. The model fits satisfactorily very well as described by the diagnostic measures.

Khan (2012) reports that although a National Water Apportionment Accord 1991 has allocated 8.78 MAF of water for KP. The province utilizes only 5.5 MAF. Due to the absence in some areas and wastage of water in some canals fed by the Indus, about 3.2 MAF of the water of KP is used by the province Punjab, irrigating five million acres in the province. The accord also allowed 14 percent of the additional river water supply including flood flow and future storage. But due to weak irrigation system more water goes waste that can be used fruitfully if system is seriously improved.

The project of Gomal Zam in the district tank is a good step towards agriculture development that will irrigate about one million acre feet of the arid able land in Districts Dera Ismail Khan, Lakki and Tank. The flood water from districts of Chitral Sawat and Dir if properly stored than these area and the neighbouring districts of Kohistan and Malakand can also be benefitted and agricultural waste can be minimised.

4.1.2 Manufacturing Sector

In the manufacturing sector the role of labor is most significant with a change rate about 87% in the manufacturing value added although due to transitional transfer a significant number of labor force have been transferred to services sector. Raw material, capital are also playing a pivotal role in the sectorial growth. Error correction term for the short-run is theoretically sound with a correction value of about 43%. In the short-run analyses the credit factor becomes positive but with a very minute effect. All the diagnostic statistics appear with better results. ADF statistic proves the long-run relationship between the variables of the system.

Long-run movements

$$y_t^m = 5.18 + 0.87 l_t^m + 0.62\, k_t^m + 0.32\, cred_t^m + 0.25\, infs_t^m + 0.75\, raw_t^m \quad \ldots \quad 26$$

(0.0012) (0.0000) (0.0003) (0.0007) (0.0000) (0.0030)

Adj-R-Sq = 0 998 *S.D.(y^m) = 0.17)* *RSS = 0 34* *ADF = -4 87**

Norm-statistic = 3.08 [11.7%] *L-M – Statistic = 8 98 [.2%]* *ARCH-Statistic = 0 34 [14%]*

Short – run movements

$$\Delta y_t^m = 0.35\, \Delta y_{t-1}^m + 0.12\, \Delta l_t^m + 0.97\, k_t^m + 0.008\, \Delta cred_t^m + 0.51\, \Delta\, infs_t^m + 0.54\, \Delta\, rm_t^m - 0.43\, v_t^m \quad \ldots \quad 27$$

(0.0000) (0.0000) (0.0004) (0.0007) (0.0103) (0.0000) (0.0001)

Adj-R-Sq = 0 52 *S.D.(Δy^m) = 0.03* *RSS = 0.13*

Norm-statistic = 0 24 [91 4%] *L-M – Statistic = 1.98 [60.2%]* *ARCH-Statistic = 1.34 [72%]*

4.1.3 Services Sector

For the services sector the most salient regressor for the value added is the private sector investment. Ellahi and Adiqa (2012) show that the private sector investment in Pakistan is the main factor of economic growth. As the case for KP, 87% change is occurred due to private investment. While public investment participation is very low.

A comparative ratio of total investment to CPI is not bad. The services sector value added is affected by more than quarter a change due to this ratio. As investment increases this unit change can be seen with an increase. All the estimates are significant. We have a long-run relationship among the variables. Statistic for the residuals are well satisfactory.

Long-run dynamics

$$y_t^s = 5.18 + 0.87c_t^p + 0.12\, c_t^g + 0.32\, \gamma_t^s \quad \ldots \quad 28$$

(0.0012) (0.0000) (0.0003) (0.0000)

Adj-R-Sq = 0 998 *S.D.(y^s) = 0.17* *RSS = 0.34* *ADF = -4 87**

Norm-statistic = 4.13 [31.4%] *LM – Statistic = 8.98 [.2%]* *ARCH-Statistic = 1.34 [14%]*

Short – run dynamics

$$\Delta y_t^s = 0.35\, \Delta y_{t-1}^s + 0.97\, cons_t^p + 0.08\, \Delta cons_t^g - 0.50\, v_t^s \quad \ldots \quad 29$$

(0.0001) (0.0000) (0.0004) (0.0007) (0.0003)

Adj-R-Sq = 0 52 *S.D.(Δy^s) = 0.07* *RSS = 0.13*

Norm-statistic = 0 .23 [7.4%] *LM – Statistic = 1.98 [2.3%]* *ARCH-Statistic = 454 [72%]*

The value for error correction mechanism is correctly signed and reveals that the mechanism is working and an equilibrium will be attained in about 2 years. The private consumption in the short run is the strongest driver of services sector value-added. The government consumption in the long-run as well as in the short run has a weak linear relation.

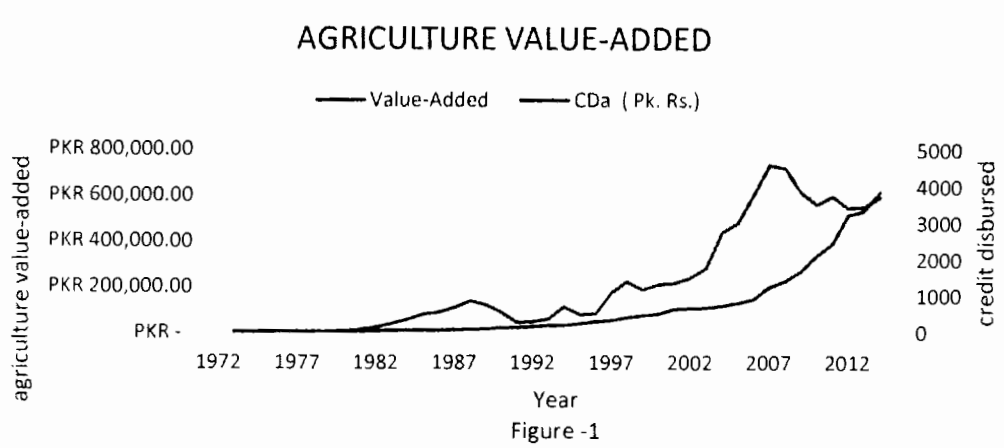


Figure -1

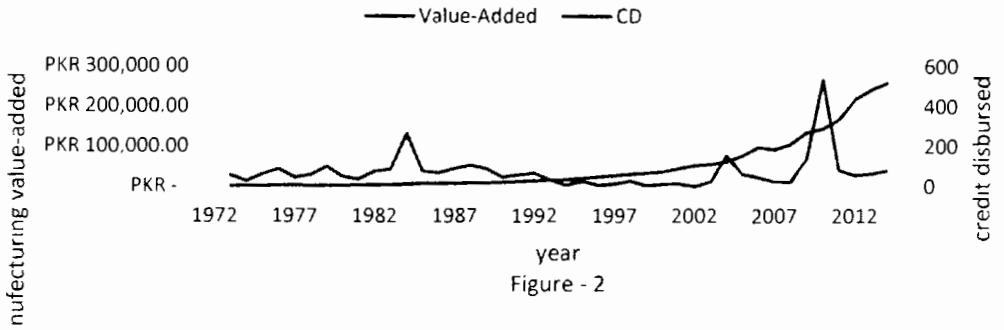


Figure - 2

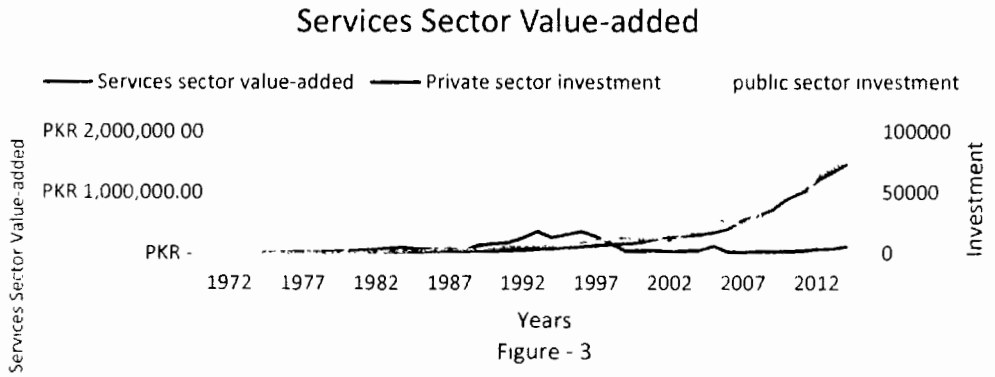


Figure - 3

4.2 Aggregate Demand Block

4.2.1 Consumption Sub-block

4.2.1.1Private Consumption

To capture long-run dynamics in the economy for real private consumption sector we have sound results. The equation 26 describes that real disposable income plays an important factor for private consumption, it exerts a strong positive impact with long run elasticity. The marginal propensity to consume (mpc) for the residents of KP is to be estimated at 0.87 i.e. 87% as compared with real interest rate (deposit) with elasticity value 0.02, while with negative impact. It is further observed that if the disposable income gets a rise of about 10 percent then a direct increase in the in real private consumption will be of magnitude 8.7 percent. The results show a very little savings. The provincial marginal propensity to save is about 0.13. We have consistent results with earlier outcomes of Ra and Rhee (2005) and Khan and Din (2011). Estimated value for autonomous consumption is 3.18 which is quite high than that of induce consumption but still less than the national level of 5.18 reported by Khan and Din (2011). All the results are found to be significant at 5 percent level of significance.

