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Economic Management Modelling in the ECO Region

3RD MILESTONE REPORT

| Islamabad, Pakistan

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PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS

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List of Acronyms

ACF	Auto Correlation Function
AD	Aggregate Demand
ADF	Augmented Dickey Fuller
ARDL	Auto Regressive Distributed Lags
ARFIMA	Auto Regressive Fractionally Integrated Moving Average
ARIMA	Autoregressive Integrated Moving Average
ARMA	Auto Regressive Moving Average
AS	Aggregate Supply
BEQM	Bank of England Quarterly Model
CES	Constant Elasticity of Substitution
CGE	Computable General Equilibrium
CIS	Commonwealth of Independent States
COMFAC	Common Factor
CPEC	China Pakistan Economic Corridor
DGP	Data Generating Process
DSGE	Dynamic Stochastic General Equilibrium
ECM	Error Correction Mechanism
ECO	Economic Cooperation Organization
ECT	Error Correction Term
FDI	Foreign Direct Investment
FRB/US	Federal Reserve
G2S	general to specific
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GEM	Global Economic Model
IMF	International Monetary Fund
IS	Investment – Savings
JEM	Japanese Economic Model

KITT	Kiwi Inflation Targeting Technology
LFPR	Labor Force Participation Rate
LM	Liquidity – Money
MAPE	Mean Absolute Percentage Errors
MAS	Modelling And Simulation
NAIRU	Non-Accelerating Inflation Rate of Unemployment
NEMO	Norwegian Economic Model
OLS	Ordinary Least Squares
PACF	Partial Auto Correlation Function
PAM	Partial Adjustment Model
QPM	Quarterly Projection Model
QPS	Steady State Version of Quarterly Projection Model
SBP	State Bank of Pakistan
SSS	Strict Steady State
TOTEM	Terms-Of-Trade Economic Model
USD	United States Dollar
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
VMA	Vector Moving Averages
WTO	World Trade Organization

Executive Summary

Effective macroeconomic management promotes macroeconomic stability and unleashes productive forces in the economy for sustainable economic growth. Macro-econometric models are important tools that can help in devising appropriate fiscal and monetary policies to achieve growth and development objectives. This study has developed a set of macro-econometric models for the Economic Cooperation Organization (ECO) member countries that provide a rigorous macroeconomic framework for conducting policy simulations and forecasting. The models have been specified based on latest research while widely used time series techniques have been employed for estimations and forecasting.

The simulation results for Afghanistan's economy show that the economy is beset by an adverse security situation which continues to hamper economic growth. The results show that while the economy will grow at a moderate rate in the medium term, the high rate of population growth will offset any gains in the real sector thereby reducing per capita income. This has important implications for macroeconomic policy in Afghanistan. In particular, there is a need to tackle the security challenges to prepare the ground for an economic revival that focuses on boosting the commodity producing sectors while at the same time maintaining macroeconomic stability.

For Azerbaijan, the estimated models and projections show that while the economy exhibits a robust trend for economic growth, there is a need to diversify the economy and promote non-oil manufacturing and services sectors for sustained economic growth.

Currently the macroeconomic environment in the economy depends on fluctuations in oil prices which determine government revenues and hence the level of fiscal deficit. A more diversified economy will lead to a more stable revenue stream thus enabling the government to undertake crucial development spending to enhance productivity and boost economic growth.

The model for Iran's economy has highlighted key macroeconomic relationships in the long run as well as their short run dynamics. The results show that the economy will grow at a sluggish rate not least because of continued sanctions that may impede international trade and investment. Macroeconomic stability in Iran is expected to prevail on the back of low fiscal deficit and prudent monetary management to contain inflationary pressures. The economy continues to rely largely on the oil sector and there is a need to achieve greater diversification for broad-based growth. The current economic reforms program can be instrumental in encouraging private investment through improvement in business climate and provision of better physical infrastructure.

Like many other economies in the region, Kazakhstan also relies heavily on the energy sector though it has managed to establish a significant industrial base along with a services sector. Though Kazakhstan's recent economic performance has been lackluster, our projections show a positive growth outlook in the medium term as the non-oil economy is expected to grow on the back of policies aimed at greater economic diversification.

The estimated model for Kyrgyz Republic highlights important macro-economic relationships that dictate the performance of the Kyrgyz economy. The performance of the Kyrgyz economy significantly depends on its trade relations with Russia and remittances from its migrant labor working in Russia. Weak economic growth in Russia have led to sluggish economic growth in the Kyrgyz Republic. On the other hand, while currency depreciation added to the inflationary pressure initially, inflation has subsided in recent years due mainly to low international prices of food. The medium-term outlook for the economy is moderate growth with a stable macroeconomic environment.

A comprehensive macro-econometric model of Pakistan's economy covers all the major building blocks including production, aggregate demand, fiscal and monetary framework, and foreign trade and capital inflows. The model has been used to generate forecasts of key macroeconomic variables in the medium term. The results show that while the economy will remain vulnerable on account of rising external imbalances, the manufacturing and services sector are likely to post robust growth in the medium term. Also, prudent macro-economic management is expected to help reduce fiscal deficit through increase in direct and indirect revenues and targeted expenditure towards productivity-enhancing spending. Pakistan needs to urgently tackle its ballooning current account deficit that is threatening macroeconomic stability and may pose a significant risk to economic growth in the short to medium term.

Dynamic simulations in the case of Tajikistan's economy reveal that aggregate demand plays an important role in the expansion of services sector which accounts for more than 40 percent of Gross Domestic Product (GDP). Whereas public investment helps attract private investment in the economy, public consumption responds to the level of domestic economic activity to cater to the growing demand for public goods and services. The medium-term economic outlook is moderate for Tajikistan though high fiscal deficit may pose a risk to macroeconomic stability. There is thus a need for the government to rationalize public spending and generate more revenues to reduce fiscal deficit to a more sustainable level.

Like Pakistan, a detailed macro-econometric model for the Turkish economy focuses on major commodity producing sectors on the supply side along with major components of aggregate demand, fiscal and monetary variables and foreign trade sector. While economic growth in the medium term is projected to remain modest, the macroeconomic environment is expected to be characterized by relatively high inflation. On the external front, both exports and imports are likely to show robust growth. Despite this, however, the Turkish economy is vulnerable to external shocks as its firms are leveraged with external debt and recent currency depreciation has worsened their balance sheets. These developments could hamper the growth momentum and raise the risk of macroeconomic destabilization. The immediate policy concern for Turkey is thus to bolster its currency and help its troubled firms to restructure their loans. The Turkish economy has demonstrated resilience in the past and given prudent macroeconomic management, it is expected to effectively deal with the emerging challenges and recharge the process of economic growth.

For Turkmenistan, the study has conducted simulation and forecasting of major segments of the economy including production, demand, fiscal and monetary framework and foreign trade. Like many other economies in the region, Turkmenistan' economy is driven by hydrocarbons and consequently its macroeconomic environment depends heavily on international developments in hydrocarbons. While the economy is expected to grow strongly in the medium term, the growth would likely be concentrated in the energy sector making the economy vulnerable to international shocks. Turkmenistan needs to diversify its economy for a more broad-based sustainable growth.

Uzbekistan's macro-econometric model consists of simulation and forecasting of supply and demand aggregates as well as fiscal and monetary variables and external trade. Over the years, the economy has diversified and all the productive sectors including manufacturing, agriculture and services play an important role. The Uzbekistan's economy has a robust growth outlook in the medium term though macro-economic stabilization may pose a challenge as inflation remains high and this trend may persist in the medium term. However, the strong fiscal position may allow the government to pursue a tight monetary policy to curb inflationary pressures in the economy. The government's economic reforms program is expected to boost private investment leading to job creation and sustained economic growth.

The macro-econometric models developed in the present study can form the basis of economic policies that are based on a complete understanding of the underlying macroeconomic structures and dynamic properties of the relevant macroeconomic variables. Furthermore, the ECO member countries can develop coordinated policy responses to external shocks duly taking into their specific macroeconomic structures and the level of regional integration as shown by the intra-regional trade and investment flows. Macroeconomic stabilization efforts based on a sound macro-econometric model are expected to be more effective in promoting a macroeconomic environment that is conducive to private investment, job growth and prosperity for the citizen of the ECO member countries.

Chapter 1 - Economic Management Modelling

1.1. Introduction

Prudent macroeconomic management is essential for putting the economies on the path of sustainable economic growth. However, effective macroeconomic management requires a rigorous framework to identify the key relationships in the economy and to estimate the impact of exogenous changes in policy variables on macroeconomic aggregates including for example fiscal position, external account balance, exchange rates, and domestic credit. Since one of the principle aims of the ECO is to increase mutually beneficial cooperation with regional and international organizations. The commonalities present between member countries indicate a big potential for cooperation in area of economic development in these resource rich economies. A coordinated development strategy is essential for achieving this objective.

This study is expected to provide the ECO decision making bodies with the economic management strategy for the ECO region. The development of macro-econometric model will help concerned authorities of member countries to better pursue their macroeconomic goals including job creation, economic growth and external stability. Economic management is an important component of a nation's strategies for economic development and subsequently a better standard of living for citizens. In this era of globalization, economic opportunities arising from the global market can be better harnessed through efficient economic management. Economic management modelling provides tools and procedures through which this objective could be realized. An efficient economic management strategy must address structural issues. It must be designed and conducted against the background of local conditions and circumstances. Priorities must be set with a longer-term perspective. The key objective of this study is to develop a macro-econometric model for the ECO member countries that can provide a rigorous analytical platform for assessing the impact of macroeconomic policies in the economy. Such models are widely used to conduct evaluation of macroeconomic policies as well as to forecast the trajectory of key macroeconomic variables. Specifically, the study shall:

i. Develop a model specification based on latest research in macro-econometric modelling.
ii. Collect time series data on all the relevant variables that appear in model specification.
iii. Estimate the model using the latest econometric techniques.
iv. Evaluate the robustness of the model using the standard evaluation criteria.
v. Work out the quantitative impact of exogenous changes in policy variables on macroeconomic aggregates including, for example, fiscal position, external account balance, exchange rates and domestic credit.
vi. Provide medium term forecasts of key economic variables including rate of economic growth, inflation rate, unemployment rate, fiscal deficit, monetary aggregates, exchange rates and trade and current account balances.
vii. Develop a set of concrete policy recommendations based on the overall direction of the economy predicted by the model.

Chapter 2 - Economic Management Modelling – A Primer

2.1. Introduction

Understanding the behavior of the economy in response to various internal and external shocks has long been a topic of research and debate amongst economists and policy makers alike. Macro-econometric models are systems of equations designed to explain the behavior of the economy in terms of policy, institutional and structural variables. The basic idea behind structural macro-econometric modelling based on solid theoretical reasoning rather than empirical observation was laid out by the Cowles Commission. Ever since this groundbreaking work, substantial efforts have been made to turn this framework into a practical tool. Since the 1980s there has been a renewed interest in macro-econometric models with four key issues being explored in the literature namely: designing models to inform policy formulation and implementation; estimating parameters of these models; determining the best approach to evaluation of the model's predictive power; and policy analysis.

This chapter sets the stage for a detailed analysis of economic management modelling for policy design and implementation in the ECO region by providing the theoretical underpinnings and specifics of the model that will be used. Section 2.2 reviews the development of core macroeconomic models for policy use by bringing into focus four distinct generations of econometric models. Section 2.3 outlines the specification that will be used in the present context with details of the various blocks and sub-blocks that have been identified. Brief workings of the model are enumerated in Section 2.4 and conclusions are presented in Section 2.5.

2.2. Generations of Macro-models for Policy Use

Over the decades macro-econometric models have served as important tools of analysis for macro-econometric forecasting and policy assessment (Hervé *et al.*, 2011). The concept of macro-econometric modelling itself can be traced back to the work of Jan Tinbergen in the 1930s. Fukac and Pagan (2010) have identified four generations of macro-models for policy use. Our emphasis is on the 3rd generation (G-III) macro-econometric models, as it provides us an appropriate basis for the empirical analysis in the present context of economic management modelling in the ECO region.

2.2.1. First Generation Models (G-I)

The G-I generation models evolved during 1950s and 1960s based on standard IS/LM framework determining the **demand** side of the economy (Fukac and Pagan, 2010). These models became very large with the disaggregation of the components of national income identity. Dynamics is incorporated in these models in two ways. One way is to make regressand (y_t) a function of lags of regressor (x_t) and if the number of lags is large (as might be the case for the effect of output upon investment) then some restrictions are imposed on the lagged effects of a change in regressor upon regressand. One of the versions of these restrictions is termed as "Almon lags" (Almon, 1965). Alternatively, the dynamics are imposed using a different strategy associated with the Partial Adjustment Model (PAM) having the structure given in Eq (2.1):

$$\Delta z_t = \delta(z_t^* - z_{t-1}) \tag{2.1}$$

Where z_t^* is some target for z_t which is made observable by relating it to a functional form of regressor (x_t). The specification of the functional form connecting z_t^* and x_t in Eq (2.1) is normally derived from theoretical ideas. For example, targeted consumption c_t^* can be related to income (y_t) and interest rate (r_t). This yields Eq (2.2) below:

$$c_t^* = \alpha y_t + \beta r_t \tag{2.2}$$

Another key issue that has a long history in macroeconomic discussions is the modelling of expectations in these models. Typically, expectations are modeled as a combination of the past history of a set of variables with the weights attached to those variables being estimated directly using the observations on the variable's expectations.

The first generation models are demand driven while the supply side in these models is ignored and as a consequence no attention is paid to stocks and flows. Wallis (1999) states that these models assume that variables evolve deterministically over longer periods of time without discussing whether such paths are consistent over time. Also, the role of relative magnitudes of the variables is usually not taken into account in model design. The link between the real and nominal sides of the economy is established by treating prices as a markup over wages where the mark-up is influenced by business conditions. A dynamic explanation of wages is suggested by the standard Phillips curve while later versions directly work with rate of inflation with the following structure given in Eq (2.3) here:

$$\pi_t = \alpha_1 \pi_{t-1} + \alpha_2 u_{t-1} + \varepsilon_t \tag{2.3}$$

Where π_t is price inflation and u_t is the unemployment rate. A debate prevailed about whether there was a trade-off between inflation and unemployment i.e. $\alpha_2 \neq 0$, $\alpha_1 < 1$. The same relation can be augmented as Eq (2.4) below:

$$\pi_t = \alpha_1 \pi_{t-1} + \alpha_2 (u_{t-1} - \bar{u}) + \gamma (p_{t-1} - lc_{t-1}) + \varepsilon_t \tag{2.4}$$

Where p_t is the log of the price and lc_t is the unit labor cost. This modification relates prices to wages. Without such modifications, there is no guarantee that the level of prices and wages would be related. These models are generally estimated using single equation methods hence their evaluation largely involves applying a range of specification tests to the individual equations. Eq (2.5) specifies a representation of these equations:

$$y_t = \beta_1 y_{t-1} + \beta_2 z_t + \beta_3 z_{t-1} + \varepsilon_t \tag{2.5}$$

Where z_t is a vector that may contain endogenous variables. Specification tests are based on residuals ε_t that are supposed to contain information about specification problems. Although useful, these residual based specification tests are unable to test the forecasting ability of these models. For that it needs to be recognized that z_t is not given but also needs to be solved for. The performance of system of equations and single equation methods might therefore be very different.

One can estimate a numerical value for z_t from the model (given some exogenous variables). The software developed to do so is an important innovation of this generation of models. In multi-step forecasts, both y_{t-1} and z_{t-1} need to be generated by the model and for this purpose dynamic simulation methods evolved.

2.2.2. Second Generation Models (G-II)

The G-II models evolved in early 1970s and prevailed for the subsequent two decades. Driven by inflation and oil price shocks of the early 1970s these models are based on standard Aggregate Supply (AS)/Aggregate Demand (AD) model, which are generally recognized as **supply** side models (Fukac and Pagan, 2010). These models introduce production function as a constraint to aggregate supply primarily over longer time horizons. The RDX2 model of the Canadian economy developed by Helliwell *et al.* (1971) is credited as spearheading the development of these models.

The G-II models preserve much of the composition of the previous generation in that the demand side is captured by disaggregated equations stemming from the national income identity. These equations are augmented by equations which incorporate **supply side** features. Some versions also model consumption decision and the choice of factors of production. An inter-temporal dimension is introduced in consumption patterns by utilizing life-cycle hypothesis. Resultantly, consumption is modeled as function of financial wealth (w_t) and current labor income (y_t) i.e. $c_t^* = ay_t + bw_t$. To make the model dynamic, distributed lags are introduced in long run relationships determining the desired levels z_t^*. A key advancement on previous work is the use of an Error Correction Mechanism (ECM) form given in Eq (2.6) below:

$$\Delta z_t = \alpha \Delta z_t + (z_{t-1} - z_{t-1}^*) \tag{2.6}$$

Initially employed by Sargan (1964) in inflation modelling, the ECM is extensively used by Davidson *et al.*, (1978). A production function is introduced in this model, and household's decisions are assumed to be governed by a life cycle perspective. Furthermore, the presence of household wealth and the capital stock implies that dynamics in the model stem from depreciation and savings. Consequently, dynamic stability of the complete system remains a pressing issue.

Just like first generation models there is variety in the second-generation models. Often this variety is the result of a slow absorption of new features that have gained increasing importance in academic research. The determination of real quantities in G-II models and formulation of expectations are devised in an ad hoc way. One of the reasons is the size of the models. The U.K. models are the most advanced in making expectations consistent with the model. By mid 1980s a number of models were introduced, such as the London Business School and National Institute models, which had implemented such solutions (Wallis and Whitley, 1991). This was due to the influence of the Macro-Economic Modelling Bureau at the University of Warwick.

With some modifications the dynamics in prices are introduced through the Phillips curve which can be formulated as Eq (2.7) given here:

$$\pi_t = \alpha\pi_{t-1} + \beta(u_t - u) + \varepsilon_t \tag{2.7}$$

Where u is the NAIRU (Non-Accelerating Inflation Rate of Unemployment), and, often, $\alpha = 1$. The NAIRU is assigned a prescribed value which remains the object of attention. Many of these models are designed to exhibit dynamic stability and would converge to an equilibrium deterministic path.

2.2.3. Third Generation Models (G-III)

G-III models became dominant in the 1990s. Unlike the approach of previous generation, where one starts with steady state relation (deterministic growth path or balanced growth path) and then introduces dynamics as per need of presenting data broadly; the third generation (G-III) models took a reverse approach. One of the problems with G-II models was to vary stocks in such a way as to exhibit constant ratios to flows (Fukac and Pagan, 2010). But it was more likely that there would be stock-flow consistency if decisions about expenditure items came from well-defined optimization choices for households and firms, and if rules were employed to describe the policy decisions of monetary and fiscal authorities. In connection with the latter, external debt was taken to be a fixed proportion of GDP and fiscal policy was varied to achieve this. Monetary authorities needed to respond robustly enough to expected inflation.

Amongst many versions of G-III models, an early one was an Australian model by Murphy (1988) and a multi-country model (MSG) by McKibbin and Sachs (McKibbin, 1988; McKibbin and Sachs, 1989). G-III models were frequently used in the 1990s, such as at the Reserve Bank of New Zealand (Forecasting and Policy System, Black *et al.,* 1997), the US Federal Reserve (FRB/US, Brayton and Tinsley, 1996) and the Bank of Japan's Japanese Economic Model (JEM, Fujiwara *et al.*, 2005). The most significant of these was QPM (Quarterly Projection Model) built at the Bank of Canada in the early to mid-1990s (Black *et al.*, 1994; Coletti *et al.*, 1996). The steady state version of this model; (QPS) was basically an adaption of the Ramsey model for policy use. The Ramsey model played a major role in theoretical economics rather than empirical macroeconomics.

The difference between G-II and G-III models is on the determination of equilibrium consumption. In G-II the consumption ultimately depends on financial wealth and labor income, but G-III models use a deeper set of parameters like the steady state real rate of return, utility function parameters and the discount factor. Since these parameters affect other decisions made by agents, any given relationship cannot be varied easily. For example, the relation between consumption and wealth cannot be varied without being forced to the impact other variables of such a decision. Thus, a steady state model is at the heart of G-III models. Eventually in a strict steady state (SSS), the dynamic process ceases and values of the variables consistent with these equations become constant. But the SSS model has embedded in it a built-in dynamic that describes the transition from one steady state position to another. These dynamics come from the fact that the capital stock depreciates, and assets accumulate. Therefore, solving the model produces an intermediary steady state solution for the model variables i.e. these variables will vary over time due to the fact that movements from one point to another are not immediate. In addition to this feature, in G-III models some variables are taken to be exogenous.

The intrinsic dynamics of steady state are seldom sufficient to track the movements of variables in actual economies and it becomes necessary to enhance the built-in dynamics which involves a second stage optimization. The intrinsic dynamics in QPS might be called the first stage dynamics while the extra dynamics introduced into QPMs could be labeled as the second stage dynamics. In QPM, as evident from Eq (2.8), the extra dynamics are introduced in a quasi-theoretical way by choosing z_t to minimize the following objective function:

$$\frac{1}{2}\sum_{j=0}^{\infty}\theta^j E_t\left\{\left(z_{t+j}-z_{t+j}^*\right)^2+\emptyset\left(\Delta z_{t+j}-E\left(\Delta z_{t+j}\right)\right)^2\right\}^* \tag{2.8}$$

Where $E_t(.)$ is the expected value conditional upon the information available at time t. Setting $E(\Delta z_{t+j}) = 0$ would produce an optimal rule for determining z_t (the Euler equation) as seen in Eq (2.9) below:

$$(1+\varphi+\beta\varphi)z_t+\beta\varphi E_t z_{t+1}-z_t^*=0 \tag{2.9}$$

And an ultimate solution for z_t of the form is given in Eq (2.10) here:

$$z_t=\lambda z_{t-1}+\frac{\lambda}{(1-\emptyset)}E_t\sum_{j=0}^{\infty}(\theta\lambda)^j\, z_{t+j}^*, \tag{2.10}$$

Where λ depends on θ and Φ. Thus, z_t can be constructed by weighting together past and future expected values of z_t and z_t^*. Because expectations in G-III models are of the perfect foresight variety model-consistent expectations would mean that $Et\left(z_{t+j}^*\right)=z_{t+j}^*$. But, in the practice, the expectations are modeled as a function of the steady state model solution, a finite number of lagged values of z_t , and the solution for z_{t+j}^* from QPM itself. The weights attached to these components are prescribed by the modelers. The quadratic optimization method explained above would result in an ECM connecting z_t and z_t^*, when z_t^* is a scalar and follows an autoregressive process, (Rotemberg, 1982; Nichell, 1985). Hence, effectively QPM is imposing a set of ECM equations that determines the outcomes for z_t by reference to the short-run steady state values z_t^*.

In G-III models, nominal quantities are handled by modelling prices as a markup on marginal costs and then structuring the relation to handle dynamics and expectations. As marginal costs are primarily wages, a Cobb-Douglas production function and perfect competition means that the wage share in GDP is a constant in equilibrium. With these ideas, the G-III Phillips curve has the form:

$$\pi_t = \alpha_1 E_t \pi_{t-1} + (1 - \alpha_1) E_t \pi_{t-1} + \delta \Delta mc_t + \omega(p_{t-1} - mc_{t-1}), \tag{2.11}$$

Where mc_t is the log of nominal marginal cost and $p_{t-1} - mc_{t-1}$ is lagged real unit labor costs. Thus, as evident in Eq (2.11), current inflation is determined from past inflation, future expectations of inflation, current growth in nominal costs and the extent to which real unit labor costs are not constant.

Formal estimation of parameters of these models requires information on key ratios such as consumption to income ratio. Evaluation of these models has been very difficult and thus rarely done. The steady state solutions for the logs of the endogenous variables are constructed from the exogenous variables by using a set of weights that are functions of the model parameters, and these parameters are assumed to be time invariant. Such assumptions imply constancy in a number of ratios. For example, the investment to capital stock ratio would be a constant since, in steady state; it equals a parameter - the depreciation rate of capital. In practice, however, these ratios are rarely constant and thus there is a mismatch between the actual data and model predictions. To deal with this problem, observed ratios are smoothed using filters to produce an adjusted ratio that changes slowly and converges to a pre-specified long-run ratio in the steady state. Basically, this strategy means that the steady state model parameters are allowed to vary smoothly over time with the restriction that they converge to a set of final steady state choices.

The attention of G-III models is centered upon the “gap” between z_t and z_t^* and consequently all the variables are converted to “gap” format, particularly when the models are used in forecasting mode. This enables modelers to improve forecasting performance by augmenting the equations for z_t with variables that are zero in the steady state. Hence, in the case where z_t is the log of the price level, one could add on an output gap to the equation that comes from the second stage optimization. This emphasis on “gaps” gave rise to the academic models known as New Keynesian, and today these small models are often used for policy analysis and some forecasting e.g. Berg, Karam and Laxton (2006).

To some extent the philosophy governing G-III models is common, with a stream of literature on Computable General Equilibrium (CGE) modelling stemming from Johansen (1960). In that literature models are log-linearized around some “steady state” values and the computation of these steady states (often termed the benchmark data set) involves exploitation of data on input-output tables etc. Another feature of G-III models is the treatment of shocks to variables. With the introduction of policy rules, one could no longer think about changing variables such as government expenditure or the money supply, since these are now endogenous variables. Only exogenous shocks to them might be varied. Application of these models to a small-open economy with the rest of the world treated as exogenous resulted in an implausible implication that agents could borrow indefinitely at fixed external rate of interest. Two adjustments have been proposed to deal with this problem. In the first, the infinitely-lived consumers of the Ramsey model are replaced by agents with finite lives, i.e. in the model the representative consumer's discount rate depends on the probability of death. A second approach is to introduce risk premium that rises with the level of foreign borrowing so that eventually agents would not wish to borrow from foreign sources to finance consumption. The ratio of foreign debt to GDP therefore becomes a crucial element in the latter models and consequently decision rules had to be constructed to ensure that this prescribed ratio was achieved in steady state (see Schmitt-Grohé and Uribe, 2003, for a discussion of strategies for dealing with this issue).

2.2.4. Extensions of G-III Models

Extensions of G-III models represent an achievement of the program for adapting the Ramsey model for policy use. Just like G-III models, the extensions are designed to have an underlying steady state representation. But other features of their design are different from the standard G-III models. Four of these are of particular importance. Firstly, shocks become explicitly part of the model and their persistence describes the dynamics of the model. However, the non-observability of shocks (they are essentially defined by the model itself) points to the need to quantify the parameters of the model from data. Secondly, there is no second-stage process to introduce dynamics in the model. Instead, the adjustment cost terms used to rationalize slow adjustment in G-III models now appear directly in the primary objective functions that lead to the agent's decision rules i.e. the short and long-run responses are found simultaneously rather than sequentially. Thirdly, the structural equations of the model are kept in Euler equation form rather than using a partially solved-out version as was characteristic of G-III models. One reason for doing so is that it is easier to modify the model design through its Euler equations. Finally, since shocks become an integral part these models, solution methods are needed to account for the shocks. With focus on shocks a careful treatment is needed when referring to “forward” and “backward” expectations; all expectations are formed using information available at time t, and so technically all depend on past observations except for the exogenous variables in the system. Another effect of the shift to a “shocks” perspective is that the distinction between “parameters” and “shocks” becomes fuzzy. Thus, a depreciation rate might now be treated as a random variable that evolves randomly over time with an expected value equal to whatever specified value for it appears in the steady state model. This provides a formal way of allowing the model parameters to change, something that was only done in an ad hoc way in G-III models.

2.2.5. Fourth Generation Models (G-IV)

The fourth generation of macro-models evolved in the early 2000s and these models have been developed primarily by many central banks and institutes. Some of the representative models are TOTEM (Bank of Canada, Murchison and Rennison 2006), MAS (the Modelling and Simulation model of the Bank of Chile, Medina and Soto, 2005), AINO at the Bank of Finland (Kuismanen, Ripatt and Vilmunen, 2003), SIGMA (Erceg, Guerrieri and Gust, 2006) at the U.S. Federal Reserve, and KITT (Kiwi Inflation Targeting Technology) at the Reserve Bank of New Zealand, (Beneˇs *et al.*, 2009). GEM (the Global Economic Model of the IMF, Laxton and Pesenti, 2003), BEQM (Bank of England Quarterly Model, Harnett *et al.*, 1987), NEMO (Norwegian Economic Model at the Bank of Norway, Brubakk *et al.*, 2006), The New Area Wide Model at the European Central Bank, (Christoffel, Coenen and Warne, 2008), the RAMSES model at the Riksbank (Adolfson *et al.*, 2007).

A key departure in G-IV models is the specification of the optimal inter-temporal rule describing consumption decisions as follows:

$$C_t = \beta E_t (C_{t+1} \cdot R_{t+1}) \tag{2.12}$$

This representation in Eq (2.12) contrasts with the G-III model approach that combines this relation with the wealth accumulation identity (to express consumption as a function of financial wealth) and labor income (Fukac and Pagan, 2010). The reason for doing so is that it is easier to modify the model design through its Euler equations. An example is the extra dynamics introduced into consumption decisions by the use of habit persistence. This can take a number of forms, but often results in the addition of C_{t-1} to the equation to give:

$$C_t = \beta E_t\left(C_{t-1}^{\gamma} C_{t+1}^{1-\gamma} R_{t+1}\right) \tag{2.13}$$

The extensions given in Eq (2.13) in G-III modelling are essentially adjustments to the basic strategies employed in the design of 3G models and are intended to produce a more precise and satisfactory statement of the design criteria. But there are also additions, which signify the properties of G-IV. Some of these are mentioned below:

1. As usual these models are about aggregates, but the theoretical structure is based on information about the actions of heterogeneous units. The aggregation of micro decisions is done by using an "aggregator" akin to CGE modelling. This uses Constant

Elasticity of Substitution (CES) functions as a way of combining the separate items into a compound commodity. On account of the use of CES functions any underlying heterogeneity has an impact only through the presence of parameters that describe the nature of the heterogeneity i.e. the distribution of the micro-decisions. Based on a micro-economic structure, the model can potentially expand the range of information available for parameter estimation using studies of micro-economic decision making.

2. For the firms following different pricing strategies, the aggregation method described above outlines the basis of the Calvo pricing model. In this pricing model some firms can optimally adjust their prices each period while other firms need to follow a simple rule-of-thumb. Consequently, the heterogeneity in decisions about prices can be summarized by a single parameter - the fraction of firms (θ) who are able to optimally reset their price at each point in time. The aggregate Phillips curve can then be shown to have the form:

$$\pi_t - \bar{\pi} = \frac{1}{1+\beta}(\pi_{t-1} - \bar{\pi}) + \frac{(1-\theta)(1-\beta\theta)}{\theta(1+\beta)}(rmc_t - \bar{r}\bar{m}\bar{c}) + \frac{\beta}{1+\beta}E_t(\pi_{t-1} - \bar{\pi}) + \varepsilon_t \tag{2.14}$$

rmc_t is the real marginal cost (or unit labor costs with a Cobb-Douglas production function) and $\bar{\pi}$ is a target rate of inflation in Eq (2.14). Instead of using the Calvo pricing structure in G-IV models, sometimes the approach used by (Rotemberg, 1982) is employed. But interestingly, the nature of the Phillips curve is very similar.

3. Initially in G-IV models, technology was treated as stationary; many models now allow the technical change to have a stochastic permanent component and a deterministic one. Thus the "steady state" solution evolves stochastically over time.

4. The G-IV models are stochastically focused; when log-linearized these models can be represented as structural equations of the form given in Eq (2.15); the system may have higher order lags and any exogenous variables are placed in z_t to evolve as a VAR structure:

$$Az_t^N = Bz_{t-1}^N + CE_t(z_{t+1}^N) + D\varepsilon_t \tag{2.15}$$

Where z_t^N and ε_t are the model variables and shocks respectively. The solution to Eq (2.15) above when ε_t is serially uncorrelated is:

$$z_t^N = Fz_{t-1}^N + G\varepsilon_t \tag{2.16}$$

If the shocks ε_t follow a VAR(1) process then the solution to the system is a VAR(2), as shown in (Kapetanios, Pagan and Scott, 2007). Note that, while F is a function solely of A, B, C; G will depend on these parameters plus any parameters describing the persistence in the shocks ε_t – see Binder and Pesaran (1995). This demarcation can be a very useful for analytical purposes.

There is no specific method of estimating the parameters in G-IV models. In some cases, the approach used is the same as in G-III models. Broadly, this involves estimating any parameters that appear in the steady state with observable ratios of variables i.e. a method of moments estimator is implicitly utilized. For parameters describing the transitional paths, quantifications are generally based on opinions about desirable model performance. Increasingly the latter approach has been replaced by variants of maximum likelihood estimation.

2.3. Model Estimation Technique

We have employed the general to specific (G2S) modelling technique first suggested by Davidson *et al.* (1978). This technique allows us to estimate the key parameters of the model based on sound theoretical reasoning while keeping the analysis tractable. The estimation procedure starts with a more general unrestricted model and comes up with a parsimonious and economically justified model. Moreover, for nested and non-nested versions, at each step of G2S modelling the restrictions (linear/non-linear) are tested by employing a variety of tests including overall F-test, likelihood ratio test, Wald test, Lagrange Multiplier test, Cox test, and Saragan test.

Following convention, an Auto Regressive Distributed Lags (ARDL) model is selected as a general unrestricted model as detailed below. This model allows incorporation of variables with distinct order of integration.

2.3.1. Auto Regressive Distributed Lag Models-

The general form of an ARDL model is given below:

$$y_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i\, y_{t-i} + \sum_{i=0}^{m} \beta_i x_{t-i} + \varepsilon_t \tag{2.17}$$

Where y_t is a dependent variable and x_t is the regressor. The applicability of the estimation methodology for the ARDL form given in Eq (2.17) must be seen in the light of data availability and due to the short time span in the data, the number of feasible estimation methods that can be employed in the present context is limited. Therefore, this study opts for the use of single-equation based cointegration approach; i.e. Engle and Granger (1987)'s two-step procedure, to estimate the model. The performance of all estimated equations will then be evaluated using usual tests of specifications and residual analysis; slight misspecification will be tolerated if the forecasting ability of the equations is good. Residual analysis is one of the convenient ways to check the correct specification of any econometric model. Provided the residuals are independent and identically distributed (i.i.d), the results from any economically justified macro models are valid and interpretable. It should be noted that independent here means that residuals should not have autocorrelation; i.e. the residuals should not depend on their previous values. Also, identically distributed means the residuals should have same spread.

It is well documented in the recent literature that most of the macroeconomic time series display non-stationary behavior. If two series have unit root processes then the traditional Ordinary Least Squares (OLS) method yields spurious results even though the estimated coefficients are highly significant (Granger and Newbold, 1974; Phillips, 1986).

To overcome this shortcoming, Engle and Granger (1987) suggest the estimation of a cointegration relationship in the first step with static OLS method. The resulting residuals are then tested for stationarity. If they are found to be stationary, then in the second step one can estimate an Error Correction Model (ECM) as representing the long-run equilibrium relationship between the two variables.

According to the Granger (1986) representation theorem, the existence of linear cointegration relationship can be represented as an ECM with the advantage that the long-run and short -run properties can be estimated jointly while investigating the direction of long-run and short-run causality. Therefore, ECMs are used to represent the dynamic behavior of the variables under consideration in the following way:

$$\Delta y_t = \gamma + \rho u_{t-1} + \sum_{i=1}^{p} \alpha \Delta y_{t-i} + \sum_{i=1}^{q} \beta \Delta x_{t-i} + v_t \quad (2.18)$$

Where y_t is the dependent variable, x_t is the set of explanatory variables and u_{t-1} is lag of residual series (from static equation of first step) representing an ECM. The lag lengths p and q in Eq (2.18) are chosen such that the error term v_t is white noise. If the ECM is working then the parameter ρ should be negative and statistically significant, otherwise the deviations from the equilibrium path will not be corrected (Tjipe, Nielsen and Uanguta, 2004).

Although the multivariate cointegration method advanced by (Johansen, 1991) is generally considered to be superior to that of Engle-Granger's method, a drawback of the former is that such multivariate cointegration techniques require high frequency data.

Since there are a limited number of observations in the present context for each country, the choice of Engle-Granger's cointegration method is warranted.

For model estimation, a number of econometric tools have been devised using mathematical and statistical techniques; however, these techniques often lack sound economic justification. Depending on the Data Generating Process (DGP), these models may perform better in prediction and projections. Vector Autoregressive (VAR) technique is an a-theoretical modelling technique with no prior economic theory. VAR technique enables us to have projected vales of macro variables. Macro variables may have a long run relationship, and these long run cointegrated variables might have a built in ECM; to capture this mechanism one can employ a VECM as per the requirement. In this study Impulse Responses have been estimated by employing the Vector Moving Averages (VMA) specification.

2.3.2. DSGE Models

There are several weaknesses of the traditional DSGE modelling, including statistical mis-specification, non-identification of deep parameters, substantive inadequacy, weak forecasting performance and potentially misleading policy analysis. It is argued that most of these weaknesses stem from failing to distinguish between statistical and substantive adequacy and secure the former before assessing the latter. They are based on strong assumptions. The main failures of the DSGE models are explained by their emphasis on building macro models based on the neoclassical microeconomic assumptions of "rational behaviour" of a representative agent that maximizes consumption under a budget constraint and maximizes profits in production with a resource constraint, within a well-behaved market clearing process and guided by rational expectations.

In some time periods agents may be maximizing profits but as soon as uncertainty increases, they rapidly shift towards risk aversion. Hence, human behaviour and thus economic decisions cannot be assumed as constant or permanent over time because they change following the increase or decrease in uncertainty, confidence and expectations. North (1993) demonstrated that under uncertainty it is not possible to assume the idea of a "rational behaviour" propounded by conventional neoclassical economics and it is closer to real life to accept that people learn and behave by trial and error.

Mirrlees (1997) demonstrated that under incomplete information, a quite common fact in the real world, markets may not clear and resources may not be fully employed. There is plenty of scientific evidence that a permanent trend towards market automatic adjustment in the sense of market clearing with full employment does not exist. Moreover, Buiter (2009) suggests that the rational expectation approach emphasizing that today's prices depend on price expectations for tomorrow, can be extended in time towards the future. This extension process allows us to say that tomorrow prices will depend on price expectations for the day after tomorrow. Since this process is continuous and doesn't have an end it can be concluded that today's prices depend on price expectations for the infinite remote future. And once the infinite is incorporated within reasoning, the equation becomes undetermined. In the same way, rational expectations operate when there is only one future market equilibrium. Once multiple possible future equilibria or the possibility of a future disequilibrium are allowed for, the hypothesis becomes inoperative.

DSGE models are not "empirically relevant" as they assume that agents are optimizing, that markets tend to clear, and that the economy is on an equilibrium time path. The DSGE approach is structured toward preserving the use of micro foundations, while at the same time invoking various – often unrealistic – processes in order to generate something resembling dynamic behaviour. DSGE models rely excessively on an assumption of complete market and are unable to describe the highly nonlinear dynamics of economic fluctuations (Buiter, 2009). In fact DSGE models did not include the financial sector because the predominant macroeconomic thought in the US at the time was that the financial market always cleared and therefore no financial disequilibrium was possible – Krugman (2009)'s "efficient market hypothesis". Tovar (2009) added a second important dimension: that DSGE models are not able to capture the full implications of international financial linkages in a world of large financial openness.