The reflationary term for effect of real interest rate is very small and have a negative impact. That as real interest rate increases we have a decrease in private consumption, the result reveals similarity with national level behaviour reported by Hanif *et al.* (2008) and Haider and Khan (2008). The wealth impact, is measured through real money balance M2 definition, is found insignificant but somewhat with positive marginal value of 34% on real private consumption. Estimated equations are given bellow, respectively;

Long - run movements

$$cons_t^p = 3.18 + 0.34\, m2 + 0.87 y_t^d - 0.02\, r_t^d \quad \ldots \quad 30$$

(0.0002) (0.0934) (0.0000) (0.0000)

Adj-R-Sq = 0.99 *S D.(cons^p) = 0 17* *RSS = 0.14* *ADF = -4.87**

Norm-statistic = 0.18 [37.1%] *LM – Statistic = 5.98 [11.2%]* *ARCH-Statistic = .21 [94.1%]*

Short – run movements

$$\Delta cons_t^p = 0.15\, \Delta cons_{t-1}^p + 0.12\, \Delta y_{t-1}^d - 0.50\, v_t^{pcons} \quad \ldots \quad 31$$

(0.000) (0.000) (0.004) (0.0007)

Adj-R-Sq = 0 32 *S D.(Δ cons^p) = 0.05* *RSS = 0 03*

Norm-statistic = 3.71 [0.914] *LM – Statistic = .98 [60.2%]* *ARCH-Statistic = .64 [37.2%]*

4.2.1.2 Government Consumption

For the province KP total tax revenues and expenditure on development relative to PGDP are the main regressors for public consumption. The government consumption heavily depends on the total revenues and more on direct sources of revenues. The results reported in equation (32) predicts that the predictors exerts positive and visible influence on the public consumption. The elasticities observed are 25% and 32% respectively for the explanatory economic factors. It is evident that public revenue is more effective for fiscal policy to maintain economy on equilibrium path. Following Khan and Din (2011) the *ADF* statistic for trend testing is observed to be -2.87 that is significantly less than 10% level of significance indicating no long-run relationship among the economic variables in the system. Hence we consider to estimate the simple vector autoregressive (VAR) model in equation (33) to observe the dynamics in the short-run of the economic behavior.

Because of lack of cointegration among the variables responsible for the change in public consumption sector we develop VAR that indicates that lagged values of public consumption and total public revenues are the main determining factors in the short-run. The model satisfactorily authorizations the diagnostic measures both for the short-run and for the long-run.

Long-run equation

$$cons_t^g = 7.328 + 0.251\,\beta_t^g + 0.430\,rev_t^g \quad \ldots \quad 32$$

(0.0001) (0.0000) (0.0003)

Adj-R-Sq = 0.93 *S.D.($cons^g$) = 0 12* *RSS = 0 31* *ADF = -2.87*

Norm-statistic = 0.38 [57.1] *LM – Statistic = 4.93 [6.2]* *ARCH-Statistic = 1.21 [24.1]*

Short – run equation

$$\Delta cons_t^g = 0.41\,\Delta cons_{t-1}^g + 0.12\Delta\beta_t^g + 0.430\,\Delta rev_t^g \quad \ldots \quad 33$$

(0.0001) (0.0000) (0.0000)

Adj-R-Sq = 0 62 *S D (Δ $cons^g$) = 0.09* *RSS = 0.11*

Norm-statistic = 0 013 [0.927] *LM – Statistic = .59 [43.7]* *ARCH-Statistic = .04 [21.7]*

4.2.2 Investment Sub-Block

4.2.2.1 Private Investment

Private investment and economic growth has a strong relationship. Continuity in the development process heavily depends upon private investment by promoting economic growth. Decisions by the Private investors depend on expectations about the future and the investment in long-lived capital assets

[Khan and Din (2011)]. Private sector credit also plays an important role, as well as provincial private sector investment is concerned we see a visible downward trend in private investment besides the trend in credit has a sharp drift. This opposite direction is due to the worse law and order conditions of the region.

It is a dilemma for the provincial manufacturing and industrial sector that the IDBP and SIDB has not sanction any private sector loan since 2000. At present the province has no IDBP branch in all over the provincial territory. After 2010 a better upward picture is seen due to federal policies for the betterment of most affected areas due to war against terrorism. Besides the provincial government, in response to the challenges, such as peaking inflation and worse situation of law and order in the province the GoKP strongly committed itself to resorting macroeconomic stability in the province. Still the province needs to be facilitated beyond what is its right.

Long-run estimates

$$invs_t^p = 0.630\, y_t^r - 0.019\, r_t^l + 0.32\, \sigma_t^{invsp} + 0.22\, invs_t^g \quad \ldots \quad 34$$

. (0.0000) (0.0001) (0.0000) (0.0006)

*Adj-R-Sq = 0 99 S.D.(invs^p) = 0.03 RSS = 0.38 ADF = -4.33**

Norm-statistic = 0.71 [0.981] LM – Statistic = 4.08 [27.1] ARCH-Statistic= 081 [50.2%]

Short – run estimates

$$\Delta invs_t^p = 0.92\, \Delta y_t^r + 0.12\, \Gamma_t^{invsp} + 0.52\, \Delta invs_t^g - 0.28\, v_t^{pinvs} \quad \ldots \quad 35$$

(0.0000) (0.0000) (0.0000) (0.0000)

Adj-R-Sq = 0 67 S D.(Δ invs^p) = 0.12 RSS = 0 21

Norm-statistic = 2.33 [9.1%] LM – Statistic = 5.23 [14 3%] ARCH-Statistic =1 26 [65 1%]

ADF statistics shows a significant occurrence of cointegration between real private investment and its predictants in the long-run movement. There is a long-run association among real income, private investment, and proportion of private area credit to gross provincial domestic product, government investment and weighted average lending rate. Grounded on the long-run projected movements short-term ECM is estimated in the equation (35) that proves a positive impact of public investment and real income. An insignificant impact is observed in the short-run by private sector credit. The error correction term has a theoretical significant negative sign. The normality, Lagrange multiplier and autoregressive conditional heteroscedasticity statistics are theoretically sound.

4.2.2.2 Government Investment

Pakistan's macro economy has transitioned towards alliance under the International Monitory Fund program, parting behind the bouncy ride of FY 2008-09 with expected real GDP growth of 3.3% in FY2010; higher than the 2% growth seen in FY2009. This national progress does impact the provincial government investment. According to the estimated values for PGDP the growth is seen form 1999 at 3.9% to 9.0% in 2004. The impacts are observed on gross provincial domestic product too.

In response to the challenges, such as peaking inflation and worse situation of law and order in the province the GoKP strongly committed itself to resorting macroeconomic stability. The fiscal policy is being used as a tool since 2000. Public works are the fiscal policy of a government and in fact fiscal policy is the government investment.