The limited usefulness of DGSE models in analysing the financial crisis of 2007-2010 has been acknowledged of late by prominent macroeconomists including Blanchard (2016), Kocherlakota (2016) and Romer (2016). The DSGE models have no room for fiscal policy and even less attention to fiscal policy alternatives. The idea is that monetary policy and particularly the monetary rule for the interest rate is all that is needed to maintain the economy in an equilibrium path. The DSGE models are built to deal with low intensity shocks. They cannot easily absorb high intensity shocks or a sharp increase in uncertainty and the standard method of estimating these models, which is a mix of calibration and Bayesian approaches, is unconvincing. The models are estimated as a system, rather than equation by equation as in previous macro-econometric models. They come, however, with a very large number of parameters that need to be estimated, so that classical estimation of the full set is unfeasible. Thus, a number of parameters are set a-priori, through "calibration." This approach would be reasonable if these parameters were well established empirically or theoretically. But the list of parameters chosen through calibration is typically much larger, and the evidence often much fuzzier. The remaining parameters are estimated through Bayesian estimation of the full model. The problems that result are twofold. One is standard in any system estimation and involves the effect of misspecification of any part of the model on other parts of the model. Two, the process of mapping from parameters to actual data is quite complex. It is for these reasons that we have chosen not to use the DSGE model and instead use the general to specific technique which is parsimonious and allows the estimation of model parameters with reasonable accuracy based on sound theoretical reasoning.

2.4. Specification of the Model

In the discussion that follows, theoretical specification of the macro econometric model is outlined. The model includes both supply side as well as the demand side of the economy. On the supply side production functions for agriculture sector, manufacturing sector and services sector are specified. On the demand side, the model largely focuses on the behavior of consumption, investment and foreign trade of goods and services. The model covers five key blocks of the economy viz. the production block, aggregate demand block, fiscal block, foreign trade block and monetary block. The following sections present the structural specification of each block.

2.4.1. Sectoral Production Blocks

To model production activities, we have disaggregated production into three major sub-sectors: (1) agriculture, (2) manufacturing, and (3) services. The selection of the sectors is primarily based on the structure of the economy. However, data availability constraints have also played a role in the selection of sectors for disaggregating production. The results thus need to be interpreted with caution as unavailability of some variables may cause omitted variable bias.

2.4.1.1. Agriculture Sector

Following Zerfu (2002), Iqbal, Ahmad and Abbas (2003) and Naqvi *et al.*, (1983), agriculture sector production is assumed to be a function of labor force engaged in agriculture (L_t^a), disbursement of credit to agriculture sector (CD_t^a) and availability of water (W_t). The functional form is given by:

$$Y_t^a = f(L_t^a, CD_t^a, W_t) \tag{2.19}$$

Where:

Y_t^a	=	Agriculture value added
L_t^a	=	Labor engaged in agriculture
CD_t^a	=	Credit disbursed to agriculture
W_t	=	Water availability.

Factors other than the ones included in Eq (2.19) that may influence agricultural output include land, fertilizer, pesticides, tractors and biological inputs like seeds of high yield variety. These inputs, excluding land, are typically purchased using credit. This is especially true for biological inputs (Dhansekaran, 1999; Iqbal, Ahmad and Abbas, 2003). Thus, the inclusion of agricultural credit disbursed in Eq (2.19) accounts for the influence of these factors. Use of the variable 'land' or 'cropped area' in the production function has been abstracted away from because all other inputs like labor, credit, water, etc. are applied to the cropped area and therefore this variable is already subsumed in other inputs included in the functional form described by Eq (2.19).

The influence of infrastructure like farm to market roads and electricity on agricultural output needs no emphasis. Parikh (1983) assumes that infrastructure and water availability influence agricultural output significantly.[1] To capture the effect of infrastructure, Eq (2.19) incorporates road length as proxy for infrastructure ($IFRS_t$), and it now takes the following form:

$$Y_t^a = f(L_t^a, CD_t^a, W_t, IFRS_t) \tag{2.20}$$

It is hypothesized that all the right-hand side variables in Eq (2.20) exert a positive impact on agriculture sector value added.

[1]Developing countries, have undertaken a variety of reforms as part of their liberalization efforts over the years. Some of these reforms directly influenced the agricultural output, for example, decrease in subsidy levels, government input purchase restrictions etc. Reforms in other sectors are assumed to have influenced agricultural output indirectly. In the empirical section dummy variable are introduced to capture the impact of reforms.

2.4.1.2. Manufacturing Sector

The manufacturing sector includes small-scale and large-scale industries, construction, electricity and gas sub-sectors. Furthermore, export-processing industries are also included in this sector. In the manufacturing sector, capital stock and labor force are important factors of production and hence these are included in the manufacturing production function. The production function for manufacturing sector is specified as:

$$Y_t^m = f(K_t^m, L_t^m) \tag{2.21}$$

Where

Y_t^m = Manufacturing value added.

K_t^m = Capital stock employed in manufacturing

L_t^m = Labor employed in manufacturing

Besides capital stock and labor, other factors such as credit disbursed to manufacturing sector, availability of infrastructure, import of machinery and equipment and use of raw material are likely to influence the volume of production in the manufacturing sector (Zerfu, 2002). Therefore, Eq (2.21) can be extended by incorporating credit disbursed to manufacturing sector (DC_t^m), infrastructure ($IFRS_t$), import of machinery and equipment (IMM_t) and use of domestic raw material (DRM_t). The rationale for this proxy is that a significant part of manufacturing output is agro-based, for example the textile and sugar industries use the output of the agriculture sector as raw material. Now the production function for manufacturing sector takes the following form:

$$Y_t^m = f(K_t^m, L_t^m, DC_t^m, IFRS_t, IMM_t, DRM_t) \tag{2.22}$$

All the right-hand side independent variables in Eq (2.22) are expected to influence manufacturing sector value added positively.

2.4.1.3. Services Sector

The services sector value added is taken as a function of aggregate demand in real terms (domestic absorption). Real aggregate demand is defined as the sum of private consumption, government consumption and investment divided by consumer price index. The equation for services sector can be specified as:

$$Y_t^s = f(RAD_t) \tag{2.23}$$

Where:

Y_t^s	=	Services sector value added
RAD_t	=	Real aggregate demand

Aggregate output (GDP) is defined as the sum of the value added of agriculture, manufacturing and services sectors, i.e.:

$$GDP_t = Y_t^a + Y_t^m + Y_t^s \tag{2.24}$$

2.4.2. Aggregate Demand Block

The aggregate demand for goods and services is the sum of domestic absorption and the trade balance (Zerfu, 2002; Basdevant and Kaasik, 2003):

$$Y_t = A_t + (X_t - M_t) \tag{2.25}$$

Where A is domestic absorption and refers to the sum of consumption (C), investment (I) and government expenditures (G), whereas X and M denote exports and imports of goods and services respectively. National income now is defined as:

$$Y_t = C_t + I_t + G_t + (X_t - M_t) \tag{2.26}$$

This relationship always holds as an identity.

Aggregate demand can be decomposed into consumption and investment sub-sectors. The consumption sub-sector can be further disaggregated into private consumption and government consumption.

2.4.2.1. Consumption Sub-block

The consumption sub-block is comprised of private consumption and government consumption, as detailed below.

2.4.2.1.1. Private Consumption

The specification of real private consumption function is based on an optimizing model of life-cycle behavior. The main variables explaining the real private consumption are the real disposable income and real interest rate (Tjipe, Nielsen and Uanguta, 2004). To capture the wealth effect, real money balances are included in the real private consumption function (Rashid, 1981; Elliott, Kwack and Tavlas, 1986; Rankaduwa, Rao and Ogwang, 1995):

$$P_t^c = f\left(Y_t^d, r_t^d, RM_t\right) \tag{2.27}$$

Where P_t^c is real private consumption, Y_t^d is real disposable income, r_t^d is real interest rate and RM is the real money balances (M_2 definition).

Following (Haque, Lahiri and Montiel, 1990), real disposable income $\left(Y_t^d\right)$ is defined as:

$$Y_t^d = \frac{GDP_t - DTXR_t - INDTXR_t + WREM_t + CRP_t}{CPI_t} \qquad (2.28)$$

Where $DTXR$ denotes direct tax revenues and $INDTXR$ is indirect tax revenues. $WREM$, CRP and CPI are worker's remittances, credit to private sector and consumer price index respectively. Worker's remittances are included to capture the effect of remittance on private consumption.

According to the absolute income hypothesis, real disposable income exerts positive effect on real private consumption (Odada, Eita and Nhuleipo, 2000). The life-cycle and the permanent income hypotheses dictate the inclusion of real interest rate (or inflation rate) as an explanatory variable, whose impact is not clear *a priori*.

2.4.2.1.2. Government Consumption

Real government consumption depends on development expenditure relative to GDP, government revenues and inflation[2]:

$$C_t^g = f\left(EXDEVY_t, R_t^g, \pi_t\right) \tag{2.29}$$

Where:

C_t^g	=	Government Consumption
$EXDEVY$	=	Ratio of Development Expenditure to GDP
R^g	=	Government Revenues
π	=	Inflation Rate

It is assumed that ratio of development expenditures to GDP, government revenues and inflation rate are positively related to real government consumption.

2.4.2.2. Investment Sub-block

Aggregate investment is disaggregated into private investment $\left(I_t^p\right)$, government investment $\left(I_t^g\right)$ and increase in stocks ($\Delta stocks$). Increases in stocks may be an important component of business cycle. It can be argued that increase in stocks may be heavily dependent on fluctuations in agricultural production, which in turn is affected by exogenous factors such as climate. Hence, increase in stocks is assumed to be exogenous (Ra and Rhee, 2005).

[2] Current government expenditures consist of general public service, defense affairs and services, public order and safety affairs, economic affairs, environment protection, housing and community amenities, health services, recreation, culture and religion, education affairs and services and social protection [for further detail, see State Bank of Pakistan's Annual Report FY 2009, p. 27]

2.4.2.2.1. Private Investment

Private investment plays a key role in sustaining the development process by promoting economic growth. Private investment decisions depend on investment in long-lived capital assets and expectations about the future (Guru-Gharana, 2000). In this study real income, real interest rate, ratio of private sector credit to GDP, and government investment are included as explanatory variables:

$$I_t^p = f\left(Y_t, r_t^l, CRPY_t, I_t^g\right) \tag{2.30}$$

Where:

I_t^p	=	Private Investment
Y_t Y_t	=	Real Income
r_t^l	=	Real Interest Rate
$CRPY_t$	=	Ratio of private sector credit to GDP
I_t^g	=	Government Investment

The accelerator theory suggests that as income increases, investment 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, McKinnon (1973) and Shaw (1973) argue that interest rate could exert positive impact on the level of investment because real interest rate could increase saving, which in turn leads to an increase in investment (Khan and Khan, 2007). 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-Gharana, 2000). Availability of credit to private sector is another important determinant of private investment and influences the investment behavior positively (Jongwanich and Kohpaiboon, 2008). It also provides a link between real and monetary sectors (Guru-Gharana, 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). Therefore, government investment is included in the specification to capture the 'crowding-out' or 'crowding-in' effects (Jongwanich and Kohpaiboon, 2008).

2.4.2.2.2. Government Investment

Government investment includes expenditures on capital construction such as infrastructure and innovations. Moreover, government investment serves as a fiscal policy instrument and is assumed to be exogenously determined.

$$I_t^g = \bar{I}_t^g \tag{2.31}$$

$$G_t = C_t^g + I_t^g \tag{2.32}$$

2.4.3. Fiscal Block

The fiscal sector constitutes government revenue and government expenditures. In this sector the budget deficit is resulted when government spending exceeds government revenues. Like many other countries, in ECO member countries, domestic and external resources are used to finance budget deficit. The budget deficit is defined as:

$$BD_t = \left(EX_t^g - R_t^g\right) \tag{2.33}$$

Where:

BD_t	=	Budget Deficit
EX_t^g	=	Government expenditures
R_t^g	=	Government revenue

Government revenues $\left(R_t^g\right)$ originate from direct tax revenues $(DTXR_t)$, indirect tax revenues $(INDTXR_t)$ and non-tax government revenues $(NTXR_t)$ sources, i.e.:

$$R_t^g = DTXR_t + INDTXR_t + NTXR_t \tag{2.34}$$

Non-tax revenues are usually comprised of fees and other similar kind of charges, which are proportional to aggregate economic activities (i.e. NY). Direct and indirect tax revenues are modeled as endogenous variables whereas non-tax revenue of the government is taken as exogenous variable (Guru-Gharana, 2000; Tjipe, Nielsen and Uanguta, 2004). Two different revenue functions are modeled as they are of different nature and have different degrees of response to changes in income.

2.4.3.1. Direct Tax Revenue

Direct tax revenues may be influenced by activity level of the economy (i.e. NY), average direct tax rate $(ADTXR)$, which is defined as the ratio of direct taxes to nominal output (NY) and inflation rate. Therefore:

$$DTXR_t = f(NY_t, ADTXR_t, \pi_t) \tag{2.35}$$

An increase in the NY (tax base) is expected to raise revenues from direct taxes. Direct tax revenues will go up as average tax rate rises (Tjipe, Nielsen and Uanguta, 2004). It is also assumed that there is positive relationship between direct taxes and inflation rate because in each year public and private employee's compensations are adjusted for cost of living and those additional compensations are taxed.

2.4.3.2. Indirect Tax Revenue

The indirect tax revenues can also be influenced by nominal income (NY), the average indirect tax rate ($AINDTXR$) and inflation rate (π), i.e.:

$$INDTXR_t = f(NY_t, AINDTXR_t, \pi_t) \tag{2.36}$$

A large proportion of indirect taxes is raised in the form of sales tax, custom duties, etc.; therefore, a higher price level would contribute to higher indirect tax revenues. A higher output level leads to an increase in revenues from indirect taxes due to higher spending. Similarly, a positive relationship between indirect taxes, average tax rate and inflation is predicted.

The elasticity of taxes with respect to income is assumed to be approximately unity (Elliott, Kwack and Tavlas, 1986). Such a response implies that the tax system, on average, is neither progressive nor regressive.

2.4.3.3. Government Expenditures

Government expenditures (EX^g) consist of current expenditures ($EXCUR$), development expenditures ($EXDEV$) and expenditures on capital disbursement ($EXCD$). The total government expenditure is therefore given by:

$$EX_t^g = EXCUR_t + EXDEV_t + EXCD_t \tag{2.37}$$

This model treats development expenditure and expenditures on capital disbursement as exogenous variables, while current expenditure on goods and services is taken as endogenous variable:

$$EXDEV_t = \overline{EXDEV_t} \quad (2.38)$$

$$EXCD_t = \overline{EXCD_t} \quad (2.39)$$

Government current expenditures are assumed to be influenced by nominal income (NY) and the inflation rate (π). As nominal income increases, the expenditure on development projects is also expected to increase. Similarly, a rise in inflation rate is also expected to increase government's development expenditures. Therefore, the following function for government expenditures can be specified:

$$EXCUR_t = f(NY_t, \pi_t) \quad (2.40)$$

2.4.4. Foreign Trade Block

The foreign trade block consists of two equations explaining the determination of volume of exports of goods and services and volume of imports of goods and services.

2.4.4.1. Exports

It is assumed that all ECO member countries are small open economies and are price-takers in the world markets. Accordingly, changes in the world prices affect the domestic production levels, which in turn, affect export levels. The quantity of real exports of goods and services(X) depends positively on the real effective exchange rate $(REER)$ as well as world income (Y^F) (Tjipe, Nielsen and Uanguta, 2004). Other important determinants in the exports equation are: domestic real income (Y), and the price of exports relative to domestic price (RP^X) level. Thus, following Khan (1996), Zerfu (2002) and Murty and Soumya (2007), the aggregate export function can be specified as:

$$X_t = f(Y_t, REER_t, Y_t^F, RP_t^X) \tag{2.41}$$

Domestic real income, foreign income and relative price of exports is expected to influence real export demand positively, while real effective exchange rate exerts negative impact on exports because an increase in the real effective exchange rate (i.e. real deprecation) affects export demand negatively.

2.4.4.2. Imports

The demand for real imports (IM^t) is assumed to be determined by domestic demand for imports (i.e. real income), real effective exchange rate, foreign capital (K^f) and relative price of imports $\left(RP^{im}\right)$, which is given by the ratio of imports price index $\left(P^{im}\right)$ to domestic price level (P). Thus, the real imports equation can be specified as:

$$IM_t = f\left(REER_t, Y_t, K_t^f, RP_t^{im}\right) \tag{2.42}$$

Depreciation in real effective exchange rate or an increase in the price of imports relative to domestic price level leads to a contraction in import demand. While an increase in the domestic real income and foreign direct investment results in an increase in imports.

Finally, putting export and import equations together, the trade balance (TB) can be defined as:

$$TB_t = X_t - IM_t \tag{2.43}$$

2.4.5. Monetary and Price Block

The monetary block of the present macro-econometric model explains the behavior of money demand, short-term interest rate and the domestic price level.

2.4.5.1. Money Demand

The main objective of monetary policy is to provide adequate liquidity for economic growth while maintaining price stability. The effectiveness of monetary policy depends on the stability of money demand function. The standard literature suggests that the demand for real money balances (M_2) is positively related to the level of real income. If the level of real income increases, there is an opportunity for the agents to hold more money. The literature also suggests that demand for real money balances is negatively related to the opportunity cost of holding money (i.e. short-term interest rate). The functional form of real money balances can be expressed as:

$$\frac{M_t^d}{P_t} = f(Y_t, i_t) \tag{2.44}$$

Where:

M^d/P = Demand for real money balances

i = Short-term nominal interest rate.

2.4.5.2. Interest Rates

This model treats short-term interest rate as monetary policy instrument. The short-term interest rate can be modeled as a function of money supply (M^s), domestic price level (P) and policy discount rate (dr). Therefore, the monetary policy reaction function can be expressed as:

$$i_t = f(M_t^S, P_t, dr_t) \tag{2.45}$$

The policy discount rate (dr) is included in Eq (2.45) to capture the pass-through effect of monetary policy changes on the market rate of interest.

2.4.5.3. Prices

Taking the lead from Moser (1995), the general price level (P)can be expressed as a weighted average of the tradable goods price (P^T) and non-tradable goods price (P^N). The log-linear form can be expressed as:

$$\ln P_t = \theta \ln P_t^T + (1-\theta)\ln P_t^N \tag{2.46}$$

Where θ represents the share of tradable goods in total expenditures. It is assumed that the price of tradable goods (P^T) is determined exogenously in the world market. In domestic currency term, it can be represented by foreign price (P^f) adjusted for nominal exchange rate (E) and can be written as:

$$\ln P_t^T = \ln P_t^f + \ln E_t \tag{2.47}$$

An increase in the foreign prices adjusted for exchange rate will lead to an increase in the overall price level. The price of non-tradable goods (P^N) is assumed to be determined in the domestic money market. The demand for tradable goods is assumed to move in line with overall demand in the economy. Consequently, the price of non-tradable goods is determined by the money market equilibrium condition, where money supply (M^s) equals real money demand (M^d/P). The disequilibrium in the money market affects non-tradable goods prices, which can be written as:

$$\ln P_t^N = \phi[\ln M_t^S - \ln m_t^d] \tag{2.48}$$

Where m^d is the demand for real money balances, and φ is a scale variable representing the relationship between economy-wide demand and demand for non-tradable goods. Replacing the real money demand function into Eq (26) leads to the following price equation for non-tradable goods:

$$\ln P_t^N = \phi[\ln M_t^S - (\ln Y_t, i_t)] \tag{2.49}$$

By substituting the value of lnP^T and lnP^N into Eq (27) yields the final form of general price equation:

$$P_t = f\left(M_t^S, Y_t, i_t, P_t^f, E_t\right) \tag{2.50}$$

It may be noted that Eq (2.50) is in line with the monetarist and structuralist theories of inflation.

2.5. Workings of the Model

The model consists of 24 equations of which 13 are behavioral equations and 8 are identities and linking equations. The model works in the following ways:

1. Production affects consumption, exports, imports, government revenues, government expenditures, which in turn affect the domestic price level.
2. Credit to private sector affects private investment which influences output level through the channel of capital stock.