Following Ajaz and Ellahi (2012) provincial government revenue and foreign aid are the main determinants of public investment. GPDP and inflation rate also affect the public investment but the former has positive while the later has a negative impact. Data for foreign aid is not correctly available. So the estimated sketch of the long-run and short-run public investment is elaborated as;

Long-run estimated sketch

$$invs_t^g = 12.34 + 0.630\, y_t^n - 0.019\, rev_t^g + 0.32\, exp_t^k + 0.22\, \pi_t \quad \ldots \quad 36$$

(0.0000) (0.0000) (0.0000) (0.0000) (0.0001)

Adj-R-Sq = 0.99 *S.D.($invs^g$) = 0.09* *RSS = 0.29* *ADF = -4 09**

Norm-statistic = 3.45 [64.1%] *LM – Statistic = 1 78 [5.3%]* *ARCH-Statistic = 2 62 [35.2%]*

Short – run estimated sketch

$$\Delta invs_t^g = 0.12\, \Delta invs_{t-1}^g + 0.08\, \Delta y_t^n + 0.12\, rev_t^g + 0.72\, \Delta exp_t^k - 0.28\, v_t^{g\,invs} \quad \ldots \quad 37$$

(0.0000) (0.0000) (0.0000) (0.0000) (0.0001)

Adj-R-Sq = 0 38 *S D.(Δ $invs^p$) = 0.18* *RSS = 0 32*

Norm-statistic = 2.33 [62.0%] *LM – Statistic = 5.23 [14.3%]* *ARCH-Statistic = 3.26 [65 1%]*

PRIVATE SECTOR CONSUMPTION

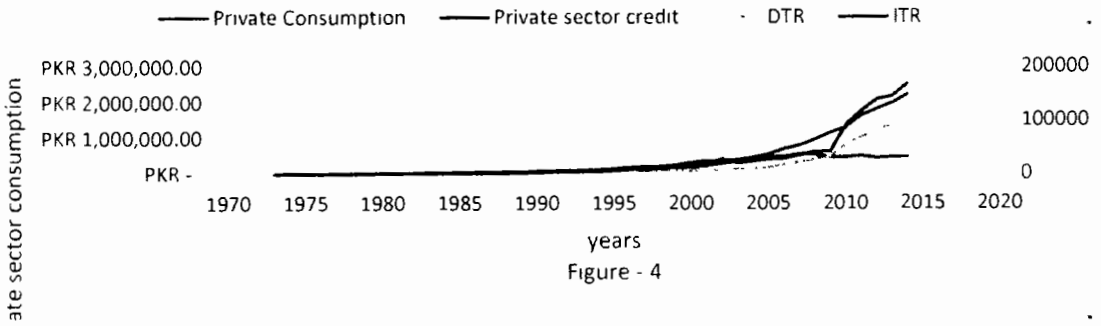


Figure - 4

PUBLIC SECTOR CONSUMPTION

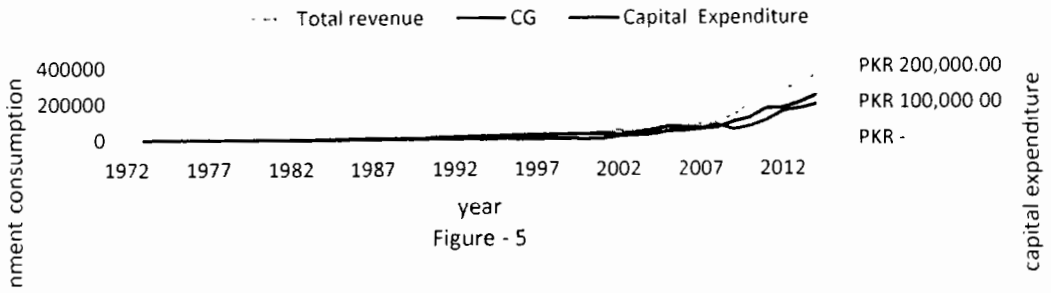


Figure - 5

PRIVATE SECTOR INVESTMENT

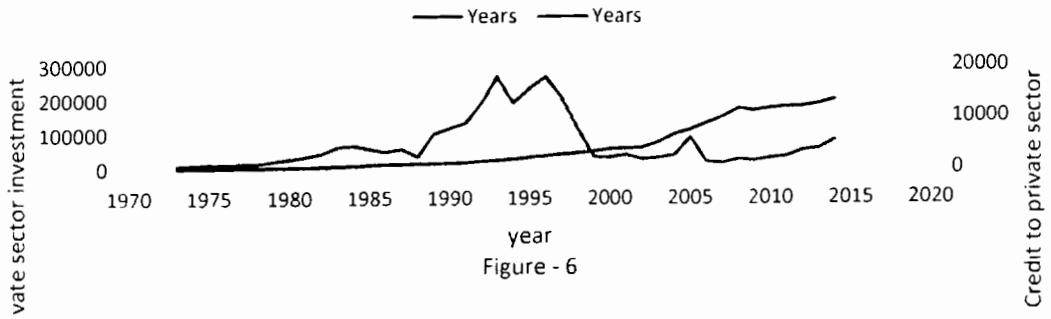


Figure - 6

PUBLIC SECTOR INVESTMENT

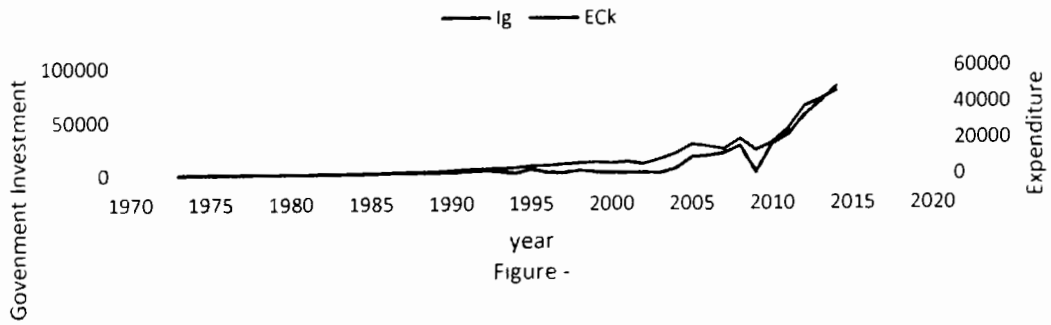


Figure -

4.3 Fiscal Block

4.3.1 Revenues through direct taxes

The estimated long-run behavior of the explained economic variable of direst tax revenue is reported in equation (38). According to the relation the contribution of nominal income of the provincial government exerts a strong positive impact on revenues through direct taxes. It is well according to the financial theory that correlation between nominal income and revenues through direct taxes and is positive. Here one thing is surprising that follows Khan and Din (2011), the variable average direct tax rate (*adtr)* is observed to be insignificant, so we better drop it from the long-run relation. With earlier findings of Mukarram (2001), Chaudhary and Hamid (2001), Hanif et al, (2008) and Khan and Din (2011), our result of elasticity of direct taxes in the long-run with reverence to nominal provincial income is more than unity i.e. 1.65. This elasticity reveals that more than one percent increase in direct taxes will happen by having an increase of one percent in nominal income. Value for ADF statistic is -5.16 that is residuals produced by equation (38) have no trend. It is a sign of long run association between nominal income and revenues through direct taxes. The long-run and short-run elasticity with respect to nominal income are 1.65 and 0.92, respectively. These results have significance in the budgetary situation of GoKP.

Long-run estimates

$$dtr_t = -3.45 + 1.65\ y_t^n + 0.027\ €_t^{dtr} + 0.31\pi_t \quad \ldots \quad \ldots \quad 38$$

(0.0000) (0.0000) (0.0000) (0.0006)

Adj-R-Sq = 0.99 *S.D (dtr_t) = 0.12* *RSS = 0.72* *ADF = -5.16**

Norm-statistic = 0 34 [0.284] *LM – Statistic = 14 08 [0.0071]* *ARCH-Statistic = 6.81 [0.132]*

Short – run estimate

$$\Delta dtr_t = 0.46\,\Delta dtr_{t-1} + 0.92\,\Delta y_t^n + 0.28\,\Delta \epsilon_t^{dtr} + 0.28\,\Delta\,\pi_t - 0.23\,v_t^{dtr} \quad \ldots \quad 39$$

. (0.000) (0.0000) (0.0000) (0.0000) (0.0000)

Adj-R-Sq = 0 67 *S.D (Δ dtr) = 0.12* *RSS = 0.21*

Norm-statistic = 2.63 [12.0%] *LM – Statistic = 5.23 [14.3%]* *ARCH-Statistic= 1.26 [65.1%]*

4.2.2 Revenues through indirect taxes

The estimated long-run behavior of the explained economic variable of indirect tax revenue is reported in equation (40). Similar to the revenues through direct taxes are supposed to be dependent on the nominal income, inflation rate and average rate of indirect taxes. According to the relation the contribution of nominal income of the provincial government exerts a strong positive impact on revenues through direct taxes. It is well according to the financial theory that correlation between tax revenues and nominal income is positive. Here one thing is surprising that follows Khan and Din (2011), the variable average indirect tax rate (£) is observed to be significant. In earlier studies by Mukarram (2001), Chaudhary and Hamid (2001), Hanif *et al.* (2008) and Khan and Din (2011), our result of long run resistance of indirect taxes with the comparison of income at variable prices (nominal income) is more than unity i.e. 1.65. This elasticity reveals that more than one percent increase in direct taxes will happen by having an increase of one percent in nominal income. Value for ADF test statistic is -3.67 that is residuals produced by equation (40) have no trend. It is a sign of long run association between revenues through direct taxes and income at variable price. Long run and short run resistances with reverence to nominal earning are 1.65 and 0.92, respectively. These results have significance in the budgetary situation of KP government.