3. Public investment influences private investment, which in turn affects output level.
4. Foreign price affects the domestic price level, which in turn affects the prices of raw material.
5. Domestic price level is also affected by real and monetary variables.
6. Real effective exchange rate determines the volume of imports, which in turn, affects private investment.
7. Private investment affects real output, which influences government revenues and expenditures and hence budget deficits.
8. Disequilibrium between aggregate demand and aggregate supply also affects the domestic price level.

Therefore, market clearing may be achieved through adjustment in monetary and fiscal policies.

2.6. Conclusion

The foregoing discussion in this chapter has highlighted key developments in the literature on macroeconomic modelling that are relevant in the context of developing a rigorous model of ECO member countries. Against this backdrop, a suitably designed model that incorporates key sectors and features of the ECO member countries has been proposed, and the suggested workings of this proposed model highlighted. Based on this model, and the data collected, estimations and several key policy simulations will be conducted and detailed for each ECO member country individually in Chapters 5 through 14.

Chapter 3 - Stylized Facts – Macroeconomic Indicators and Policy Highlights

3.1. Introduction

This chapter presents the basic economic indicators for the ten members of the ECO region. The ECO region occupies a vital geopolitical location, bordered by Russia, China, the Indian Ocean, the Persian Gulf and the Caspian basin. The ten countries in the ECO are well-endowed with rich economic resources in different fields and sectors such as agriculture, energy, mining and human resources[3], and they constitute a large strategic trade region. Nevertheless, this intrinsic potential is not apparent in the form of reasonable levels of economic and human development in these countries as a group. The chapter is organized as follows. Section 3.2 highlights trends in overall output, economic growth and employment. Sections 3.3 and 3.4 respectively discuss monetary policy and financial sector developments. An overview of foreign trade is provided in section 3.5 whereas section 3.6 concludes.

3.2. Output, Growth and Employment

In 2014, having accounted for 6.19 percent of the world total population, the ten ECO member countries produced only 2.28 percent of the world total GDP at constant

[3] Pakistan has a strong textile base and is the 5th largest producer in the world, while Iran, Azerbaijan, Kazakhstan and Turkmenistan have oil and gas reserves, and Afghanistan is enriched with precious and semi-precious gems and famous for hand woven carpets. Uzbekistan has gold and mineral resources and Kyrgyz republic is naturally endowed with gold, coal, uranium and precious metal. Tajikistan has abundant minerals (specifically aluminum) and Turkey is one of the largest exporters of transport equipment.

prices of 2005. Over the last 24 years, the group of ECO countries has increased its share in the world output only by 0.49 percent.

Considering the fact that the individual countries such as United States and China had much higher shares in global GDP (22.02 and 13.25 percent respectively in 2014) than that of all the ECO member countries as a group (see Table 3.1 for trends in GDP for all ECO members), it can be stated that the contribution of the ECO countries to the world output is just marginal, especially given its enormous resources.

Table 3.1: GDP in ECO Countries (1990-2014)

(Billion USD)

Country	1990	1995	2000	2005	2010	2014
Afghanistan	5.73	4.53	3.50	6.62	10.39	13.63
Azerbaijan	12.14	5.09	7.15	13.25	28.28	30.86
Iran	122.60	141.58	168.18	219.85	279.06	276.74
Kazakhstan	50.23	30.83	34.88	57.12	77.29	96.23
Kyrgyz Republic	3.07	1.56	2.04	2.46	3.06	3.71
Pakistan	62.68	78.59	92.25	117.71	139.22	162.96
Tajikistan	3.82	1.45	1.46	2.31	3.16	3.99
Turkey	269.68	315.86	386.58	482.99	565.10	673.13
Turkmenistan	14.07	8.89	11.06	14.18	23.23	35.98
Uzbekistan	11.17	9.06	10.99	14.40	21.71	29.70
ECO	555.20	597.44	718.09	930.88	1150.49	1326.92
World	31,105.61	34,592.40	40,957.12	47,264.85	52,895.09	58,254.25

Source: UN National Account Aggregates and World Development Indicators

Within ECO, Turkey, Pakistan and Iran dominate both in terms of population as well as economic size. In terms of population, Pakistan is the largest country (188.9 million growing at the rate of 2.1 percent per annum), followed by Iran (79.1 million growing at the rate of 1.2 percent per annum) and Turkey (78.7 million growing at the rate of 1.5

percent). In terms of income, Turkey is leading with more than half of region's income (51.1 percent), followed by Iran (20.2 percent), and Pakistan (12.6 percent). However, in terms of per capita income Kazakhstan with a population share of only 3.8 percent (17.5 million growing at the rate of 1.5 percent per annum) is at number two (USD 5,566) after Turkey (USD 8,897) and Iran (USD 3,541) is at number three. Azerbaijan is the only country which recorded a decline in per capita GDP in 2015 after accomplishing an uninterrupted rise from 1995 to 2014[4]. Turkmenistan is the fastest growing economy in terms of per capita income (growing at the rate of 8.4 percent per annum since 1990).

3.2.1. Production by Sectors

In terms of production structures, over the years share of agriculture has declined significantly in all the member countries. Despite this decline, it occupies more than 20 percent share in Afghanistan[5], Pakistan[6] and Tajikistan[7]. Up until 2010, industry was the major activity in terms of its contribution to national income in Azerbaijan (64.1 percent), Iran (41.4 percent), Kazakhstan (42.9 percent) and Turkmenistan (48.4 percent). But by 2015, it is the services sector that plays a leading role in all the ECO economies with the exception of Turkmenistan.

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[4] Specifically starting from 2006, when the Baku Tbilisi Ceyhan (BTC) pipeline was launched, the income levels rose considerably, but fell down in 2015 due to drastic fall in oil prices. The fall in income in real terms is not much, but at current prices, income per capita fell from USD 5,359.7 in 2014 to USD 2,808.8 in 2015.

[5] Agriculture is critical to Afghanistan's food security (mainly produces wheat and cereals). The majority of Afghans rely on agriculture for their livelihoods and their family's sustenance.

[6] Cotton, wheat, rice and maize are its major crops, not only consumed but an important source of foreign exchange earnings.

[7] Cotton accounts for 60 percent of agricultural output, supporting 75 percent of the rural population, and using percent of irrigated arable land.

Table 3.2: Population and GDP Shares in the ECO Region

(%)

	Population			GDP			Per Capita GDP (USD)		
	1991	2000	2015	1991	2000	2015	1991	2000	2015
Afghanistan	4.35	5.63	7.11	0.90	0.49	1.00	474	177	431
Azerbaijan	2.47	2.3	2.11	2.12	1.00	2.28	1,696	888	3,232
Iran	19.49	18.8	17.29	24.28	23.42	20.21*	2,193	2,554	3,541*
Kazakhstan	5.60	4.25	3.83	7.86	4.86	7.11	3,073	2,343	5,566
Kyrgyz Republic	1.52	1.4	1.3	0.50	0.28	0.28	699	417	644
Pakistan	37.64	39.48	41.29	11.57	12.85	12.56	583	667	910
Tajikistan	1.84	1.77	1.85	0.62	0.20	0.30	722	235	490
Turkey	18.68	18.06	17.19	47.83	53.84	51.12	4,995	6,113	8,897
Turkmenistan	1.28	1.29	1.17	2.36	1.54	2.80	3,836	2,457	7,130
Uzbekistan	7.13	7.04	6.84	1.95	1.53	2.34	545	446	1,025

Source: UN National Account Aggregates and World Development Indicators.

Note: GDP and Per Capita GDP at constant prices of 2005.

*value for 2014

While the manufacturing sector has expanded in almost all the ECO countries, it is not much diversified in most of the economies. Except for Turkey, Iran and to some extent Pakistan, the manufacturing sector in other economies is dominated by energy and food industries. Turkey is classified as emerging market economy. It has a strong industrial base with significant industries of mine-metal and chemical, automotive, electrical and electronics, textile and clothing. Iran, besides producing petrochemicals, steel and copper products, have significant automobiles, and other light engineering sectors. Pakistan has significant textiles and light engineering sectors.

In terms of sectoral growth, with the exception of Azerbaijan, in all the ECO countries positive growth in services sector has significantly contributed to overall growth process with well-developed services sector in Pakistan, Turkey and Iran. In Afghanistan, industry is largely at its infant stage, while services (with a share of more than 50 percent) are primarily underdeveloped, fueled mainly by services provided by informal dealers[8] in the financial sector. In Turkmenistan, all sectors are expanding, but industry has the greatest share in GDP, on account of the moderate expansion in hydrocarbons, electrical power, and chemicals, paired with a strong pickup in construction materials, textiles, food, and agro-industrial goods.

[8] Significant part of the informal economy comes from smuggling goods into neighboring countries. But its main component is the drug economy, from poppy culture to opium and heroin trafficking.

Table 3.3: Supply-side Composition of GDP

(%)

	Agriculture				Industry				Services			
	1991	2000	2010	2015	1991	2000	2010	2015	1991	2000	2010	2015
Afghanistan	49.7	57.0	29.6	25.7*	23.5	23.2	21.9	22.1*	26.8	19.8	48.5	52.2*
Azerbaijan	32.3	17.1	5.9	6.8	31.4	45.3	64.1	37.0	36.3	37.5	30.0	56.2
Iran	12.3	9.1	6.9	9.3*	34.2	40.6	41.4	38.2*	53.4	50.3	51.7	52.4*
Kazakhstan	26.0	8.7	4.8	5.0	25.6	40.5	42.9	33.2	48.5	50.8	52.3	61.8
Kyrgyz Republic	37.0	36.7	19.4	15.9	35.5	31.4	29.2	26.9	27.6	31.9	51.4	57.1
Pakistan	25.8	25.9	24.3	25.5	25.4	23.3	20.6	19.0	48.8	50.7	55.1	55.5
Tajikistan	36.6	27.4	22.1	27.2*	36.9	38.9	28.2	25.5*	26.4	33.7	49.7	47.3*
Turkey	15.8	11.3	9.5	8.6	32.7	31.3	26.4	26.5	51.5	57.4	64.2	64.9
Turkmenistan	32.2	24.4	14.5	14.5	30.5	44.4	48.4	48.4	37.3	31.2	37.0	37.0
Uzbekistan	37.0	34.4	19.3	18.3	36.6	23.1	32.8	34.6	26.5	42.5	48.0	47.1

Source: UN National Account Aggregates and World Development Indicators.
*value for 2014

Table 3.4: Agriculture Sector Growth Performance

(%)

	2010	2011	2012	2013	2014	2015
Afghanistan	-6.4	-7.6	18.2	0.0	-0.1	-2.0
Azerbaijan	-3.2	5.8	6.6	4.9	-2.6	6.6
Iran	4.9	-0.1	3.7	4.7	3.8	-
Kazakhstan	-11.6	26.5	-17.4	11.2	1.3	4.1
Kyrgyz Republic	-2.6	1.8	1.2	16.5	-0.5	6.2
Pakistan	0.2	2.0	3.6	2.7	2.7	2.9
Tajikistan	6.8	0.4	9.5	7.7	6.7	-
Turkey	2.4	6.1	3.1	3.5	-2.1	7.6
Turkmenistan	29.8	10.1	13.7	10.0	9.6	-
Uzbekistan	6.8	6.6	7.0	6.8	6.9	6.8

Source: UN National Account Aggregates, World Development Indicators, and Key indicators of Asia and Pacific.

Table 3.5: Industry Sector Growth Performance

(%)

	2010	2011	2012	2013	2014	2015
Afghanistan	6.3	9.8	7.8	1.8	2.4	1.4
Azerbaijan	5.3	-2.6	18.6	1.8	-1.7	1.6
Iran	6.4	2.6	-18.3	-4.7	4.9	
Kazakhstan	7.4	3.5	1.8	3.1	1.5	-0.3
Kyrgyz Republic	2.5	7	-11.7	30.5	5.7	1.4
Pakistan	3.4	4.5	2.5	0.6	4.5	3.6
Tajikistan	-2.4	5.8	7.7	8.8	6.7	
Turkey	13.9	10	1.6	4.1	3.5	3.3
Turkmenistan	-1.1	10.1	13.7	10	9.6	
Uzbekistan	8.1	8.5	11.5	8	8.3	8.5

Source: UN National Account Aggregates, World Development Indicators, and Key indicators of Asia and Pacific.

Table 3.6: Service Sector Growth Performance

(%)

	2010	2011	2012	2013	2014	2015
Afghanistan	18.1	10.3	16.0	2.6	2.2	2.8
Azerbaijan	5.7	1.9	-30.6	16.9	11.9	-13.7
Iran	6.7	6.2	1.4	-0.8	1.7	..
Kazakhstan	9.6	8.6	10.6	6.8	5.6	2.4
Kyrgyz Republic	0.2	8.6	2.5	2.0	7.0	2.2
Pakistan	3.2	3.9	4.4	5.1	4.4	5.0
Tajikistan	7.1	12.3	12.3	11	6.7	
Turkey	7.6	8.8	2.5	5.5	4.3	4.8
Turkmenistan	18.4	10.1	13.7	10	9.6	
Uzbekistan	10.4	9.7	7.3	9.0	9.0	8.9

Source: UN National Account Aggregates, World Development Indicators, and Key indicators of Asia and Pacific.

3.2.2. GDP by Major Expenditure Items

A look at GDP by components shows that final consumption, which is comprised of household and general government spending, continued to be the largest expenditure item in all the ECO economies[9]. High levels of final consumption expenditure leave little room for the group of ECO economies to invest sufficiently in productive capacities. Certainly, the share of gross capital formation in the GDP of seven ECO economies (with the exception of Pakistan, Turkey and Iran) has improved since the year 2000 but is still significantly below the levels observed in other developing countries.

Over the years, final consumption expenditure marked a decrease in Afghanistan which is accommodated by gross capital formation (mostly in the non-agriculture sectors). In Azerbaijan decrease in final consumption expenditure is adjusted by gross capital formation and net exports since 1991. Public investment expanded continuously, while net

[9] Household Consumption expenditure accounted for roughly about 80 percent or more in nine out of ten economies. Only exception is Turkmenistan, where its share in total final consumption expenditure is 54 percent.

exports have shown a downward trend (from 33.6 percent of GDP in 2010 to 17.1 percent in 2014 and further to 3.0 percent in 2015) because of significant increase in imports and decrease in the value of oil exports. Rising incomes attributable to higher salaries and pensions and increased consumer lending fueled private consumption. While rise in gross fixed capital formation mainly reflected higher investment in the non-oil economy, much of which was supported by government development programs. In Iran decrease in final consumption expenditure is adjusted by increase in net exports after the lifting of sanctions.

In Kazakhstan, decrease in final consumption expenditure is adjusted by gross capital formation and net exports since 2000. In 2015, net exports in Kazakhstan declined sharply because of the fall in global oil prices. In Tajikistan on the demand side, consumption remained the main driver of growth. Remittances have been used mainly for consumption, and because of the poor business environment and weak financial intermediation, these could not be channeled into productive investment[10]. This has also increased demand for non-traded goods and services as well as imports, both of which have risen sharply particularly from 2004 onward. Exports did not perform well as their share in GDP is declining noticeably from 2004 onward. Net exports have declined from –33.7 percent of GDP in 2010 to -44.0 percent of GDP in 2014.

For Turkmenistan, reduction in final consumption expenditure (in both household and general public) is accommodated by increase in gross capital formation as well as net

[10]Although the government has increased spending in infrastructure projects, spending remains limited to transport and energy projects with long gestation periods.

exports. Among the oil exporting countries in the region, Turkmenistan is at the top as far as share of net exports in total GDP is concerned. On the demand side, economic growth is supported by public investment. The government continued to support the private sector, encouraging import-substitution and export-promotion outside the hydrocarbon economy, where most of the growth occurred.

In Pakistan final consumption expenditure has increased over the years (in 2015, 91 percent of which is private consumption). Until 2008, it was fueled by rapid growth in private credit. Later increased remittances and growth in rural and small business income boosted private consumption expenditure. This has also increased the demand for non-traded goods. Net exports as a percentage of GDP have also decreased despite the fall in commodity and fuel prices in 2015 because of the decline in textile exports.

In the Kyrgyz Republic, increase in both final consumption expenditure (private consumption) and gross capital formation is observed but at the cost of external economy. Share of imports in Kyrgyz Republic's GDP has increased tremendously over the years. Higher employment, wage increases, and a rise in remittances boosted demand for imported goods into the Republic over the years, thus net exports declined sharply from -30.1 percent of GDP in 2010 to -50.2 percent of GDP in 2015.

In general, for the ECO region, gross capital formation measures the amount of savings in an economy which are transformed into investments in production. About 24 percent of the total GDP generated in the ECO countries was invested in productive assets in 2014. In terms of gross fixed capital formation (after adjusting for inventories) almost 22 percent of the GDP in ECO economies was invested in productive assets. This marks 2.0 percentage points increase since year 2000.

3.2.3. Overall Economic Growth

The global economic crisis affected the economic growth rates of both developed and developing countries in the recent years. After negative growth in 2009, the global economy has since been experiencing positive growth rates. So far, recovery in global economy has mainly come from positive economic growth rates in developing countries. In 2015, the world economic growth is measured at 2.5 percent. The GDP growth of ECO region (on the whole) has shown a negative growth in 2009 but has recovered afterwards. This is in line with the persistent slowdown in major economic activities. However, individually, the ECO countries have shown a mixed trend.

Table 3.7: Demand Side Components of GDP

(% of GDP)

	Final Consumption					Gross Capital Formation				
	1991	2000	2010	2014	2015	1991	2000	2010	2014	2015
Afghanistan		120.6	117.1	121.4	117.3		12.3	17.9	18.2	21.2
Azerbaijan	92.5	78.7	48.3	57.2	68.3	3.1	20.7	18.1	25.8	28.7
Iran	74.4	63.2	57.8	61.3		42.2	35.1	37.1	33.4	
Kazakhstan	69.8*	74.4	60.3	62.4		31.5*	18.1	25.4	24.1	
Kyrgyz Republic	85.9	85.7	102.7	113.5		15.4	20.0	27.4	36.8	
Pakistan	82.5	84.0	90.0	91.5	91.0	19.0	17.2	15.8	15.0	15.1
Tajikistan	76.1	92.7	119.4	130.1**		22.9	9.4	17.9	19.1**	
Turkey	80.1	82.2	86.0	84.2	84.3	22.7	20.8	19.5	20.0	18.5
Turkmenistan	42.4	50.7	16.3	23.9***		45.8	34.7	51.9	47.2***	
Uzbekistan	78.8	74.8	73.6	80.9	77.7	25.1	22.1	23.2	23.1	23.8

Source: World Development Indicators
*for 1992, **for 2013, *** for 2012

Table 3.8: Net Exports

(% of GDP)

	1991	2000	2010	2014	2015
Afghanistan		-32.9*	-34.9	-37.6	-38.6
Azerbaijan	4.5	0.7	33.6	-17.1	3.0
Iran	4.8***	1.7	5.1	5.3	-
Kazakhstan		7.5	14.4	13.5	3.9
Kyrgyz Republic	-1.3	-5.7	-30.1	-50.2	-
Pakistan	-1.6	-1.2	-5.8	-6.4	-6.2
Tajikistan	1.0	-2.2	-37.3	-44.0	-
Turkey	-2.8	-4.1	-5.6	-4.2	-2.9
Turkmenistan	11.9	14.6	31.8	33.4	-
Uzbekistan	-3.9	3.1	3.1	-4.0	-1.5

Source: World Development Indicators and UN National Account Aggregates
*for 2002, **for 2014, ***for 1993

Table 3.9: GDP Growth

(%)

	1995	2000	2009	2010	2011	2012	2013	2014	2015
Afghanistan	49.9	-5.5	17.2	3.2	8.7	10.9	6.58	2.1	1.5
Azerbaijan	-11.8	11.1	9.4	4.6	-1.6	2.1	5.9	2.6	1.1
Iran	2.4	5.8	2.3	6.6	3.7	-6.6	-1.9	4.3	4.3
Kazakhstan	-8.2	9.8	1.2	7.3	7.3	5.0	6.0	4.3	1.2
Kyrgyz Republic	-5.4	5.4	2.9	-0.5	6.0	-0.1	10.5	3.6	3.5
Pakistan	5.0	4.3	2.8	1.6	2.7	3.5	4.4	5.4	5.5
Tajikistan	-12.4	8.4	4.0	6.5	2.4	7.5	7.4	6.7	4.2
Turkey	7.2	6.8	-4.8	9.2	8.8	2.1	4.2	2.9	4.0
Turkmenistan	-7.2	5.5	6.1	9.2	14.7	11.1	10.2	10.3	6.5
Uzbekistan	-0.9	4.0	8.1	8.5	8.3	8.2	8.0	8.1	8.0
ECO	4.4	6.3	-0.8	7.2	6.6	0.8	3.3	3.9	3.2
World	2.9	4.3	-2.04	4.1	2.9	2.2	2.1	2.5	2.5

Source: UN National Account Aggregates and World Development Indicators.

The Afghan economy has suffered because of political instability over the years[11]. The negative growth rate was recorded prior to 2002. After 2008 with support from the Western economies the country recorded high growth for a few years[12]. However, the withdrawal of international security forces in 2014 along with deteriorating security situation and continuing political uncertainties have resulted in a significant deceleration in economic growth (1.5 percent in 2015)[13]. This slowdown has curtailed job opportunities; unemployment has increased to 9.1 percent in 2014 from 8.5 percent in 2012. Poverty has increased over the years from 35.8 percent in 2012 to 39.1 percent in 2014. Increasing poverty, decrease in employment opportunities, and the deteriorating security situation have contributed to increased out-migration. Overall growth in 2015 was largely driven by growth in industry (1.4 percent) and services (2.8 percent), offsetting the contraction in the agriculture sector (-2 percent).

In Azerbaijan, growth accelerated to 5.9 percent in 2013 from 2.1 percent in 2012, driven mainly by a 16 percent expansion in the services sector. However, the sharp decline in international oil prices in 2015 has badly affected the economy of Azerbaijan. In 2015, the GDP growth declined to 1.1 percent in real terms[14]. Azerbaijan economy, being rich in

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[11] Three decades of conflict devastated Afghanistan's economy and drove more than 2.5 million Afghans away from their homes and livelihoods.

[12] Afghanistan's GDP is now nearly two and a half times greater than it was in 2002 and per capita GDP has increased by 70 percent in only 12 years.

[13] With uncertainty leading to a slump in investor and consumer confidence, growth weakened significantly across the board in non-agricultural sectors, including manufacturing, construction and services.

[14] Azerbaijan has a unique opportunity to enter the ranks of higher middle-income countries, evidenced by the decline in the poverty rate from 50 percent in 2001 to 6 percent in 2012, and unemployment reduced from 12 percent to 5.0 percent. While some of this improvement was driven by high growth rates, a strong increase in wages, and the introduction of a well-targeted social benefit system, much of it resulted from a jump in oil and gas revenues. In 1990s, major economic reforms were introduced that allowed for some legislative acts: including state orders, quoting, licensing were abolished, liberalized process of foreign trade liberalized, improvements in finance and monetary-credit policy, customs and tax policy etc.

hydrocarbons is divided into oil sector and non-oil sector. In 2015, the non-oil sector constituted 69.3 percent of the total value-added. GDP growth remained very high until 2009[15]. The end of oil boom in 2011 led the non-oil sector to improve its position. On the whole, during last few years' economic growth in the country is attributed to the expansion of non-oil sector. The growth in non-oil sector is derived from increased government expenditures which in turn are financed by oil revenues. Thus, reductions in oil revenues in 2015 squeezed public spending hindering economic growth. On the production side this decline was mainly driven by the negative growth in the services sector, despite the agriculture growth of 6.6 percent in 2015[16].

Iran's economy is characterized by a large hydrocarbon sector, small scale agriculture and services sectors, and a noticeable state presence in manufacturing and financial services. Iran ranks second in the world in natural gas reserves and fourth in proven crude oil reserves. Economic activity and government revenues still depend to a large extent on oil revenues and therefore remain volatile. After the political change in 2013, the Iranian economy has shown a turnaround, moving from the recessionary years in which it experienced a 6.6 percent decline in 2012 and 1.9 percent in 2013 into positive growth in recent years[17]: the country recorded a growth of 4.3 percent in 2015[18]. The

[15] No impact of global financial crisis.

[16] Agriculture is a meaningful component of Azerbaijan's non-oil economy and has significant potential for boosting export revenues for the country. While the sector only accounts for 7 percent of GDP, it is still a key source of jobs and is a priority in the context of food security.

[17] Due to its isolation from global financial markets, 2008 global financial crisis did not affect Iran. However, following sanctions related to Iran's nuclear program, the Iranian Rial fell to a record low in 2012, thus debilitating overall economy.

[18] Sector wise data is not available for 2015. In 2014 all the three sectors on supply side recorded a positive growth; maximum growth of 4.9 percent was recorded in industry.

lifting of sanctions and the fact that the country can export more oil and petroleum products will help sustain the growth path, despite the negative impact emanating from lower oil prices. Another phenomenon that will have an impact on the Iranian economy in future will be the recent unfreezing of sizable Iranian assets in international banks[19]. However, the outlook for the Iranian economy has become uncertain in view of recent political developments resulting in the re-imposition of sanctions by the US.

From 2000 to 2007, Kazakhstan's economy grew at 10 percent (on average)[20]. However, it lost its momentum in 2008 and growth fell to 1.2 percent in 2009 on the back of slowing world economy. Later in 2010 the economy recovered. In 2015, Kazakhstan's real GDP growth slowed from 4.3 percent in 2014 to 1.2 percent[21] due to falling oil prices and weakened domestic and external demand. Kazakhstan' workforce is estimated to be 7.4 million people. The general education and scientific level of the workforce is rather high[22]. The government is reforming its industrial policy to diversify Kazakhstan economy away from over dependence on oil sector by developing light industry. Kazakhstan became the 162nd member of WTO in 2015 and is expected to benefit from trade liberalization.

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[19] More than USD 100 billion of Iran's international assets have been unfrozen after the implementation of the JCPOA (Joint Comprehensive Plan of Action).

[20] The break-up of the USSR in December 1991 and the collapse of demand for Kazakhstan's traditional heavy industry products resulted in a short-term contraction of the economy, with the steepest annual decline occurring in 1994. In 1995-1997, economic reforms and privatization resulted in a substantial shifting of assets into the private sector. The Caspian Pipeline Consortium agreement to build a new pipeline from Western Kazakhstan's Tengiz oil field to Black Sea increases oil exports. The Kazakhstan economy slowed in 1998 due to slumping oil prices and the financial crisis in Russia but recovered again in 1999.

[21] On the supply side, agriculture grew by 4.1 percent in 2015, industry recorded a negative growth of 0.3 percent and services grew by 2.4 percent.

[22] Education is a high priority for Kazakhstan, and in 2011, Kazakhstan ranked first on UNESCO's "Education for All Development Index" by achieving near-universal levels of primary education, adult literacy, and gender parity.

The Kyrgyz Republic is not only one of Central Asia's poorest countries but also smallest in the ECO region with a share of only 0.28 percent in region's GDP[23]. The economy depends heavily on gold exports and remittances from Kyrgyzstani migrant workers, primarily in Russia. In terms of growth, real GDP moderated in 2014 (declined from 10.5 percent in 2013 to 3.6 in 2014 and then to 3.5 in 2015) as a result of weak external demand (basically prolonged economic slowdown in Russia) and lower production at Kumtor Gold mine[24]. Decline in gold production affected the overall performance of exports. Moreover, adverse weather pushed down agricultural yields in 2014. In 2015, besides external factors slowdown in industry was responsible for further deceleration by 0.1 percent in 2015.

Pakistan's economy grew strongly at about 6 percent by 2007 but thereafter economic growth fell sharply due to the global financial crisis, hike in global oil and food prices and domestic energy crisis. Slow growth from 2008 to 2013 reflected weak macroeconomic fundamentals in recent years. Investment remained low as energy shortages and security concerns continued to undermine investor confidence. Energy shortages also affected industrial sector quite badly. Growth accelerated in Pakistan from 2012 onwards as a result of cumulative impact of the government's macroeconomic and structural reform program. Besides real GDP growth of 5.5 percent in 2015 was supported

[23] Although its economy and society are the most liberal in Central Asia, the Kyrgyz Republic has experienced significant political and social instability since independence in 1991.

[24] Kyrgyz Republic has experienced many years of negative growth owing to its dependence on external economy, its reliance on one gold mine, Kumtor, which accounts for over 10 percent of GDP, and on worker remittances, equivalent to about 30 percent of GDP in 2011–15.

by fall in commodity and fuel prices, increased energy availability and improved security conditions. On the supply side all sectors contributed to growth, agriculture grew by 2.9 percent, industry by 3.6 percent and services by 5 percent.

Tajikistan's economic growth has been robust since the end of its civil war in 1997, riding on post-conflict recovery, significant increases in remittance inflows, and a favorable external environment largely brought about by economic development in the Russian Federation[25]. Tajikistan's economy from 1997 to 2004 grew by an average of 8 percent supported by broad-based growth across sectors. From 2005 to 2014, growth averaged 7 percent, mainly because of the volatility in the international prices of Tajikistan's two main exports, cotton and aluminum, affecting the whole economy and highlighting its vulnerability to fluctuations in commodity prices[26]. From 2005 onwards, workers' remittances started flowing in increasingly significant volumes. This made Tajikistan the world's most remittances-dependent economy. In 2015, decline in remittances (due to slowdown in Russia) and weak global demand for cotton and aluminum slowed down Tajikistan's GDP growth.

In Turkey just as in Pakistan, economic growth fell sharply in 2008 to 0.7 percent. In 2009, the economy experienced a sharp contraction in output with growth at negative 4.8

[25] The 5-year civil war severely damaged infrastructure; disrupted industrial and agricultural production, and caused near-total economic collapse. The government initiated various economic and political reforms to restore macroeconomic stability. Tajikistan's economic transition from a centrally planned system toward a more market-oriented system only began around 1997; most of the subsequent period is basically a recovery from war.

[26] The global economic crisis in 2009 was one such external demand shock. Tajikistan's economic growth decelerated to 4 percent with the sharp decline in the prices of cotton and aluminum and with the deterioration of trade. With better macroeconomic management, the country's GDP growth recovered.

percent as a result of global financial crisis[27]. In 2009, the Turkish government introduced various economic stimulus measures to reduce the impact of the global financial crises, such as temporary tax cuts on automobiles, home appliances, and housing. As a result, economy grew at 9 percent on average in 2010 and 2011. This growth on supply side was mainly driven by all the three sectors, but mainly by industry and services. However, growth slowed in 2012 and onwards relative to previous years. In 2015, with a slight recovery real GDP grew at 4 percent compared to 2.9 percent in 2014[28].

In Turkmenistan, growth remained strong since late nineties. Real GDP growth in 2014 was recorded at 10.3 percent. However, lower global energy prices led to the fall in revenues from oil and natural gas exports, thus bringing down GDP growth to 6.5percent in 2015. Growth remains highly dependent on hydrocarbons and related sectors. After the diversification of natural gas export routes in 2009, China became the largest export market for Turkmenistan[29].

Uzbekistan's economy grew rapidly over the past decade. Growth remained robust at an average of around 8 percent led by wage and pension increases, high public investment spending, and large remittances. Increased exports of gas, gold, and copper, combined with high commodity prices, have generated revenues that have financed large

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[27] Turkey was one of worst affected country during the financial crisis.

[28] Slow growth in Europe and a deteriorating geopolitical environment in its neighborhood have negatively impacted its exports, investment, and growth. Turkey's slowdown is mainly caused by longer-term structural factors. Among the most fundamental of Turkey's structural problems is over reliance on foreign investment. Turkey's excessive dependence on capital inflows from abroad, as well as its persistently high current account deficit has left it extremely vulnerable to external shocks.

[29] Despite the ongoing diversification of markets, Turkmenistan's exports are increasingly dependent on a single large market, i.e., China and dominated by natural gas making the economy vulnerable to fluctuations in global prices.

increases in investment and salaries to strengthen consumption. However, recession in Russia[30]and slow growth in China and declining prices of export commodities including natural gas, copper and cotton have contributed to a slight reduction in GDP growth in 2015. On the supply side, all the three sectors contributed significantly to growth in Uzbekistan.

3.2.4. Labor Force and Unemployment

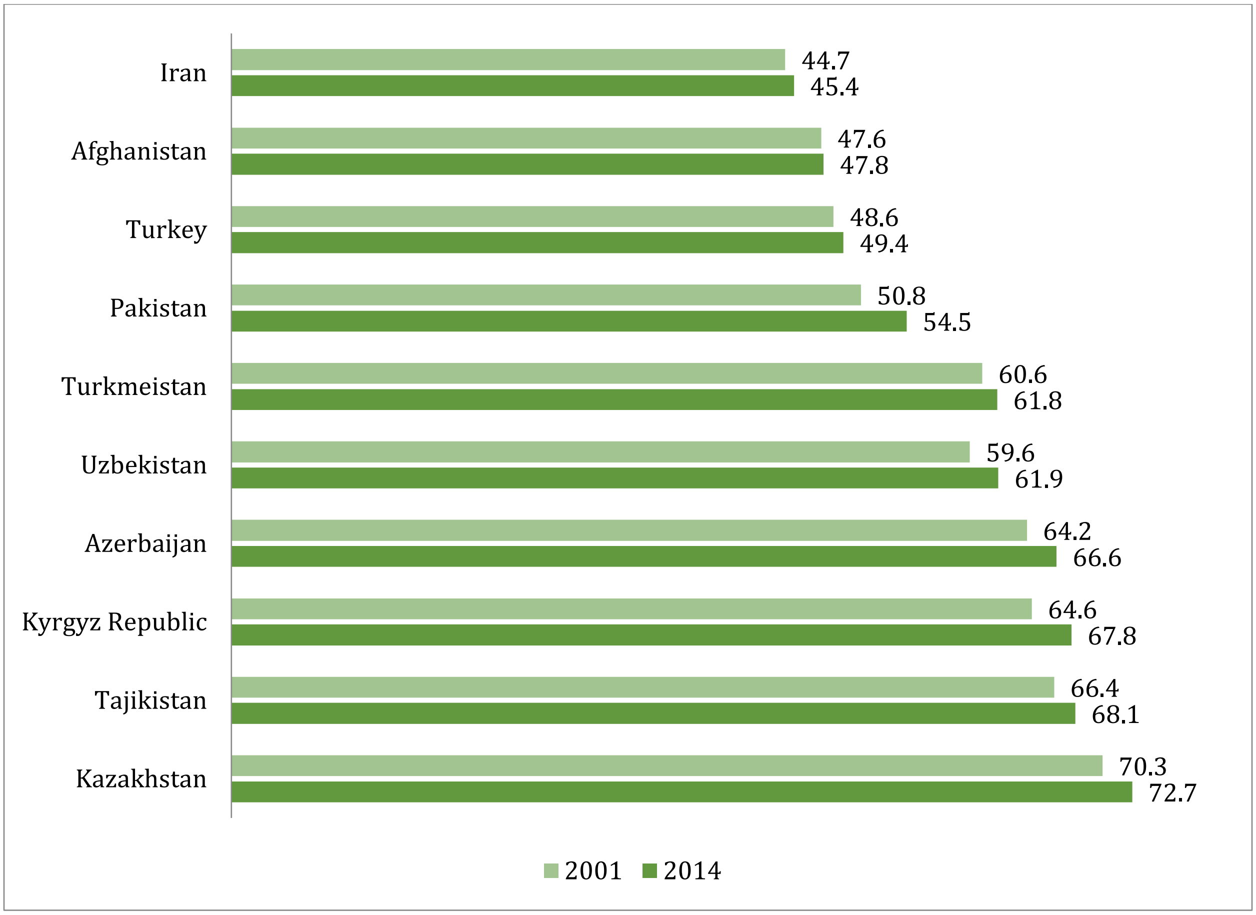
To understand labor market, we will first consider the labor force participation rate (LFPR), which measures the proportion of people aged 15 and above that engages actively in the labor market, either by working or actively searching for a job. As shown in Figure 3.1, the labor force participation rate in ECO region ranges from 45.4 percent in Iran to 72.7 percent in Kazakhstan. The labor force participation rate in ECO region has increased in all the countries since 2001, though quite marginally in Afghanistan and Iran. Maximum increase is recorded in Pakistan.

Although, ECO member countries registered globally comparable performance in terms of male labor force participation rates (around 70 percent or more) in 2014, their performance in the case of female labor force participation rate remained significantly lower. But the positive thing is the increasing trend in the female labor force participation rates in all the countries. Female labor force participation rate in 2014 was highest in Kazakhstan (67.9 percent) and lowest in Afghanistan (15.9 percent). Pakistan has made

[30] Russia is second largest trading partner after China and main source of remittances in Uzbekistan.

significant progress in increasing its female labor force participation from 15.9 percent in 2001 to 24.8 percent in 2014.

Figure 3.1: Labor Force Participation Rates (%)



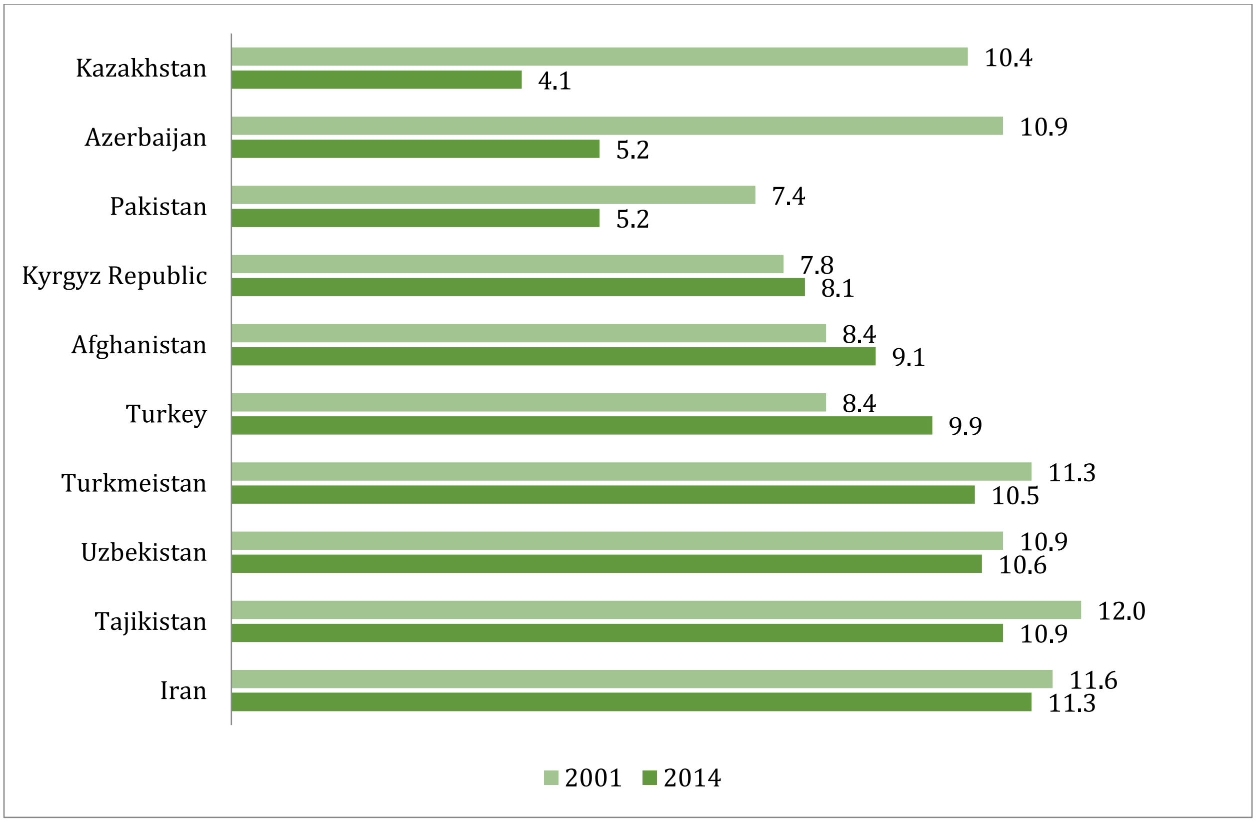
Source: World Development indicators

Unemployment (an important macroeconomic variable measuring economic performance) remained one of the most challenging issues across the globe. High unemployment (particularly among youth and women) is a serious concern in Iran[31], is highest among the ECO economies (Figure 3.2). Kazakhstan and Azerbaijan have made

[31] Inflation, output gap, economic uncertainty associated with an unstable currency, the real growth of investment, and the aftereffects of Iraqi war, all have limited job opportunities, particularly for the rising number of youth population in Iran. Economic sanctions in 2012 further added to its labor market problems.

tremendous progress since 2001 reducing their unemployment from 10.4 percent and 10.9 percent in 2001 to 4.1 percent and 5.2 percent in 2014 respectively[32]. In Afghanistan[33] and Turkey[34], unemployment has increased since 2001.