Long-run sketch

$$itr_t = - 2.72 + 0.62\ y_t^n + 0.027\ \pounds_t^{itr} + 0.31\ \pi_t \quad \ldots \quad 40$$

(0.0000) (0.0000) (0.0000) (0.0000)

Adj-R-Sq = 0 989 *S.D.(itr_t) = 0.08* *RSS = 0.170* *ADF = -3.91**

Norm-statistic = 29.34 [0.782] *LM – Statistic = 14.08 [0.0071]* *ARCH-Statistic = 6.81 [0.132]*

Short – run sketch

$$\Delta\ itr_t = 0.71\ \Delta\ itr_{t-1} + 0.92\ \Delta y_t^n + 0.28\ \Delta\pounds_t^{itr} + 0.15\ \Delta\pi_t - 0.43\ v_t^{itr} \quad \ldots \quad 41$$

(0.000) (0.0000) (0.0000) (0.0000) (0.0000)

Adj-R-Sq = 0 67 *S.D.(Δ itr_t) = 0.12* *RSS = 0.21*

Norm-statistic = 1 67 [62.0%] *LM – Statistic = 5.23 [14.3%]* *ARCH-Statistic = 26 [65.1%]*

It is observed that the regression coefficient of nominal income is positive and there exists a long-term relationship between revenues through in-direct taxes and the nominal income. The long-term resistance of revenues through in-direct taxes with reverence to nominal income equals 62%. This value is less than unity means that the present system of indirect taxes is neither progressive nor regressive. The value of augmented Dickey-Fuller statistic is satisfactory indicates a cointegration among the variables of equation 39. All the regressors positively affect the revenues through indirect taxes within short-term spans. Error adjustment value v_{t-1}^{itr} appears according to theoretical sign and significance of the term suggests the presence of co-integration amongst the interacted economic variables. All the investigative statistics appear with no problem.

4.3.3 Provincial Government Expenditure

Provincial government expenditures (*EXP*) comprises all public investments and consumptions but not the provincial government transfer payments. For current use, public purchases of goods and services straightly gratify specific person or joint essentials of the adherents of the community. It consists of development expenditures (EXP^d), current expenditures (EXP^c) and capital disbursement expenditures (EXP^k). Here spending on provincial developmental works and provincial capital disbursement are being treated as exogenous variables following Khan and Din (2011), while endogenously treated the current expenses on services and goods. Here we assume that nominal income Y_t and rate of inflation π_t are affecting the provincial government current expenditures. The relation is directly proportional because the spending on development schemes probable to grow as nominal income rises and/or rate of inflation increases [Khan and Din, (2011)].

Long-run estimates

$$exp_t^c = \underset{.}{0.85} + \underset{(0.0000)}{0.23}\ y_t^n + \underset{(0.0000)}{0.018}\ \pi_t \qquad \ldots \quad 42$$

Adj-R-Sq = 0 98 *S.D.(dtr$_t$) = 0.08* *RSS = 0.57* *ADF = -3 38**

Norm-statistic = 2.64 [8 40%] *Nominal LM – Statistic = 10.08 [6.70%]* *ARCH-Statistic = .81 [9.80%]*

Short – run estimate

$$\Delta exp_t^c = \underset{.}{0.46}\ \Delta exp_{t-1}^c + \underset{(0.00009)}{0.92}\ \Delta y_t^n + \underset{(0.0000)}{0.28}\ \Delta\pi_t - \underset{(0.0000)}{0.23}\ v_t^{dtr} \qquad \ldots \quad 43$$

Adj-R-Sq = 0.32 *S.D (Δ exp^c_t) = 0.09* *RSS = 0 56*

Norm-statistic = 3.57 [12 5%] *LM – Statistic = 1.09 [4 30%]* *ARCH-Statistic = 1.26 [46%]*

The ADF statistics significantly reveals a long-run relation between current expenditures and its regressors. There is a positive and somewhat strong impact observed by the nominal gross provincial domestic product as compared with rate of inflation whose impact is looking positive but very weak. Variation in the expenditures is very minute showing a lepto-kurticity in the provincial expenditures. A very high statistics for coefficient of determination indicates the parismoneoucity of the estimated relation. On the other side in the short run lag expenditures are strongly regressed, a very strong unit elasticity is in between income and expenditures of the provincial government. Rate of inflation also predicts expenditures in short-term very well. The EC mechanism found to be significant hence equilibrium can be achieved. All the statistics are showing good results, there is no problem for the fit of the model.

DIRECT TAX REVENUES

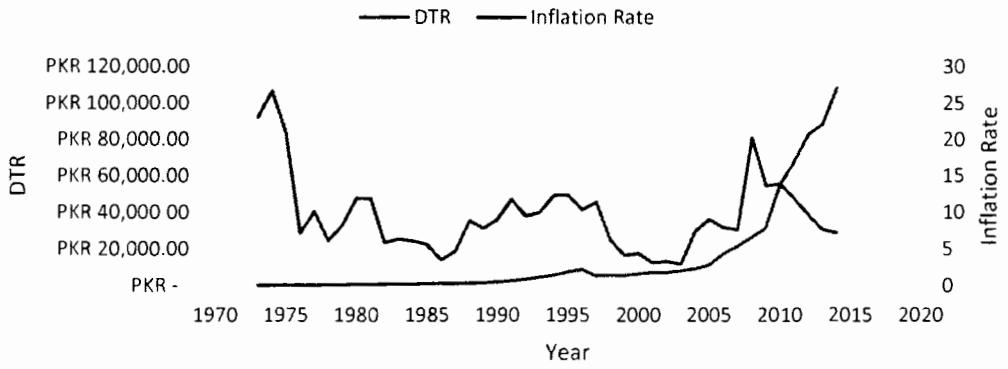


Figure - 8

INDIRECT TAX REVENUE

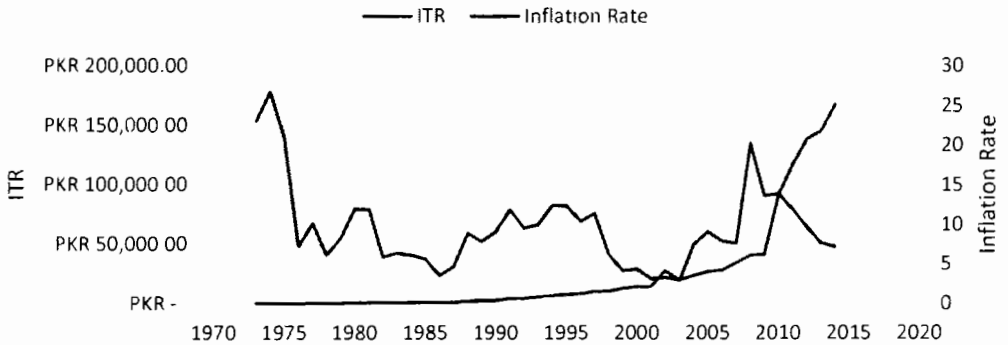


Figure - 9

PUBLIC SECTOR EXPENDITURE

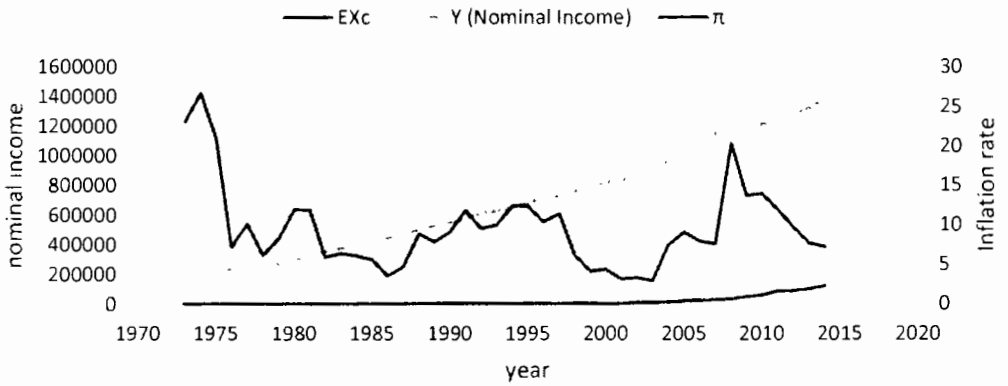
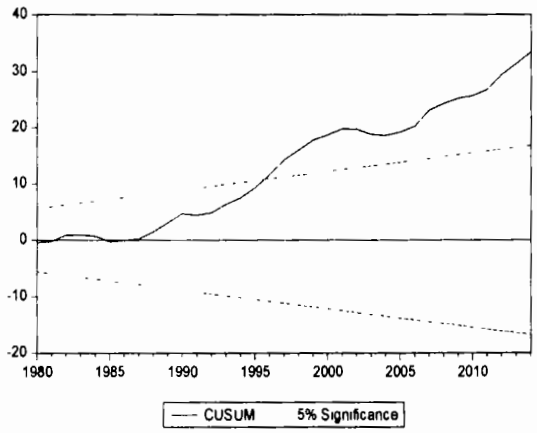


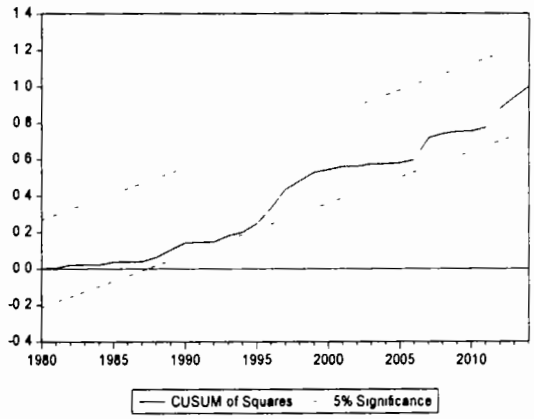
Figure - 10

4.4 Trend Check through CUSUM

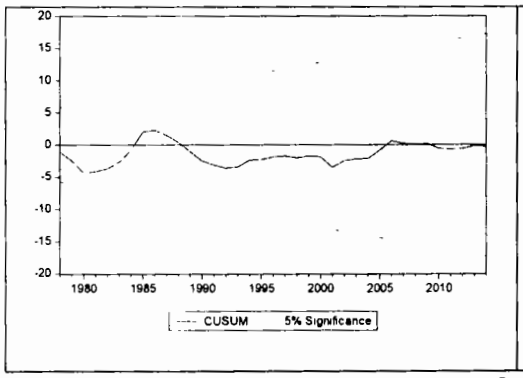
Following are the CUSUM for man CUSUM of variance for different models of different sectors. All the graphs in the Figure.11 depict a control scene.

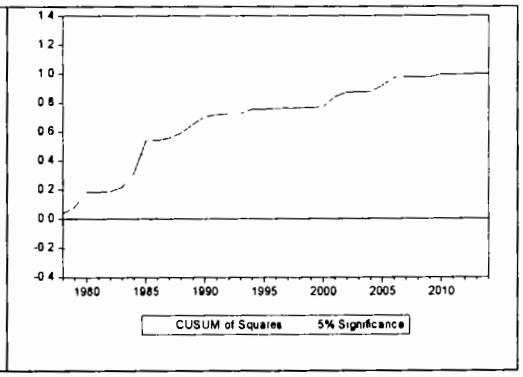
Supply Side Agriculture-Sector



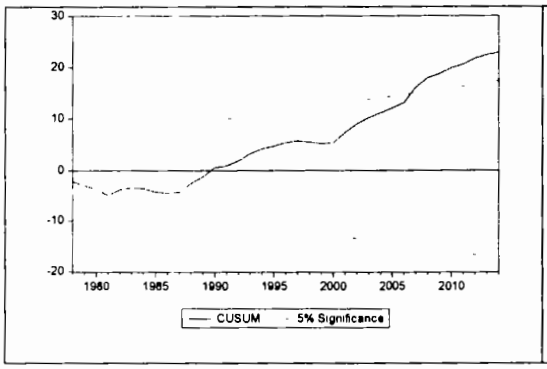


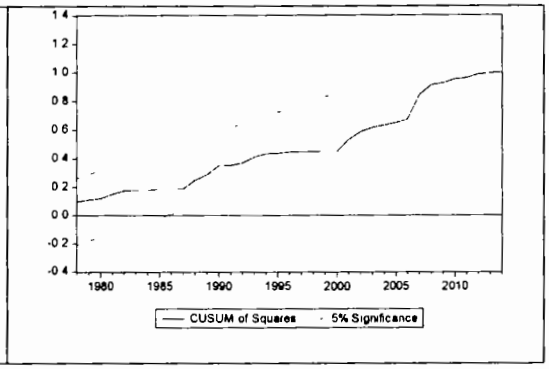
Manufacturing-Sector



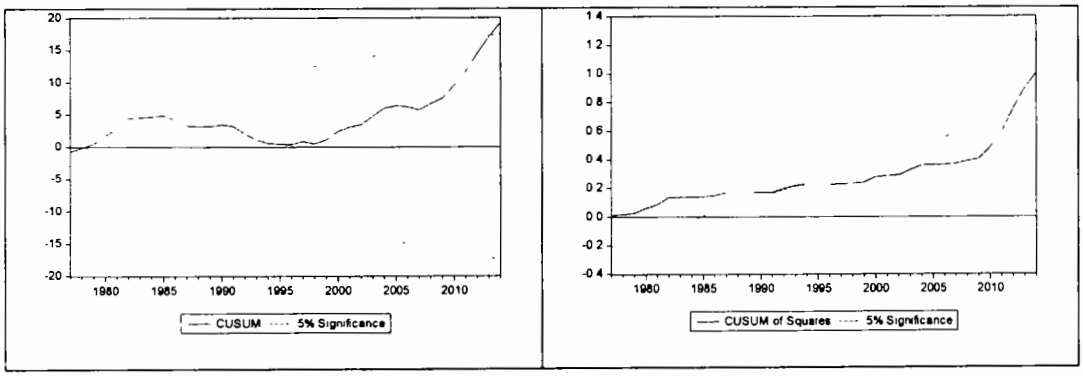


Services Sector





Aggregate Demand Sector Public Consumption



Private Consumption

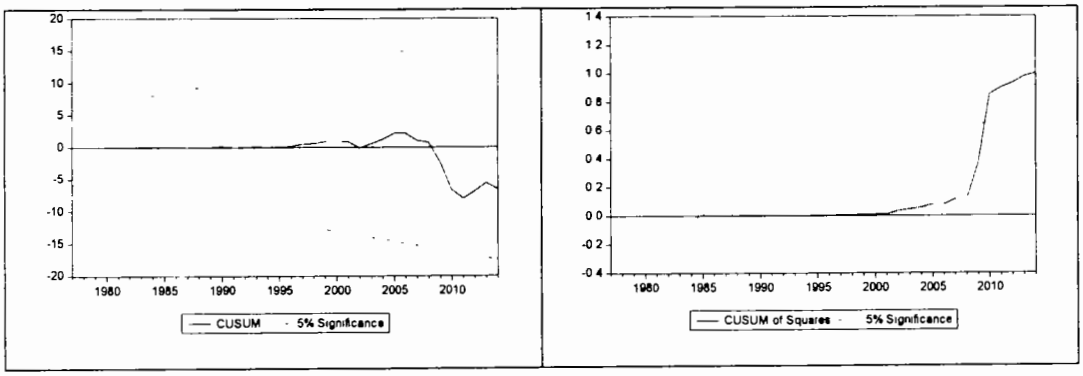


Figure - 11

4.5 Model Validation

The present model is validated by observing the statistics of "mean absolute percentage error" (*MAPE)* and *"the Theil's inequality coefficient" (U)* . These two techniques help in determining the forecasting performance of the estimated regression model. The value for MAPE should be smaller. Close to zero means the forecasted value through the model has less error, if it is zero , the ideal situation that there is no error in estimating the parameter [Khan and Din (2011), Tjipi *et al.* (2004)]. The coefficient for Thiel's inequality varies in between zero and one. This statistics compares the forecasted results with random walk. Closer to zero indicates the fit is good and close to unity means the forecasting is not satisfactory. Table 1 gives the evolutionary forecasts for crucial endogenously active economic factors.