Figure 3.2: Unemployment Rate (%)



Source: World Development indicators

[32] Azerbaijan and Kazakhstan, resource-rich countries in the South Caucasus region have used their resource wealth well over the past decade, reducing poverty and unemployment. Though, Progress on poverty reduction largely stalled in 2014 and 2015 due to slow growth and a weak labor market. Kazakhstan has made great progress in terms of increasing highly qualified workforce.

[33] Insecurity, lack of jobs in government and the private sector organizations and a downturn of industries are the main factors behind growing unemployment in Afghanistan.

[34] Though Turkey's unemployment rate recovered from the financial crisis, decreased from 12.6 percent in 2009 to 8.1 percent in 2012, but increased again in 2013. Youth represent a particularly vulnerable group in Turkey. Low skills are a key barrier to achieving better labor market outcomes for youth in Turkey.

3.3. Monetary Policy

Most of the countries in ECO have generally maintained macroeconomic stability since 2012 as inflation rate remained in single digits[35]. Iran is the only country where inflation has remained in double digits since 1991. However, inflationary pressures in Iran continued to fall under the less accommodative monetary policy stance (contractionary monetary policy), with the consumer price index falling to 13.7 percent in 2015[36], from a peak of 39.3 percent in 2013[37] (Table 3.10). This fall can further be explained by the relative stability in the foreign exchange market as well as the government's attempt to increase non-monetary services (such as health services covered by state insurance) to the population.

In Afghanistan, inflation fell markedly in 2014 because of the decline in both food and non-food inflation (as prices for vegetables, oil, and fats fell because of ample supply and lower international prices; and non-food inflation decline mainly because of falling property rents. In 2015, Afghanistan experienced mild deflation with consumer prices averaging -1.5 percent. Both food and non-food prices fell reflecting weak domestic demand as well as declining global prices for fuel and other commodities. In Azerbaijan slower economic activity and strict controls over consumer lending helped trim average annual inflation to only 1.4 percent in 2014 despite the poor harvest, a slowdown in food

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[35] Inflation is on decline across the globe reflecting the impact of decline in prices for oil and other commodities and weakening demand in some advanced economies. Global estimates of inflation show a decrease from 5.3 percent in 2011 to 3.6 percent in 2014.

[36] In 2016, it further reduced to 12.6 percent.

[37] Factors responsible for inflationary pressures in Iran's economy include economic sanctions in recent years that have resulted in disrupted supply chains and higher operating costs; withdrawal of subsidies on food staples, electricity, water, and gas, all pushed up prices.

price inflation offset a rise in other prices. However, in 2015, devaluation[38] and higher inflation in trading partners accelerated inflation rate back to 4 percent despite a decline in global food prices. Similarly, in Kazakhstan and Kyrgyz republic devaluation of their respective currencies accelerated inflation in 2014. In 2015, average annual inflation eased slightly as food prices dropped.

Table 3.10: Inflation Rate

(%)

	2008	2009	2010	2011	2012	2013	2014	2015
Afghanistan	30.6	-8.3	0.9	10.2	7.2	7.7	4.6	-1.5
Azerbaijan	20.8	1.4	5.7	7.9	1.0	2.4	1.4	4.2
Iran	25.5	13.5	10.1	20.6	27.4	39.3	17.2	13.7
Kazakhstan	17.2	7.3	7.1	8.3	5.1	5.8	6.7	6.6
Kyrgyz Republic	24.5	6.9	8.0	16.5	2.7	6.6	7.5	6.5
Pakistan	20.3	13.6	13.9	11.9	9.7	7.7	7.2	2.5
Tajikistan	20.5	6.4	6.4	12.4	5.8	5.0	6.1	5.7
Turkey	10.4	6.3	8.6	6.5	8.9	7.5	8.9	7.7
Turkmenistan	14.5	-2.7	5.0	5.3	5.3	6.8	6.0	6.0
Uzbekistan	7.2	7.8	7.6	7.3	7.2	7.0	6.4	5.6

Source: World Development Indicators and Asian Development Bank

Note: Inflation as measured by Consumer Price Index

In Pakistan, since 2011, average consumer price inflation is decelerating (with contractionary monetary policy for few years) and declining trend in global prices for oil and food. In Turkey, a stable lira eased the pressure on prices of imported goods and average inflation rate declined in 2015. In Tajikistan, since 2012, inflation is on average around 6 percent. In 2015, despite depreciation, inflation slowed, reflecting the drop in private consumption (result of fall in remittances), lower global prices for petroleum and

[38] Declining energy prices and the drop in export earnings forced the central bank to devalue the Manat and abandon the peg to the US dollar. This cost the central bank more than two-thirds of its foreign exchange reserves.

wheat, and currency depreciation in Tajikistan's main trade partners. In Turkmenistan, despite devaluation, declines in prices for food and services and import-substitution policy of the government in 2015 helped in containing the inflation rate at the same level. In Uzbekistan, inflation slowed since 2013 in line with global trends. In 2015, despite higher public wages and pensions, tariff hikes, and currency depreciation, inflation slowed in 2015, reflecting lower global food prices and import costs.

The basic objective of monetary policy in general in all the ECO economies is not only to limit inflation but to support economic growth. Central Banks in these economies therefore keep on varying three instruments: broad money, interest rate as well as exchange rate to achieve their basic objective.

In Afghanistan, monetary policy became relatively tight since 2012. Broad money after growing at the rate between 20 to 30 percent in the fast-growth era slowed to 3.3 percent in 2015 (Table 3.11), attributed to significant slowing in demand for local currency in anticipation of the transition, as dollarization increased[39].

In Azerbaijan, the objective of Central Bank while limiting inflation to 5 percent is to stabilize exchange rate and support economic growth. The Central Bank relaxed its policy rate from 5 percent in 2013 to 3 percent to 2015, to strengthen economic activity and support firms in the non-oil economy. Broad money grew positively by 2014 that helped in the credit growth. However, the drop in international reserves caused broad money to

[39] The deteriorating security situation has eroded trust in the local currency and left the economy even more highly dollarized.

contract by 1.1 percent after having grown by 11.8 percent in 2014. Since economic policies were framed on the basis of the oil price of USD 90, decline to an average of USD 50 in 2015 resulted in an economic imbalance, and ultimately led to sharp devaluation.

In Iran, with economic recovery in 2014, stimulating private sector growth and job creation is a continued focus for the government considering the increased number of workers who should enter the labor market in the coming years[40]. With decline in inflation in 2015, the monetary policy changed its course from tight to expansionary, and interest rate became positive in real term (which remained negative for many years prior to 2015)[41].

In Kazakhstan, broad money grew by 34 percent in 2015 (compared with 7.9 percent in 2012), reflecting growth in credit to the economy as well. Monetary policy during 2015 tried to strike a balance between decline in growth attributable to low oil prices and curbing the inflation that followed after the adoption of a floating exchange rate (from a tightly managed exchange rate) and the resulting plunge in the value of the currency. To contain inflation, the central bank increased the interest rate. However, extensive dollarization, with more than 65 percent of bank deposits in foreign currency, limited the effectiveness of monetary policy. In Kyrgyz Republic, monetary policy remained cautious as the central bank intervened repeatedly to stabilize the local currency which is

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[40] Because of Iran's large student population, the labor force will grow by about 2.5 percent per year in the next five years, equivalent to about 3 million job market entrants (IMF, 2016).

[41] With expected slowdown 2015 onwards, Central Bank announced stimulation of demand and economic activity in terms of easing monetary expansion and credit growth through reducing deposit rate (IMF, 2016).

continuously getting weaker against US dollars since 2009[42]. As in Kazakhstan, extensive dollarization limited the impact of monetary policy in the Kyrgyz Republic[43].

In Pakistan as inflation began to decelerate, the State Bank of Pakistan (SBP) began to cut its policy rate gradually. Government borrowing from the SBP and commercial banks remained high, as foreign financing was negligible. To maintain market liquidity, the SBP injected funds through open market operations in 2013. The heavy reliance on short-term borrowing (by the government) has increased the government's exposure to interest rate and rollover risks. However, in 2015, monetary policy eased significantly (as inflation fell and the government borrowed less from it). The SBP cut its policy rates to support domestic credit growth which showed contraction since 2009.

In Tajikistan, monetary policy remained largely accommodative. The deposit rate has come down from 8.6 percent in 2010 to 4.2 percent in 2015. Broad money after growing at almost 20 percent in 2012 and 2013 slowed to 7 percent in 2014 but picked up again in 2015 (grew by 18.7 percent). Credit to the private sector is on the increasing side since 2013. The average exchange rate for the Tajik Somoni is increasing (but only marginally till 2014) which helped in containing import prices and inflationary expectations[44].

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[42] It was relatively strong in 2007 and 2008.

[43] The central bank used policy interest rate to contain inflation. However, the full impact of the rate hike was limited by extensive dollarization, as more than half of all bank loans and deposits are in foreign currency and dollarization increased as the currency weakened.

[44] Lower remittances and export receipts, along with currency depreciation in Tajikistan's main trade partners, caused the Tajik Somoni to depreciate, despite sizable interventions to stabilize exchange rates. To ease currency pressures, foreign exchange control was strengthened in 2015 - the operations of private exchange were brought under the control of banks and authorization for foreign exchange operations was

A More flexible monetary policy approach was adopted by Turkey after 2010 to prevent the negative effects of external shocks[45]. The availability of low cost short-term foreign financing led to a rapid credit expansion in Turkey and put appreciation pressure on the Turkish lira. The Central Bank of Turkey has modified the conventional inflation targeting regime by adopting financial stability as an additional objective and a particular emphasis is on credit and exchange rate channels. The new strategy, in addition to the interest rate, also used reserve requirement ratios to manage financial imbalances.

In Turkmenistan, tight monetary policy slowed broad money growth since 2012. The Central Bank maintained its exchange rate peg[46] until 2014, strengthened by comfortable foreign exchange reserves. In the beginning of 2015, Turkmenistan Manat devalued by 19 percent, but with little effect on inflation. Similarly, in Uzbekistan, broad money growth has slowed over the last few years. The central bank is continuously lowering the official exchange rate of the Uzbek Sum against the US dollar (the unofficial rate fell even faster in the parallel market[47]). Taking into account weaker currencies across the Commonwealth of Independent States the Uzbek Sum is estimated to have appreciated in real terms making exports less competitive in 2015.

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restricted to financial institutions. The Central Bank has also signed a USD 500 million currency swap agreement with its counterpart in China.

[45] This approach is in line with that of most developed countries, adopted in the aftermath of the 2008 global financial crisis.

[46] Exchange rate pegged at 2.85 per US dollars since 2009.

[47] Gap between official and parallel exchange rates more than doubled in 2015.

Table 3.11: Broad Money Growth

(%)

	2010	2011	2012	2013	2014	2015
Afghanistan	26.9	21.3	8.8	9.4	8.3	3.3
Azerbaijan	24.3	32.1	20.7	15.0	11.8	-1.1
Iran	24.6	20.2	-	-	39.5	22.4
Kazakhstan	13.3	15.0	7.9	10.2	10.5	34.3
Kyrgyz Republic	21.1	14.9	23.8	22.8	3.0	14.9
Pakistan	14.6	12.6	17.2	13.3	11.6	12.4
Tajikistan	18.6	33.1	19.6	19.7	7.1	18.7
Turkey	18.5	15.2	10.4	21.2	11.2	16.5
Turkmenistan	74.2	52.1	32.8	25.7	16.2	20.7
Uzbekistan	52.4	32.3	27.5	26.6	24.0	

Source: World Development Indicators and Indicators for Asia and Pacific (ADB).

3.4. Financial Sector Development

The level of financial sector development in ECO countries remains shallow. As a sign of low financial deepening, the volume of broad money relative to the GDP in ECO countries was below 60 percent in 2015. Apparently, the financial system in ECO countries lacks adequate financial access, liquidity, diversification and stability benefits offered by deeper financial markets. Across the member countries, it varies substantially. Broad money as a percent of GDP was highest in Turkey at 63 percent in 2015, followed by Pakistan (53 percent).

The role of private sector credit in promoting investment and economic activity can hardly be over-emphasized. The domestic credit provided by the financial sector in Turkey was equivalent to 80 percent of the GDP (in 2015) whereas this figure was quite low for other member countries. Most of the countries apparently, experienced a more balanced growth in the size of bank credit to private sector with respect to GDP, with the exception of Afghanistan and Pakistan. For Pakistan, credit to the private sector (in terms of GDP) has witnessed a noticeable decline since 2008 plunging from 28 percent in 2008 to merely 15 percent in 2015. This ratio is among the lowest in ECO economies. In Pakistan, government borrowing form bank-dominated financial sector marginalizes the credit for private sector activities[48]. While in Afghanistan, preference for holding cash reflects continued distrust and weak financial intermediation in the banking sector since the massive failure of the Kabul Bank in 2010. The financial sector has yet to overcome negative spillover from the Kabul Bank crisis in 2010, consequently, growth in bank's net credit to the private sector has been small.

In the wake of tightening policies implemented especially in the developed countries, fiscal balances are improving systematically across the world. World fiscal deficit as a percentage of GDP witnessed a declining trend from -4.8 percent in 2010 to -2.5 percent in 2014. In the group of ECO countries, the fiscal balance as percentage of GDP has a mixed trend since 2010. In 2015, budget surplus was recorded for Afghanistan (0.7 percent of GDP)[49].

Pakistan recorded highest fiscal deficit in the region (-5.3 percent of GDP)[50]. Over the years, maximum fiscal deficit in Pakistan was recorded in 2012 (8.8 percent of GDP)

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[48] With risk free government demand for credit, banks have little incentive to advance loans to risky private sector. In 2015, despite ample liquidity provided by the Central bank, growth in private credit slowed because credit demand for working capital including trade finance slowed as commodity prices declined, power shortages continued, and external demand remained weak.

[49] Since 2009, improvement in revenue collection, more realistic budgeting and restraints on expenditures helped to balance the budget and the fiscal position improved significantly.

[50] Budget deficit in Pakistan is financed mostly by heavy borrowing from commercial banks. Nearly 80 percent of the expansion in banking system credit during 2015 went to the government.

and 2013 (8.0 percent of GDP), not only because of low tax revenues but also higher current expenditures on power subsidies, pensions, and interest on short-term domestic borrowing. Since 2014, the narrowing down in budget deficit reflects growth in non-tax revenue (increased form 12.8 percent in 2012 to 14.4 percent in 2015)[51]. Some progress is also achieved in tax revenues (increased by 1.0 percent in 2014) by eliminating concessions and exemptions. On the expenditure side, increase in power tariffs has reduced total budget subsidies decreasing total expenditures from 21.6 percent of GDP to 19.7 percent of GDP in 2015.

Despite its dependence on oil revenue (which reduced in 2015 because of lowering in global fuel prices), Iran has made progress in terms of reducing fiscal deficit through its tax reforms focused on broadening the tax base, increasing the VAT rate, stepping up tax administration efforts, and enacting tax legislation that simplifies direct taxation and removes exemptions to some large non-taxpayers (tax revenue increased from 5.2 percent of GDP in 2014 to 6.4 percent in 2015). This has compensated for the fall in oil revenue. Further, Iranian government has implemented a major reform of its subsidy program on key staples such as petroleum products, water, electricity and bread, which has resulted in a moderate improvement in the efficiency of expenditures and economic activities, thus improving its overall fiscal balance in 2015.

[51] Sharp increase in central bank profits, inflows under the Coalition Support Fund and the Pakistan Development Fund, proceeds from the auction of 3G/4G spectrum licenses, and the utilization of the Universal Support Fund.

Table 3.12: Official Exchange Rate

(per USD)

	1995	2000	2005	2010	2013	2014	2015
Afghanistan	36.57	47.36	49.49	46.45	55.38	57.25	61.14
Azerbaijan	0.88	0.89	0.95	0.80	0.78	0.78	1.02
Iran	1,748.27	1,764.77	8,963.96	10,254.18	18,414.45	25,941.66	29,011.49
Kazakhstan	60.95	142.13	132.88	147.36	152.13	179.19	221.73
Kyrgyz Republic	10.82	47.70	41.01	45.96	48.44	53.65	64.46
Pakistan	31.64	53.65	59.51	85.19	101.63	101.10	102.77
Tajikistan	0.12	2.08	3.12	4.38	4.76	4.94	6.16
Turkey	0.05	0.63	1.34	1.50	1.90	2.19	2.72
Turkmenistan	-	1.04	1.26	2.85	2.85	2.85	3.50
Uzbekistan	29.78	236.61	1,106.10	1,578.42	2,097.20	2,319.55	2,573.50

Source: World Development Indicators and Indicators for Asia and Pacific (ADB).

Table 3.13: Broad Money to GDP Ratio

(%)

	2010	2011	2012	2013	2014	2015
Afghanistan	35.2	36.4	31.9	32.7	34.9	35.2
Azerbaijan	31.1	33.4	36.6	39.2	-	-
Iran	56.8	52.1	-	-	68.2	71.3
Kazakhstan	38.9	33.2	32.7	31.3	31.4	42.1
Kyrgyz Republic	31.4	27.8	31.7	34.0	31.1	33.8
Pakistan	52.5	48.1	51.4	52.2	52.0	53.5
Tajikistan	18.0	19.7	19.6	21.0	19.9	22.3
Turkey	56.2	54.8	55.4	60.7	60.5	63.1
Turkmenistan	17.6	20.3	22.4	23.6	23.8	-
Uzbekistan	22.4	23.5	24.1	24.7	25.5	-

Source: World Development Indicators, IMF and Indicators for Asia and Pacific (ADB).

Table 3.14: Private Credit to GDP Ratio

(%)

	2010	2011	2012	2013	2014	2015
Afghanistan	11.5	4.9	4.1	4.1	3.8	4.0
Azerbaijan	17.9	17.3	20.1	25.5	30.7	38.5
Iran	54.6	54.0	54.8	50.3	54.4	-
Kazakhstan	39.3	33.8	34.6	33.8	32.6	37.7
Kyrgyz Republic	13.6	11.5	13.4	15.7	20.1	22.5
Pakistan	21.4	18.1	16.9	16.1	16.0	15.4
Tajikistan	14.2	16.0	14.6	18.4	21.5	22.2
Turkey	47.1	53.1	57.9	70.1	74.6	80.0
Turkmenistan	-	-	-	-	-	-
Uzbekistan	18.4	19.2	19.4	19.0	18.7	-

Source: World Development Indicators, IMF and Indicators for Asia and Pacific (ADB).