Table-1

Model Authentication Figures

Variables	MAPE	U
Value Added (Agriculture Sector)	3.67	0.03
Value added (Manufacturing Sector)	2.51	0.02
Value added (Services sector)	3.94	0.04
Private consumption (real)	5.66	0.07
Government Consumption (real)	0.92	0.008
Private Investment (real)	7.06	0.09
Government Investment (real)	3.88	0.034
Revenues through direct taxes	2.77	0.024
Revenues through indirect taxes	1.34	0.012
Government Expenditure	0.93	0.026

The statistics in the above table shows that the model is able to track the historical changes in economic growth. All the estimated equations have a good forecasting ability.

Chapter 5
5.1 SUMMARY AND CONCLUSIONS

The study defines the construction of a small-scale dynamic macro economy of province KP. The key objective of the study is to construct a small size dynamic macroeconomic model to link aggregate input, aggregate demand and fiscal quarters of the economy. Since macroeconometric modelling is a very complex exercise because the working of present day economy is very complicated; therefore we hardly claim that our model gives detailed picture of the Pakistan's economy. However, the present model does focus attention to study the behaviour of some key macroeconomic variables and provides some useful findings for the policymakers. The model is estimated using time series data for the period 1973-2014 and the estimated parameter are used to determine the effects of changes in some selected exogenous variables on the key macroeconomic variables. The main findings are summarises below:

In the supply block Capital, Infrastructure and labor strength have a significant part in the agrarian production in short and long runs. Agrarian Credit disbursement has a negative impact on agriculture value added that is mainly because of improper use of the credit. In the manufacturing sector the labor force, infrastructure and raw material exert a positive impact on industrial productivity. The influence of the services sector to the GPDP is meaningfully explained by real aggregate absorption.

In the aggregate demand sector real private consumption is significantly determined by the real disposable income only in long-run but not in the short-run as driven the real interest rate. For consumption made by public sector development expenditure

relative to PGDP, consumption and public returns are chief and significant elements but the influence of public revenue is greater than the development expenditure to gross domestic product. Private investment can be significantly observed through real income, rate of real interest and public investment but income at fixed price has a larger effect. Public investment positively and significantly affect private investment which reveals that the farmer exerts crowding-in effect on the later. The interest rate channel of the monetary policy is weak and is not much effective in KP like Pakistan. The marginal propensity to consume is much more high as compared to marginal propensity to save.

In the fiscal block the nominal income is the key cause of the revenues through direct and indirect taxes and a one-to-one correspondence between the nominal income and direct tax as well as between nominal income and indirect tax is observed. So the income elasticity will be close to unity.

5.2 Policy Recommendations

Following are the policy recommendations made on the theoretical and empirical observations.

- The economy of KP heavily depends on agriculture. The major barrier for agriculture value-added are untrained labour force, agriculture machinery and poor infrastructure. The credit disbursed is regressed negatively following Khan and Din (2011) that indicates improper use of the credit. Farmers usually use this amount on other purposes. So, the budgetary allocation for agriculture should be increased to train the labour. Government should increase the provisions of interest-free loans on easy terms to farmers for the purchase of basic inputs such as seed, fertilizers, farm machinery and for setting up agro-based industries. ZTBL is the big source of agriculture loan the average annual percentage for KP is about 5.8, this percentage should be increased.

- Empirical observations regarding the industrial sector performance is poor. Due to law and order situation a big portion of the industry is closed or sick. A comprehensive strategy and concert efforts should be made by local, provincial and central governments, in the long run. Credit disbursed, infrastructure are seen with poor performance but labour and raw material is proved to be strongly regressed with a significant participation. Labour force is significant both in long and short run but in short run its linear relation is somewhat weak.
- At present Industrial Development Bank Pakistan (IDBP), Pakistan Industrial Credit and Investment Corporation (PICIC) and other major industry loan sources have closed their services for KP by declaring it as a red zone. They

should on priority basis work for the relief of the severely sick industrial sector in the province. This commercial sector should reopen their closed branches to increase the growth through industrial sector.

- Services sector play important role in the growth of economy directly and indirectly. Private consumption has a strong linear relation and prove to be a strong and significant driver of services sector value-added in long and short run as well. The lagged value of services sector is also significant and moderately linearly regressed.
- Private investment is the strongest explanatory economic factor of Economic growth while Public and Private Investments are strongly positively correlated. The government sector development schemes can increase private sector investment. So, provincial government should rely heavily on public development projects and the federal government should support the local bodies to enhance public sector development projects.
- The public sector has proven to be a dis-saver that has a bad impact on private savings. To increase private savings inflation should be checked and controlled. Establishment of predictable and steady economic environment can make more private savings and economic growth as a result.
- Private sector credit is proven to be an important determinant of economic growth in the province. It is observed that insufficient and inflexible credit disbursement restricted the growth in agriculture, industrial and services sectors. So government should increase the limit of loan and flexible the terms and conditions for loans.
- Tax revenues have a positive and effective role in economic growth so for a stable and steady economic growth the tax system should be checked and

improved. Direct tax revenues are proven to be more effective than indirect tax revenues. The system of collecting property tax, wealth tax and income tax should be properly checked and improved.

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Table – 1

List of Endogenous variables and their definitions

Variable	Unit of Description	Definition
Y^a	*Millions of PK rupees*	"Agriculture sector value added"
Y^m	*Millions of PK rupees*	"Manufacturing sector value added"
Y^s	*Millions of PK rupees*	"Services sector value added"
Y^r_t	*Millions of PK rupees*	"Gross Domestic Product (real) at constant prices"
$CONS_t$	*Millions of PK rupees*	"Aggregate consumption calculated as the sum of $CONS^p_t$ and $CONS^g_t$"
$CONS^p$	*Millions of PK rupees*	"Private sector consumption"
$CONS^g$	*Millions of PK rupees*	"Public sector consumption"
CPI	*% (2000=100)*	"Consumer price index"
r^d	%	Real interest rate (Weighted Average Deposit Rate minus inflation rate)
$INVS^G_t$	*Millions of PK rupees*	Government Investment (i e public sector gross fixed capital formation at constant prices
$INVS^p$	*Millions of PK rupees*	"Private Investment (i e gross fixed capital formation at constant prices)"
y^d	*Millions of PK rupees*	"Disposable income calculated as = (Nominal GDP - total taxes+ private sector credit) / CPI"
γ_t	%	"Ratio of investment to CPI"
β	%	"Ratio of development expenditures to PGDP (nominal)"
REV^G_t	*Millions of PK rupees*	"Government total Revenues calculated as sum of DTR, ITR and NTR"
π^I	%	"Rate of inflation of Pakistan"
M2	*Millions of PK rupees*	"Money Supply (Broad money)"
BD_t	*Millions of PK rupees*	"Budget deficit calculated as the difference between GE and TR"
DTR_t	*Millions of PK rupees*	"Revenues through direct taxes"
ITR	*Millions of PK rupees*	"revenues through indirect taxes"

Table – 2

List of Exogenous variables their Unit of description and definitions

Variable	Unit	Definition
L^m	*000 persons*	"Labor force engaged in manufacturing sector"
L^a	*000 persons*	"Labor force engaged in agriculture sector"
Y^n_t	*Millions of PK rupees*	"Gross Domestic Product (at current prices)"
$CRED^a$	*Millions of PK rupees*	"Credit disbursed to agriculture sector"
$CRED^m$	*Millions of PK rupees*	"Credit disbursed to manufacturing sector"
WAT^a	*million acre feet (MAF)*	"Water availability for agriculture sector"
$LAND^a$	*000 of hectares*	"Cultivated land including current follow"
$INFS^a$	*000 of km*	"Infrastructure for agriculture sector Proxies by Road Length"
RD	*Millions of PK rupees*	"Real aggregate demand"
I	*Millions of PK rupees*	"Aggregate Investment"
γ	%	"Ratio of investment and consumer price index"
RM^m	proxies by the agriculture value added	"Raw material for manufacturing sector"
EXP^d	*Millions of PK rupees*	"Development Expenditures"
GPDP	*Millions of PK rupees*	"Provincial Gross Domestic Product (the value of the total economy, and goods and services produced in the respective Province)"
EXP^K	*Millions of PK rupees*	"Expenditure on capital disbursement"
NTR_t	*Millions of PK rupees*	"Non-tax provincial government revenue"