Table 3.15: Fiscal Revenue and Expenditure Shares of GDP

(% of GDP)

	Revenue				Expenditure			
	2000	2010	2014	2015	2000	2010	2014	2015
Afghanistan	2.9*	22.0	24.5	29.2	7.7*	21.1	26.4	28.6
Azerbaijan	14.7	26.9	31.2	31.5	16.2	27.7	31.7	32.7
Iran	21.6	26.5	14.1	14.6	15.6	20.5	15	15.7
Kazakhstan	22.9	19.7	18.0	18.4	22.2	22.1	20.7	20.6
Kyrgyz Republic	14.2	30.5	35.9	37.4	18	36.6	39.8	40.4
Pakistan	13.4	14	14.5	14.4	18.9	20.2	20.5	19.7
Tajikistan	14.1	23.2	28.4	30.1	14.7	26.1	29.0	32.4
Turkey	-	-	23.3	23.1	-	-	22.6	22.4
Turkmenistan	23.5	16.1	16.3	13.8	23.9	14.1	15.4	14.8
Uzbekistan	28	32.4	33.1	33.3	28.9	32.0	32.6	34.2

Source: World Development Indicators, Key indicators of Asia and Pacific, and IMF Country Report 2016 for Iran and Turkey. *for 2002

Fiscal discipline is the hallmark of macroeconomic performance of the Turkish economy. Turkey made significant progress in fiscal management throughout the 2000s, both quantitatively and qualitatively[52]. Turkey's central government ran negligible budget

[52] Fiscal consolidation (through nominal ceilings on expenditures, increased revenues through privatization programs in 2000s contributed to private-sector oriented growth. Turkey employed all kinds of fiscal rules, among them primary surplus was the most remarkable).

deficit in 2015. In Azerbaijan, plunging oil price has increased fiscal deficit to 1.1percent of GDP in 2015 maximum since the year 2000, compelling a tightening of fiscal policy.

The fiscal deficit in Kazakhstan's budget has remained below 3.0 percent since 2000. It was recorded at 2.2 percent of GDP in 2015 (lower than 2014) as lower revenues attributable to weak oil prices forced cuts in planned spending, thus narrowing down budget deficit. Revenue, which included transfers of oil earnings from the National Fund for the Republic of Kazakhstan rose to 18.4 percent of GDP from 18.0 percent in 2014[53].

In the Kyrgyz Republic, in the last decade or so highest fiscal deficit was recorded in 2012 (5.0 percent of GDP), which narrowed down in 2015 (-3.0 percent of GDP) reflecting improvement in total revenues (revenues reached 37.4 percent of GDP up from 35.9 percent in 2014)[54] as well as delays in implementing public investment projects that limited expenditure growth.

Similarly, in Tajikistan, fiscal balance has come down from the record high of -8.1 percent of GDP in 2007 to -2.3 percent of GDP in 2015. Though it is high from its level in 2014 (-0.6 percent of GDP). Fiscal policy became relatively expansionary in 2015, after a neutral fiscal policy stance in 2014. Though lower private consumption and drop in imports constrained tax revenue in 2015. In response, the government deferred a salary increase but maintained social spending. Despite the slowdown, total revenue including

[53] Though reduced economic activity and lower prices for commodity exports constrained tax yields, but sharp depreciation of the currency boosted receipts somewhat during the last quarter.

[54] It is mainly because of the sale of mining license.

grants rose from the equivalent of 28.4 percent of GDP in 2014 to an estimated 30.1 percent reflecting better tax administration. Expenditure also rose to 32.4 percent of GDP in 2014, as capital spending was expanded to maintain economic activity.

Turkmenistan recorded a fiscal surplus of 10 percent of GDP in 2008. Since then it has narrowed and become a deficit of 1.0 percent of GDP in 2015[55]. Lower hydrocarbon exports limited revenues in 2015[56]. Uzbekistan after remaining in surplus (in central government budget) for several years has recorded a deficit of 0.9 percent of GDP in 2015[57] as lower international prices for gas, copper, and cotton kept revenues from supporting increased capital spending that raised total expenditure as a percent of GDP from 33.4 percent in 2014 to 35.3 percent in 2015.

Table 3.16: Overall Fiscal Balance (% of GDP)

(%)

	2000	2010	2014	2015
Afghanistan	-1.2*	0.9	-1.9	0.7
Azerbaijan	-1.0	-0.9	-0.5	-1.1
Iran	1.7	0.5	-2.2	-1.2
Kazakhstan	-0.1	-2.4	-2.7	-2.2
Kyrgyz Republic	-2.2	-6.3	-3.9	-3.0
Pakistan	-5.4	-5.9	-5.5	-5.3
Tajikistan	-0.6	-3.7	-0.6	-2.3
Turkey		-3.1	-1.4	-0.1
Turkmenistan	-1.69	2.0	0.8	-1.0
Uzbekistan	-1.0	2.0	0.5	-0.9

Source: World Development Indicators, Key indicators of Asia and Pacific, and IMF Country Report 2016 for Iran and Turkey. *for 2002.

55 This reflects continued spending on social programs, including rise in public wages, pensions, and students' stipends, along with higher investment outlays.

56 Energy revenues largely covered the fiscal deficit in the non-hydrocarbon economy. It is estimated at 10.3 percent of GDP in 2015

57 The augmented budget balance, which includes the Uzbekistan Fund for Reconstruction and Development, the sovereign wealth fund is estimated to have recorded a surplus equivalent to 0.2 percent of GDP for 2015 (dropped from 4.9 percent in 2010).

3.5. Foreign Trade

Share of trade in GDP of the ECO economies in 2015 has declined in seven economies (Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyz Republic and Uzbekistan) compared with its level in 2010, because of slowdown in the developed countries and fall in energy prices. For Tajikistan, Turkey and Turkmenistan though trade shares are below the level of 2014, but these are still higher than the levels in 2010. International trade is extremely important for some of the ECO economies. For instance, merchandise trade accounts for 131 percent of GDP in Turkmenistan (exports account for 82.0 percent of GDP) in 2015, followed by Kyrgyz Republic with 125 percent of GDP, but this is because of extremely high share of imports (88 percent) in GDP. Trade share in GDP is lowest for Pakistan, both exports and imports decreased in 2015[58]. All the countries in the region have introduced trade policy reforms in recent years to boost their growth outlooks. Four countries, Pakistan, Turkey, Kyrgyz Republic and Kazakhstan are members of WTO.

As a region, total merchandise exports from ECO to the world were only a minor share of 1.89 percent in 2014. It is 0.04 percentage points below the level of 2010 and 0.81 points below the level of 1991. Since 2000, it was only in 2009 when ECO exports in the world total crossed 2.0 percent. Imports to ECO region account for 1.7 percent of the world total. Import share is almost equal to the level in 2000, but below 2010. Total exports from ECO region increased from USD 184.5 billion in 2000 to USD 353.1 billion in 2014, while imports have increased from USD 163.9 billion in 2000 to USD 316.5 billion in 2014. Trade

[58] Because of slow growth in manufacturing, exports decline. While imports value also declined due to fall in commodity prices.

balance in ECO has improved from USD 20.6 billion in 2000 to USD36.6 billion in 2014 (which dropped to USD 5.7 billion in 2010).

Turkey is a leading exporter as well as an importer in the ECO with a share of 46.2 percent and 54.5 percent respectively[59]. It has increased its trade share remarkably over the years. Among Turkey's exports, 79 percent account for manufactured exports. It is followed by Iran (with an export share of 21.3 percent and an import share of 12.8 percent) and Kazakhstan (with an export of 9.4 percent and an import share of 10.0 percent)[60].

Intra-regional trade in ECO has been increasing slowly, from 5.3 percent in 2002 to 8.9 percent in 2012. European Union, Russian Federation, United States, United Arab Emirates, China are among the major trade partners of ECO countries. Among the ECO countries, only Pakistan is the second major trading partner of Afghanistan after United States.

Total Foreign Direct Investment (FDI) of ECO countries in 2015 amounted to 34.6 Billion USD which is equal to 1.6 percent of total FDI in all countries of the world. Total FDI of the ECO region has increased its share in world FDI from 0.22 percent in 2000 to 1.6 percent in 2015. The ECO region received highest FDI in 2009 when its share in world total amounted to 2.7 percent.

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59 Turkey is a free-market economy where rules of competition are in place and the private and public sectors have pioneering and regulatory roles, respectively. A liberal foreign trade policy is implemented, and goods and products can be freely traded among individuals and institutions. Infrastructure for economic institutions has been strengthened, and the country's economy has been made more resistant to probable fluctuations in international markets through the creation of autonomous institutions.

60 Trade share of both Iran and Kazakhstan have decreased since 1991.

Table 3.17: Trade Share of GDP

(% of GDP)

	Exports				Imports				Trade			
	1991	2000	2010	2015	1991	2000	2010	2015	1991	2000	2010	2015
Afghanistan		32.4**	10.0	7.3		65.3**	44.9	45.9		97.7**	55.0	53.2
Azerbaijan	45.7	39.0	54.3	37.8	41.2	38.4	20.7	34.8	86.9	77.4	75.0	72.6
Iran	25.4**	21.5	25.4	24.2*	20.6**	19.8	20.3	18.9*	46.0*	41.3	45.7	43.1
Kazakhstan	74.0**	56.6	44.2	28.6	75.3**	49.1	29.9	24.7	149.3**	105.7	74.1	53.3
Kyrgyz Republic	35.3	41.8	51.6	37.4*	36.6	47.6	81.7	87.7*	72.0	89.4	133.2	125.1*
Pakistan	17.0	13.4	13.5	10.9	18.6	14.7	19.4	17.1	35.6	28.1	32.9	28.1
Tajikistan	33.2	98.8	15.3	15.4*	32.2	100.9	52.6	59.4*	65.4	199.7	68.0	74.8*
Turkey	13.8	27.3	21.2	28.0	16.6	31.4	26.8	30.8	30.5	58.7	48.0	58.8
Turkmenistan	39.0	95.5	76.3	82.0*	27.1	80.9	44.5	48.6*	66.1	176.4	120.8	130.6*
Uzbekistan	35.3	24.6	31.7	20.7	39.1	21.5	28.5	22.2	74.4	46.1	60.2	42.8

Source: World Development Indicators

Note: *for 2014, ** 2002 for Afghanistan, 1993 for Iran and 1992 for Kazakhstan

Table 3.18: Trade Share of ECO Region

(%)

	Exports				Imports			
	1991	2000	2010	2014	1991	2000	2010	2014
Within ECO Region								
Afghanistan	0.43	0.58	1.14	0.87	0.53	1.35	2.44	2.35
Azerbaijan	3.14	1.41	7.38	6.2	1.22	0.98	4.44	4.09
Iran	38.49	32.03	24.92	21.31	33.19	18.53	21.45	12.84
Kazakhstan	16.36	11.99	10.62	9.36	26.79	12.85	9.26	10.01
Kyrgyz Republic	1.11	0.46	0.4	0.34	1.62	0.61	0.64	0.79
Pakistan	5.87	5.44	6.68	5.63	6.36	8.67	7.54	7.29
Tajikistan	1.57	0.49	0.71	0.66	1.42	0.6	1.05	1.09
Turkey	20.23	40.19	39.88	46.15	17.72	49.06	47.9	54.45
Turkmenistan	10.12	5.83	5.92	7.58	8.57	5.56	3.51	5.01
Uzbekistan	2.68	1.58	2.35	1.89	2.59	1.79	1.77	2.08
ECO Members Share in World Trade	2.7	1.83	1.93	1.89	3.56	1.7	1.92	1.73

Source: UN National Account Aggregates.

Note: At constant prices of 2005

FDI flows to ECO countries, on the other hand, continue to remain below the region's potential. By country, Turkey received 49 percent of regional inflows of FDI, followed by Turkmenistan with a regional share of 12.3 percent. Afghanistan is at bottom in regional share of FDI (0.5 percent). In terms of GDP, Turkmenistan[61] and Kyrgyz Republic are receiving more than 11 percent of FDI. In terms of volume, Turkey is the largest recipient of FDI inflows. Turkey received 16.9 Billion USD in 2015, followed by Turkmenistan, Azerbaijan and Kazakhstan receiving, USD 4.26 billion, USD 4.05 billion and USD 4.02 billion respectively. Foreign direct investment in oil producing countries is mostly going to the petroleum sector.

Table 3.19: Share of FDI in GDP

(%)

	1995	2000	2005	2009	2010	2012	2013	2014	2015
Afghanistan		0.03*	4.32	1.58	0.34	0.30	0.20	0.24	0.30
Azerbaijan	10.81	2.46	33.80	6.55	6.34	7.70	3.56	5.89	7.63
Iran	0.01	0.18	1.31	0.75	0.78	0.79	0.60	0.50	
Kazakhstan	4.73	7.49	4.46	12.38	5.04	6.32	4.08	3.34	2.18
Kyrgyz Republic	5.79	-0.17	1.73	4.04	8.76	4.67	8.63	4.73	11.57
Pakistan	1.19	0.42	2.01	1.39	1.14	0.38	0.58	0.77	0.36
Tajikistan	0.81	2.74	2.36	0.32	-0.28	2.60	-0.64	3.35	4.98
Turkey	0.52	0.37	2.08	1.40	1.24	1.68	1.50	1.57	2.34
Turkmenistan	9.39	4.51	5.16	22.5	16.08	8.90	9.52	9.59	11.41
Uzbekistan	-0.18	0.54	1.34	2.57	4.16	1.10	1.11	0.99	1.60

Source: World Development Indicators
*for 2001

The total external debt stock in ECO region continued to increase reaching USD 672.9 billion in 2014; it is almost double the amount recorded in 2006. Turkey is the most indebted country of the region with USD 408.2 billion and 60.7 percent share from total

[61] Mainly in hydrocarbons and construction.

external debt of countries of the region in 2014. Kazakhstan with USD 157.6 billion and 23.4 percent share of total external debt of the region is the second most indebted country of the region followed by Pakistan, Uzbekistan and Azerbaijan. Turkmenistan is at the bottom in terms of external vulnerability as its external debt amounted to 0.4 billion USD. The ratio of total external debt to total GDP of the region is estimated as 35.1 percent in 2014. This indicator shows very wide variation among countries of the region from the highest ratio in Kyrgyz Republic (97.2 percent) to the lowest ratio in Turkmenistan (1.0 percent). Kazakhstan (69.3 percent), Turkey (51.1 percent) and Tajikistan (43.8 percent) are among countries of the region with relatively high ratio of external debt to GDP in 2014.

Table 3.20: Share of External Debt in GDP

(%)

	1995	2000	2010	2012	2013	2014
Afghanistan			15.1	12.7	11.9	12.1
Azerbaijan	10.5	28.9	13.3	13.9	14.0	15.5
Iran	18.9	7.3	4.3	3.4	1.9	2.0
Kazakhstan	18.4	70.5	80.5	62.8	61.4	69.3
Kyrgyz Republic	36.7	141.5	85.8	91.2	92.8	97.2
Pakistan	49.8	44.6	36.1	27.7	26.0	25.5
Tajikistan	51.4	132.6	54.6	48.9	45.2	43.8
Turkey	43.5	43.8	40.9	42.7	47.3	51.1
Turkmenistan	16.2	86.4	2.3	1.4	1.3	1.0
Uzbekistan	13.5	36.2	19.8	17.3	18.8	21.2
ECO			31.7	28.6	31.8	35.1

Source: World Development Indicators and IMF Country Reports

Gross International Reserves are usually considered as an important instrument to safeguard the economy against abrupt external shocks. Total reserves of ECO countries are equal to USD 316.1 billion in 2015 (excluding Turkmenistan) less than in 2014[62], but

[62] In general, gross reserves of countries reliant on energy exports declined in 2015.

increased over the years, because of increasing trade flows resulting in trade surpluses as well as financial reform efforts. Individually at the country level, in 2015, Iran is at the top with reserves of USD 122.6 billion[63], followed by Turkey with reserves of USD 110.5 billion[64]. Tajikistan is at the bottom with USD 0.49 billion.

In terms of growth, exports from Iran as well as imports to Iran have grown tremendously in 2014, reflecting lifting of sanctions and economic recovery. However, due to fall in the value of oil exports, Iran's current account registered a surplus of 7.8 percent of GDP in 2014 which decreased to a surplus of 4.1 percent of GDP in 2015.Iranian economy has diversified significantly over the past decade. In 2014, the non-crude oil trade surpassed USD 112 billion with some USD 50 billion in non-crude oil exports. Adding about USD 50 billion in crude oil and gas exports, the country has achieved about USD 162 billion in foreign trade in 2014. Along with the increased oil and gas production, Iran's strategy of producing more gas-based commodities such as petrochemicals, steel, aluminum and cement will further increase the country's export potential.

Tajikistan has also recorded a positive growth in both its exports and imports in 2014, after a slow growth from 2010 to 2013. However, in 2015 positive growth trends for both exports and imports reversed. The current account deficit which dropped significantly from 2010 to 2013 (from 6.6 percent of GDP to 2.4 percent), started increasing in 2014 (2.8

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[63] Because of increasing trade flows, repatriation of part of its frozen assets in international banks and increasing capital inflows (including FDI).

[64] Financial reform efforts after the global financial crisis as well as trade flow. Capital account liberalization in Turkey has apparently brought about the need to accumulate reserves as an insurance against financial volatilities including sudden stop or reversals of capital influx.

percent of GDP) and jumped again to 6.0 percent of GDP in 2015, because of the plunge in remittances and export receipts.

Current account balance in Azerbaijan remained in surplus from 2005 to 2014[65]. However, oil price declines reduced export earnings beginning in late 2014 and turned surplus into deficit (-0.4 percent of GDP) in 2015. Exports as a percent of GDP in 2015 fell below the level of 2010. Declining energy prices and the drop in export earnings forced the central bank to devalue the Manat, costing it a loss in foreign exchange reserves. Gross international reserves fell by USD 15.6 billion in 2014 to USD 7.9 billion in 2015.

In Pakistan, gross total reserves increased significantly in 2008 and onwards due partly to its support for war on terror. The current account deficit narrowed to 0.8 percent of GDP in 2010[66].But continuous increase in oil prices led to import growth with no significant increase in exports. Along with a fall in external loan and non-debt financing, larger external debt repayment, and the Central Bank (SBP) interventions in the foreign exchange market to limit local currency depreciation drained foreign exchange reserves to a critically low USD 6.0 billion, enough to cover only 1.3 months of imports by the end of 2013. The Pakistani rupee depreciated, and the current account deficit widened to 1.9 percent of GDP in 2013.

[65] In 2006, when BTC pipeline becomes functional, there was a sudden jump in current account surplus because of oil revenues

[66] With improvement in the trade deficit, a lower service account deficit following receipts under the Coalition Support Fund, and continued inflows of worker remittances.

Table 3.21: Gross International Reserves

(Million USD)

	1995	2000	2010	2011	2012	2013	2014	2015
Afghanistan	-	-	5,162	6,208	6,867	6,886	7,248	7,000
Azerbaijan	121	680	6,409	10,274	11,277	15,014	15,549	7,901
Iran	-	-	-	-	-	-	113,714	122,624
Kazakhstan	1,660	2,099	28,265	29,328	28,269	24,715	29,209	27,876
Kyrgyz Republic	134	262	1,720	1,835	2,067	2,238	1,958	1,778
Pakistan	2,528	2,087	17,256	14,784	10,803	6,008	9,098	13,526
Tajikistan	-	94	403	572	650	636	511	494
Turkey	13,891	23,515	85,960	87,937	119,183	131,054	127,422	110,490
Turkmenistan	-	-	18,800	22,400	26,400	29,300	32,400	-
Uzbekistan	-	-	14,579	18,049	22,133	22,515	24,140	24,400

Source: WDI, IMF and ADB.

In 2014, Pakistan's current account deficit decreased with strong foreign inflows through Eurobond placements, the one-off receipt of a USD 1.5 billion external grant, the sale of 3G/4G spectrum licenses, and disbursements by multilateral agencies. With large external inflows, net foreign exchange reserves rose to USD 9.1 billion in 2014, and the Pakistan rupee, which had come under depreciating pressure rebounded, and currency slightly appreciated in 2014[67]. In 2015, exports fell from 12.3 percent of GDP in 2014 to 10.9 percent of GDP in 2015 mainly from a marked drop in textile and cotton exports, while the large decline in oil import payments was largely offset by increased quantities of other imports—including consumer goods, textile raw materials, iron and steel, and selected food items—such that total imports fell by only 1.6 percent. However, gain in remittances to USD 18.7 billion brought modest improvement in the current account deficit and gross reserves increased to USD 13.5 billion in 2015.