Table – 3

List of Data Sources

- *International Monetary Fund (IMF)*
- *World Data Indicator (WDI)*
- *Khyber Pakhtunkhwa Bureau of Statistics (KPBS)*
- *Pakistan Bureau of Statistics (Federal and Regional Offices) (PBS)*
- *State Bank of Pakistan (SBP)*
- *Population Census Organization of Pakistan (PCOP)*
- *Department of Finance Khyber Pakhtunkhwa*
- *Department of Agriculture Khyber Pakhtunkhwa*
- *Federal Bureau of Revenue (FBR)*
- *National Transport Research Center (NTRC)*
- *Department of Commerce, labor and Technical Education*
- *Zarai Taraqiati Bank Limited (ZTBL)*
- *Industrial Development Bank of Pakistan (IDBP)*
- *Pakistan (PICIC)*

Table-4

List of Publications

- *Khyber Pakhtunkhwa Development Statistics (Different Issues)*
- *Statistical Year Book of Pakistan (Different Issues)*
- *Pakistan Economic Survey (Different Issues)*
- *Labor Force Survey (Different Issues)*
- *Agriculture Census Reports (various issues)*
- *Bulletin of the State Bank of Pakistan* (Various Issues)
- *Annual Budget Statement Khyber Pakhtunkhwa (Different Issues)*
- *Directory for Commerce, Labour and Technical Education (Different Issues)*
- *National Transport Research center (NTRC) Annual Reports*
- *Annual Report of ZTBL (Different Issues)*

Table –5

LIST OF STOCHASTIC EQUATIONS AND MACROECONOMIC IDENTITIES

SUPPLY BLOCK

Stochastic Equations

$Y^m = f(L^m, K^m, INFS^m, CRED^m, RAWM^m)$ ... ... (1)

$Y^a = f(L^a, K^a, CRED^a, WAT^a, LAND^a, INFS^a, FERT)$ ... ... (2)

$Y^s = f(RD^s)$ ... ... (3)

$Y^s = f(CONS^p, CONS^g, \gamma)$ ... ... (4)

Identities

$PGDP = Y^m + Y^a + Y^s$ ... ... (5)

AGGREGATE DEMAND BLOCK

Stochastic Equations

$CONS^p = f(Y^d, r^d, M_2)$... ... ... (6)

$Y^d = [(GPDP + CRED + WR) - (DTR + ITR)] / CPI$ ... ... (7)

$CONS^g = f(REV, \beta, \pi)$ ... ... (8)

$INVS^g = f(EXPK)$ ... ... (9)

$INVS^p = f(Y, r^l, INVS^g)$ ... ... (10)

IDENTITIES

$Y_t = CONS_t + INVS_t + EXP_t + (X_t - M_t)$ ... ... (11)

$I = I^g + I^p$ ..... (12)

Fiscal Block

Stochastic Equations

$DTR_t = f(Y_t^n, \delta_t, \pi_t)$ ... ... (13)

$ITR_t = f(Y_t^n, AITR_t, \pi_t)$ ... ... (14)

$EXP^c_t = f(Y_t, \pi_t)$ ... ...(15)

Identities

$BD_t = EX_t - R_t$ ... ... (16)

$R_t = DTR_t + ITR_t + NTR_t$ ... ... (17)

$EX_t = EX^d_t + EX^c_t + EX^k_t$ ... ... (18)

Table –6

Critical Values for the Augmented Dickey-Fuller Unit Root t-Test Statistics

		Probability to the Right of Critical Value							
Model	N	1%	2.5%	5%	10%	90%	95%	97.5%	99%
Model I (no constant, no trend)									
ADF_{tr}	25	-2.66	-2.26	-1.95	-1.60	0.92	1.33	1.70	2.16
	50	-2.62	-2.25	-1.95	-1.61	0.91	1.31	1.66	2.08
	100	-2.60	-2.24	-1.95	-1.61	0.90	1.29	1.64	2.03
	250	-2.58	-2.23	-1.95	-1.61	0.89	1.29	1.63	2.01
	500	-2.58	-2.23	-1.95	-1.61	0.89	1.28	1.62	2.00
	>500	-2.58	-2.23	-1.95	-1.61	0.89	1.28	1.62	2.00
Model II (constant, no trend)									
ADF_{tr}	25	-3.75	-3.33	-3.00	-2.62	-0.37	0.00	0.34	0.72
	50	-3.58	-3.22	-2.93	-2.60	-0.40	-0.03	0.29	0.66
	100	-3.51	-3.17	-2.89	-2.58	-0.42	-0.05	0.26	0.63
	250	-3.46	-3.14	-2.88	-2.57	-0.42	-0.06	0.24	0.62
	500	-3.44	-3.13	-2.87	-2.57	-0.43	-0.07	0.24	0.61
	>500	-3.43	-3.12	-2.86	-2.57	-0.44	-0.07	0.23	0.60
Model III (constant, trend)									
ADF_{tr}	25	-4.38	-3.95	-3.60	-3.24	-1.14	-0.80	-0.50	-0.15
	50	-4.15	-3.80	-3.50	-3.18	-1.19	-0.87	-0.58	-0.24
	100	-4.04	-3.73	-3.45	-3.15	-1.22	-0.90	-0.62	-0.28
	250	-3.99	-3.69	-3.43	-3.13	-1.23	-0.92	-0.64	-0.31
	500	-3.98	-3.68	-3.42	-3.13	-1.24	-0.93	-0.65	-0.32
	>500	-3.96	-3.66	-3.41	-3.12	-1.25	-0.94	-0.66	-0.33

Table – 7

Critical Values of Chi-Square for the Jarque-Berra (JB) and Lagrange Multiplier(LM) test

υ	α					
	0.100	0.050	0.025	0.010	0.005	0.001
1	2.7055	3.8415	5.0239	6.6349	7.8794	10.8276
2	4.6052	5.9915	7.3778	9.2103	10.5966	13.8155
3	6.2514	7.8147	9.3484	11.3449	12.8382	16.2662
4	7 7794	9.4877	11.1433	13.2767	14.8603	18.4668
5	9.2364	11.0705	12.8325	15.0863	16 7496	20.5150
6	10.6446	12.5916	14.4494	16.8119	18.5476	22.4577
7	12.0170	14.0671	16.0128	18.4753	20.2777	24.3219
8	13 3616	15.5073	17.5345	20.0902	21.9550	26.1245
9	14.6837	16.9190	19.0228	21.6660	23.5894	27.8772
10	15.9872	18.3070	20.4832	23.2093	25.1882	29.5883
11	17.2750	19.6751	21.9200	24.7250	26.7568	31.2641
12	18 5493	21.0261	23.3367	26.2170	28 2995	32.9095
13	19.8119	22.3620	24.7356	27.6882	29.8195	34.5282
14	21.0641	23.6848	26.1189	29.1412	31.3193	36.1233
15	22 3071	24.9958	27.4884	30.5779	32 8013	37.6973
16	23.5418	26.2962	28.8454	31.9999	34.2672	39.2524
17	24.7690	27.5871	30.1910	33.4087	35.7185	40.7902
18	25 9894	28.8693	31.5264	34.8053	37 1565	42.3124
19	27.2036	30.1435	32.8523	36.1909	38 5823	43.8202
20	28 4120	31.4104	34.1696	37.5662	39.9968	45.3147
21	29 6151	32.6706	35.4789	38.9322	41.4011	46.7970
22	30.8133	33.9244	36.7807	40.2894	42.7957	48.2679
23	32 0069	35.1725	38.0756	41.6384	44 1813	49.7282
24	33 1962	36.4150	39.3641	42.9798	45.5585	51.1786
25	34.3816	37.6525	40.6465	44.3141	46.9279	52.6197
26	35 5632	38.8851	41.9232	45.6417	48.2899	54.0520
27	36.7412	40.1133	43.1945	46.9629	49.6449	55.4760
28	37 9159	41.3371	44.4608	48.2782	50.9934	56.8923
29	39 0875	42.5570	45.7223	49.5879	52.3356	58.3012
30	40.2560	43.7730	46.9792	50.8922	53 6720	59.7031
31	41 4217	44.9853	48.2319	52.1914	55.0027	61.0983
63	77.7454	82.5287	86.8296	92.0100	95.6493	103.4424
127	147.8048	154.3015	160.0858	166.9874	171.7961	181.9930
255	284.3359	293.2478	301.1250	310.4574	316.9194	330.5197
511	552.3739	564.6961	575.5298	588 2978	597.0978	615 5149
1023	1081.3794	1098.5208	1113.5334	1131.1587	1143.2653	1168.4972

i. Adjusted R^2

In general, adj-R^2 is an estimation for true population measurement of the extent of the association among the predictors and the response. Like any other estimate, there is a margin of error associated with the estimate. As you increase the number of observations, the precision of the estimate increases (the margin of error decreases). The adj-R^2 associates the descriptive influence of regression statistical models that comprise dissimilar numbers of interpreters. Assume we associate five predictor statistical relation with a higher R^2 to a single regressor relation. Does the five regressors-model have a higher R^2 since it looks somewhat better? Or is the R^2 has a higher value since it contains extra predictors? Merely associate the adj-R^2 standards to find out. A modified style of the R^2 is the adj-R^2. The adj-R^2 rises only if a new term progresses the model more than would be expectable by casual. It declines when a regressor progresses the model by a smaller amount than likely by casual happening. The adj-R^2 may be negative, but usually it does not happen. It is constantly lesser than the value of R^2. It is given by;

$$Adj\text{-}R^2 = R^2 \left(1 - R^2\right) \frac{p}{n-p-1}$$

Where R^2 is the coefficient of determination, p is the total number of explanatory variables and n is the sample size (number of years in the present study).

ii. Sum of Squared Residuals (SSR)

The "residual sum of squares" is a degree of the quantity of errors outstanding between the regression function and available set of data . A small value of RSS signifies a regression function that describes a larger quantity of set of data.

This is the degree of inconsistency between the data and the estimated model. A small RSS indicates a tight fit of the model to the data. It is used as an optimality criterion in parameter selection. In general

$RSS = \sum_{i=1}^{n}(y_i - \hat{y}_i)^2$

iii. Augmented Dickey Fuller (ADF) Test

The Augmented Dickey-Fuller[4] t-statistics is used to check the stationarity of a time series, it tells us when to difference time series data. In our study we have all the three situations that can be faced in a time series. Firstly; when the time series is flat and have no trend and slow-turning around zero,

$$\Delta y_t = \varphi y_{t-1} + \beta_1 \Delta y_{t-1} \ \beta_2 \Delta y_{t-2} \ \ \beta_3 \Delta y_{t-3} \ + \ldots + \beta_p \Delta y_{t-p} \ + \beta_t \qquad \ldots \qquad 20$$

the hypotheses are;

H_0 : $\beta = 0$ i.e. the time series need to be differenced to make it stationary.

H_1 : $\beta < 0$ i.e. the time series is stationary and does not need to be differenced.

At second; when the time series is flat and have no trend and slow-turning around a non-zero value, like rate of inflation, ratios of development expenditure to GPDP and of credit to private sector and PGDP etc,

[4] The critical values for different level of significance are given Table – 7

$$\Delta y_t = \beta_0 + \varphi y_{t-1} + \beta_1 \Delta y_{t-1} \ \beta_2 \Delta y_{t-2} \ \beta_3 \Delta y_{t-3} \ + \ldots + \beta_p \Delta y_{t-p} \ + \beta_t \quad \ldots \quad 21$$

The hypothesis is stated;

H_0 : $\beta = 0$ i.e. the time series need to be differenced to make it stationary.

H_1 : $\beta < 0$ i.e. the time series is stationary and does not need to be differenced.

At third; when the time series is flat and have no trend and slow-turning around a non-zero value, like revenue receipts, GPDP, value added for different sectors of the economy etc,

$$\Delta y_t = \beta_0 + \varphi y_{t-1} + \delta_t + \beta_1 \Delta y_{t-1} \ \beta_2 \Delta y_{t-2} \ \beta_3 \Delta y_{t-3} \ + \ldots + \beta_p \Delta y_{t-p} \ + \beta_t \quad \ldots \quad 22$$

The hypothesis statisticed, is;

H_0 : $\beta = 0$ i.e. the time series need to be differenced to make it stationary.

H_1 : $\beta < 0$ i.e. the time series is trend stationary and needs to be analysed by means of using a time trend in the regression model instead of differencing the series.

Here we have exponentially trended time-series so we might need to take the log and then the series is differenced.

i. Standard Deviation σ

It is a measure of dispersion that measures how much a variable dispersed around its average value.

Model specification Statistics

If the assumptions of the regression model are correct, ordinary least squares (OLS) is an efficient and unbiased estimator of the model's parameters. If the assumptions of the model are incorrect, bias or inefficiency may result. Given the costs of applying OLS when the assumptions are violated, a great deal of recent work in econometrics has focused on the development of statistics to detect violations of the assumptions. These statistics are referred to collectively as *specification statistics*. If these statistics are passed, interpretation of the OLS estimates and application of standard statistical statistics are justified. If one or more of the statistics fails, modification of the model or alternative methods of estimation and testing may be required [Long and Trivedi (1992)].

1. Normality Statistic

It is one of the assumption of the multiple linear regression model that the errors will be normally distributed with zero mean and a constant variance. Most statistics for normality are based either on comparing the empirical cumulative distribution with the theoretical normal cumulative distribution for example Kolmogorov and Smirnov, Anderson and Darling, Chi-Square statistics or empirical quantiles with the theoretical normal quantiles for example Wilk and Shapiro. In contrast, the Jarque-Bera statistic suggested by Jarque and Bera (1965) is based on the sample skewness and sample kurtosis. The Jarque-Bera statistic is defined as:

$$JB = \frac{N}{6}\left(S^2 + \frac{(K-3)^2}{4}\right)$$

with *S*, *K*, and *N* denoting the sample skewness, the sample kurtosis, and the sample size, respectively. This statistic is approximately follows chi-square distribution. And we formulate the hypotheses as;

H_0 : the residuals are normal

H_1 : the residuals are not normal

We shall reject the null hypothesis if $JB > \chi^2_{\alpha,2}$

2. Autocorrelation Statistic

Breuch and Godfrey (1978) developed an *LM statistic* which can accommodate all the drawbacks of prior available statistics such as Durbin and Watson (1950). Let's have a model of the form with one criterion and *k* regressors;

$$y_t = \alpha_1 + \beta_1 \sum_{i=1}^{n} x_{it} + e_t \quad \ldots \quad \text{A}$$

; i= 1, 2, 3, … , n.

Where

$$e_t = \beta_1 e_{t-1} + \ldots + \beta_p e_{t-p} + v_t \quad \ldots \quad \text{B}$$

The statistic combines these two equations and then the null hypothesis is as;

$H_0 = \beta_1 = \beta_2 = \ldots = \beta_p = 0$

H_1 : at least one differ from zero

Following are the steps in performing the statistic;

i. Estimate the model given in equation A by OLS and obtain residuals $\hat{e_t}$.

ii. Run the regression for the model in equation B given above with the number of lags (p) according to the order of serial correlation.

iii. Compute the *LM-Statistics = (n-p)* R^2 from the regression in *step ii.* If *LM-Statistics* > $\chi^2_{p,\alpha}$ we then reject the null of no serial correlation.

3. Heteroscedasticity Statistic

White (1980) developed a more general statistic for heteroscedasticity. This statistic eliminates the problems that appeared in the previous statistics for example Goldfeld and Quandt (1965), Park (1966), Glesjer (1969) and Breusch and Pagan (1979).

Let us have following model with one criterion and n regressors,

$$y_t = \alpha_1 + \beta_1 \sum_{i=1}^{n} x_{it} + e_t \quad ; \quad \text{i= 1, 2, 3, ... , n.}$$

The steps involved in White's statistic are;

i. run the regression of model above and obtain the residuals of this regression equation.

ii. run the following auxiliary regression;

$$e_t^2 = \delta + \sum_{i=1}^{n} \delta_i x_{it} + \sum_{i=1}^{n} \pi_i x_{it}^2 + v_t$$

iii . formulate the null and alternative hypotheses'

$$H_0 = \delta_1 = \delta_2 = \ldots = \delta_n = \ldots = \pi_1 = \pi_2 = \ldots = \pi_n = 0$$

H_1 : at least one δ_i or π_i is not zero.

iv. Compute the $LM = tR^2$ *statistic*. Where t is the number of years. This statistic follows chi-square distribution with n-1 degrees of freedom.

v. Reject the null hypothesis if *LM-statistic* > $\chi^2_{n-1,\alpha}$ otherwise accept the null and conclude the homoscedasticity.