In Afghanistan, increased private capital outflows in 2015, accompanying a marked increase in emigration, put pressure on the foreign exchange market, resulting in a depreciation of the Afghan currency against the US dollar and a decline in gross international reserves to USD 7.0 billion from USD 7.3 billion in 2014. The current account including official grants is estimated to have been a surplus equal to 4.5 percent of GDP in 2015, down from 6.4 percent in 2014[68]. Excluding grants, the current account is estimated to have been in deficit equal to 20.0 percent of GDP in 2015, improving from 28 percent in 2013 mainly because imports for grant-supported projects fell. With the withdrawal of

[67] Appreciation in real effective terms was by 5.6 percent, with likely adverse implications for export competitiveness.

[68] Increased earnings from transporting the military equipment of departing international security forces, as well as higher on-budget grants in 2014

international security forces in 2014, exports of services registered a decline (mainly used by those forces) along with the reduction in many local jobs reducing national personal income.

In Kazakhstan, the current account surplus widened to 2.6 percent of GDP in 2014, with increased exports and fall in the share of imports. Gross reserves rose to USD29.2 billion from USD24.7 billion in 2013. External debt including intercompany loans reached an estimated 69.3 percent of GDP in 2014 from 61.4 percent in 2013. However, in 2015, for the first time since 2009, Kazakhstan's current account turned negative, with an estimated deficit equal to 2.8 percent of GDP. Exports plunged to 28.6 percent of GDP from 38.3 percent in 2014, largely because of low oil prices; slow growth in trading partners hurt other exports[69] as well. While Imports fell by only 0.1 percent, gross reserves declined to USD 27.9 billion.

The current account deficit (percent of GDP) in Kyrgyz Republic is increasing continuously since 2010, reflecting decline in exports[70] and remittances. In 2015 current account deficit was equal to 17.0 percent of GDP. Gross international reserves dropped to USD 1.8 billion in 2015 from an increase of USD 2.2 billion in 2013.

Current account balance in Turkmenistan turned from a surplus in 2012 to a deficit, which widened to 11.8 percent of GDP in 2015 from 5.9 percent in 2014. Lower prices and slack demand for energy products especially natural gas, Turkmenistan's main export,

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[69] Demand for metal and metal products weakened in China and Russia.

[70] Drop in the production of gold and weaker sales of fruits, vegetables and textiles.

sharply reduced export earnings. However, foreign exchange reserves were estimated at 30 months of import cover at the end of 2015.

Uzbekistan is the only country in the ECO region with current account in surplus. Though, this surplus is estimated to have narrowed to 0.3 percent of GDP in 2015 from 16.9 percent in 2006, reflecting a decline in trade surplus and remittances. Developments in the economy of the Russian Federation during late 2014 deeply affected Uzbekistan's exports and remittances. Weak consumer demand there, coupled with rapid nominal appreciation of the Uzbek Sum against the Ruble, hurt bilateral trade. Further, diminished labor demand in construction and logistics, the main employers of Uzbek migrants led to decline in remittances from the Russian Federation. Slowdown in Kazakhstan and the Republic of Korea also constrained Uzbekistan trade. Public and private external debt is estimated to have increased to 21.2 percent of GDP in 2014. Gross official reserves were estimated at USD 24.4 billion.

Overall, a major drawback for poor performance of most of the ECO countries (except for Turkey and Iran) in international markets is the lack of diversification in their export baskets. The sharp decline in oil prices in 2014-2015, generated a heavy macroeconomic shock on net oil exporters, especially for those countries whose GDP and exports are dominated by oil, while importers like Pakistan and Turkey experienced a higher economic activity in parallel with lower inflation expectations. This is also obvious from the current account balance of ECO countries; both Turkey and Pakistan have recorded an improvement in their current account deficit in 2015.

Table 3.22: Capital Account Balance (Share in GDP)

(%)

	1995	2000	2005	2010	2012	2013	2014	2015
Afghanistan	-	-		-10.4	-15.6	-28.0	-25.2	-20.0
Azerbaijan	-13.1	-3.2	1.3	28.4	21.8	16.6	13.6	-0.4
Iran	3.5	11.4	-	-	-	-	7.8	4.1
Kazakhstan	-1.0	2.0	-1.8	0.9	0.5	0.4	2.6	-2.8
Kyrgyz Republic	-14.1	-5.6	-1.5	-6.6	-15.6	-15.0	-16.8	-17.0
Pakistan	-5.5	-0.1	-3.3	-0.8	-1.0	-1.9	-1.5	-0.6
Tajikistan		-1.2*	-0.8	-6.6	-3.2	-2.4	-2.8	-6.0
Turkey	-1.4	-3.7	-4.3	-6.1	-6.1	-7.7	-5.5	-4.5
Turkmenistan	-21.6*	8.3	5.1	-10.8	0.0	-7.3	-5.9	-11.8
Uzbekistan	0.0	1.6	13.5	6.1	1.2	1.6	1.4	0.3

Source: WDI, IMF and ADB.
*for 2002 (Tajikistan) and 1997(Turkmenistan)

3.6. Conclusion

The foregoing discussion reveals that macroeconomic performance of the ECO member countries has been mixed. The global financial crisis had a varying impact on ECO member countries depending on their macroeconomic fundamentals. Also, the macroeconomic policy response to deal with the after effects of the crisis has mainly focused on fiscal and monetary policies to achieve macroeconomic stabilization. Some regional countries depend heavily on natural resources like oil and gas and thus these economies are vulnerable to external shocks. There is thus an urgent need for these economies to diversify their economies to reduce their dependence on oil. In terms of international trade, the region has shown a mixed performance over the years with Turkey leading in international trade. Intra-regional trade also remains far below potential which signifies the need for greater trade and investment linkages among the ECO member countries.

Chapter 4 - Economic Modelling Exercise for ECO Region

4.1. Introduction

The preceding discussion on macroeconomic performance of the ECO member countries has revealed the varying experiences of those countries in economic development and set the stage for an economic modelling exercise of these economies. For this purpose, annual data for the period 1972-2015 has been collected from international sources including the World Bank and IMF.

4.2. Data and Estimation Methodology

All variables except interest rates are in logarithms which are indicated by small letters instead of capital letters. The choice of estimation methodology has to be seen in the light of data availability. Due to the short time span, the number of feasible estimation methods is limited. Therefore, we have used single-equation based cointegration approach (Engle-Granger two-step procedure) to estimate the model. Although, multivariate cointegration technique advanced by Johansen (1991) is superior to that of Engle-Granger method, the Johansen approach requires longer time series which makes it unsuitable for the present study in view of its relatively small sample size. The performance of all estimated equations is evaluated using a battery of contemporary econometric diagnostic tests.

It is well documented in the recent literature that most of the macroeconomic time series display non-stationary behavior. If two series have unit root processes then the OLS method gives spurious results even though the estimated coefficients are highly significant (Granger and Newbold, 1974; Phillips, 1986). Engle and Granger (1987) suggest the estimation of cointegration relationship in the first step with static OLS method. The resulting residuals are then tested for stationarity. If they are found to be stationary, then in the second step one can estimate ECM model as long-run equilibrium relationship.

According to the Granger (1986) representation theorem, the existence of linear cointegration relationship can be represented as an error correction model (ECM). The advantage of ECM is that the long-run and short -run properties can be estimated jointly and it makes possible to examine the direction of long-run and short-run causality. Therefore, we use ECM to represent the dynamic behavior of the variables under consideration.

Following the (Davidson *et al.*, 1978) methodology we start with a more general unrestricted model and come up with relatively parsimonious model. By parsimonious one should not think of a model with limited number of regressors but rather the restricted model should capture the DGP of the underlying macroeconomic channel. At each step of G2S modelling the restrictions are tested utilizing different econometric tests such as t-test, over all F-test, likelihood ratio test, Wald test, Lagrange Multiplier test, etc. for linear and nonlinear restrictions. While following G2S methodology one may encounter with nested or non-nested models; for these two types, distinct econometric tools are available.

ARDL models are usually more general models to start with. For an ARDL(n) model one can have many economically justified models, e.g. from ARDL (1) model one can have more than ten restricted models with economic justification. Moreover, the ARDL models incorporate distinct variables in the same model with distinct order of integration. For unknown causal relation among macro variables, VAR technique can be utilized. Macro variables may have long run relationship, these long run cointegrated variables might have built in ECM; to capture this mechanism a simple ECM model or a Vector Error Correction Model (VECM)can be employed as per the need.

4.3. Specification of Structural Models

In this section, we outline theoretical specification of the macro-econometric model. The current model includes both supply side as well as the demand side of the economy. On the supply side production functions for agriculture sector, manufacturing sector and services sector have been considered. On the demand side, the model largely focuses on the behavior of consumption, investment and foreign trade of goods and services respectively. The model covers five key blocks of the economy viz. the production block, aggregate demand block, fiscal block, foreign trade block and monetary block. This section presents the structural specification of each block.

4.3.1. Production Block

To model the production activities, we have disaggregated the production into three major sub-sectors: (1) agriculture, (2) manufacturing, and (3) services. The selection of the sectors is primarily based on the structure of the economy. However, data availability constraints have also played a role in the selection of sectors for disaggregation of production.

4.3.1.1. Production Function for Agriculture Sector

Following Naqvi *et al.* (1983); Zerfu (2002) and Iqbal, Ahmad and Abbas (2003), agriculture sector production is assumed to be a function of labor force engaged in agriculture (L_t^A), disbursement of credit to agriculture sector (CD_t^A) and availability of water (W_t) proxied by area irrigated by tube wells. The functional form is given by:

$$Y_t^A = f(L_t^A, CD_t^A, W_t) \tag{4.1}$$

Where:

Y_t^A	=	Agriculture value added
L_t^A	=	Labor force engaged in agriculture
CD_t^A	=	Credit disbursement to agriculture sector
W_t	=	Water availability (area irrigated by tube wells)

Factors other than the ones included in above functional form that may influence agricultural output include land; fertilizer, pesticides, tractors and biological inputs like seeds of high yield variety. These, excluding land, are typically purchased using credit. This is especially true for biological inputs (Dhansekaran, 1999; Iqbal, Ahmad and Abbas, 2003). Thus, the inclusion of agriculture credit disbursement accounts for the influence of these factors.

The influence of infrastructure like farm to market roads and electricity on agricultural output needs no emphasis. Parikh (1983) assumes that infrastructure and water availability influence agricultural output significantly. To capture the effect of infrastructure ($IFRS_t$) the functional form incorporates road length as a proxy for infrastructure. The functional relation cited above takes the following form:

$$Y_t^A = f(L_t^A, CD_t^A, W_t, IFRS_t) \tag{4.2}$$

Where:

Y_t^A	=	Agriculture value added
L_t^A	=	Labor force engaged in agriculture
CD_t^A	=	Credit disbursement to agriculture sector
W_t	=	Water availability (area irrigated by tube wells)
$IFRS_t$	=	Infrastructure (road length)

It is hypothesized that all the right-hand side variables exert a positive impact on agriculture sector value added.

4.3.1.2. Production Function for Manufacturing Sector

The manufacturing sector includes small-scale and large-scale industries, construction, electricity and gas sub-sectors. Furthermore, export-processing industries are also included in this sector. In the manufacturing sector, capital stock and labor force are important factors of production and hence these are included in the manufacturing production function. The production function for manufacturing sector is specified as:

$$Y_t^M = f(K_t^M, L_t^M) \tag{4.3}$$

Where:

Y_t^M = Manufacturing value added

K_t^M = Capital stock employed in manufacturing

L_t^M = Labor employed in manufacturing

Besides capital stock and labor that have been included in the production function for the manufacturing sector, other factors such as credit disbursed to manufacturing sector, availability of infrastructure, import of machinery and equipment and use of raw material are likely to influence the volume of manufacturing sector production (Zerfu, 2002). Therefore, we extend the functional form by incorporating credit disbursed to manufacturing sector (CD_t^M), infrastructure ($IFRS_t$), import of machinery (IMM_t) and use of domestic raw material (DRM_t) proxied by Agriculture value added (Y_t^A). The rationale for this proxy is that a significant part of manufacturing output is agro based, for example the textile and sugar industries use the output of the agriculture sector as raw material. Now the production function for manufacturing sector takes the following form:

$$Y_{tm} = f(K_{tm}, L_{tm}, CD_{tm}, IFRS_t, IMM_t, DRM_t) \qquad (4.4)$$

All the right-hand side variables are expected to influence manufacturing sector value added positively.

4.3.1.3. Production Function for Services Sector

The services sector value added is taken as a function of aggregate demand in real term (domestic absorption). Real aggregate demand is defined as the sum of private consumption, government consumption and investment divided by consumer price index. The equation for services sector can be specified as:

$$Y_t^S = f(RAD_t) \tag{4.5}$$

Where:

Y_t^S	=	Services sector value added
RAD_t	=	Real aggregate demand

4.3.2. Aggregate Demand Block

The aggregate demand for goods and services is the sum of domestic absorption and the trade balance (Zerfu, 2002; Basdevant and Kaasik, 2003):

$$(Y_t = A_t + (X_t - M_t) \tag{4.6}$$

Where A_t is domestic absorption and refers to the sum of consumption (C), investment (I) and government expenditures (G). Also, X and M denote exports and imports of goods and services respectively. The national income now is defined as:

$$Y_t = C_t + I_t + G_t + (X_t - M_t) \tag{4.7}$$

This relationship always holds as an identity. The aggregate demand can be decomposed into consumption and investment sub-sectors. The consumption sub-sector is disaggregated into private consumption and government consumption.

4.3.2.1. Consumption Sub-Block

4.3.2.1.1. Private Consumption

The specification of real private consumption function is based on an optimizing model of life-cycle behavior. The main variables explaining the real private consumption are the real disposable income and real interest rate (Tjipe, Nielsen and Uanguta, 2004). To capture the wealth effect, real money balances are included in the real private consumption function (Rashid, 1981; Elliott, Kwack and Tavlas, 1986; Rankaduwa, Rao and Ogwang, 1995):

$$C_t^P = f(Y_t^D, r_t^D, RM_t) \tag{4.8}$$

Where:

C_t^P	=	real private consumption
Y_t^D	=	real disposable income
r_t^D	=	real interest rate
RM_t	=	real money balances (M2 definition)

Following (Haque, Lahiri and Montiel, 1990), real disposable income (Y_t^D) is defined as:

$$Y_{td} = \frac{(GDP_t - DTXR_t - INDTXR_t + WREM_t + CRP_t)}{CPI_t} \tag{4.9}$$

Where $DTXR$ denotes direct tax revenues and $INDTXR$ indirect tax revenues. $WREM$, CRP and CPI are worker's remittances, credit to private sector and consumer price index respectively. Worker's remittances are included here to capture the effect of remittances on private consumption.

According to the absolute income hypothesis the real disposable income exerts positive effect on real private consumption (Odada, Eita and Nhuleipo, 2000). The life-cycle and the permanent income hypothesis introduced real interest rate (or inflation rate) as an explanatory variable, whose impact is not clear a priori.

4.3.2.1.2. Government Consumption

Real government consumption depends on the development expenditure relative to GDP, government revenues and inflation:

$$C_t^G = f(EXDEVY_t, R_t^G, \pi_t) \tag{4.10}$$

Where:

C_t^G	=	Government Consumption
$EXDEVY_t$	=	Ratio of Development Expenditure to GDP
R_t^G	=	Government Revenues
π_t	=	Inflation Rate

It is assumed that ratio of development expenditures to GDP, government revenues and inflation rate are positively related to real government consumption.

4.3.2.2. Investment Sub-Block

Aggregate investment is disaggregated into private investment (I_t^P), government investment (I_t^G) and increase in stocks (Δ stocks). Increases in stocks may be an important component of business cycle. It can be thought that increase in stocks may be heavily dependent on the fluctuations in agricultural production, which in turn is affected by exogenous factors such as climate. Hence, increase in stocks is assumed to be exogenous (Ra and Rhee, 2005).

4.3.2.2.1. Private Investment

Private investment plays a key role in sustaining the development process by promoting economic growth. Private investment decisions depend on the investment in long-lived capital assets and expectations about the future (Guru-Gharana, 2000). In this study we included real income, real interest rate, ratio of private sector credit to GDP and government investment as explanatory variables:

$$I_t^P = f(Y_t, r_t^D, CRPY_t, I_t^G) \tag{4.11}$$

Where:

I_t^P	=	Private Investment
Y_t	=	Real Income
r_t^D	=	Real Interest Rate
$CRPY_t$	=	Ratio of private sector credit to GDP
I_t^G	=	Government Investment

The accelerator theory suggests that as income increases, investment 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, McKinnon (1973) and Shaw (1973) argued that interest rate could exert a positive impact on the level of investment because real interest rate could increase savings thereby increase investment (Khan and Khan, 2007). 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-Gharana, 2000). Availability of credit to private sector is another important determinant of private investment and influences the investment behavior positively

(Jongwanich and Kohpaiboon, 2008). It also provides a link between real and monetary sectors (Guru-Gharana, 2000).

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). Therefore, government investment is included in the specification to capture the 'crowding-out' or 'crowding-in' effects (Jongwanich and Kohpaiboon, 2008).

4.3.2.2.2. Government Investment

Government investment is measured by the expenditures on capital construction such as infrastructure and innovations. Government investment serves as fiscal policy instrument and is assumed to be exogenously determined.

4.3.3. Fiscal Block

The fiscal sector constitutes government revenue, government expenditure, and budgetary balance where budget deficit results when government spending exceeds government revenues. Like many other countries, in Pakistan domestic and external resources are used to finance budget deficit. The budget deficit is defined as:

$$BD_t = EX_t^G - R_t^G \tag{4.12}$$

Where:

BD_t = Budget Deficit

EX_{tg} = Government Expenditure

R_{tg} = Government Revenue

Government revenue (R_t^G) originates from direct tax revenue ($DTXR_t$), indirect tax revenue ($INDTXR_t$) and non-tax government revenue ($NTXR_t$) sources, i.e.

$$R_t^G = DTXR_t + INDTXR_t + NTXR_t \tag{4.13}$$

Non-tax revenue usually consists of fees and other similar charges, which are proportional to aggregate economic activities (i.e. nominal GDP, NY). The direct and indirect tax revenues are modeled as endogenous variables whereas, non-tax revenue of the government is taken as exogenous variable (Guru-Gharana, 2000; Tjipe, Nielsen and Uanguta, 2004). Two different revenue functions are modeled as they are different in nature and have different degrees of response to changes in income.

4.3.3.1. Direct Tax Revenues

Direct tax revenue is influenced by domestic economic activity (NY), average direct tax rate ($ADTXR$), which is defined as the ratio of direct taxes to nominal output (NY) and inflation rate. Therefore:

$$DTXR_t = f(NY_t, ADTXR_t, INF_t) \tag{4.14}$$

An increase in NY (the tax base) is expected to raise the revenue from direct taxes. Similarly, direct tax revenue will increase as average tax rate rises (Tjipe, Nielsen and Uanguta, 2004). It is also assumed that there is positive relationship between direct taxes and inflation rate because in each year public and private employee's compensations are adjusted for the cost of living and those additional compensations are taxed.

4.3.3.2. Indirect Tax Revenues

The indirect tax revenue can also be influenced by nominal income (NY), the average indirect tax rate ($AINDTXR$) and inflation rate (INF), i.e.:

$$INDTXR_t = f(NY_t, AINDTXR_t, INF_t) \tag{4.15}$$

A large proportion of indirect taxes is raised in the form of sales tax, custom duties, etc.; therefore, a higher price level would contribute to higher indirect tax revenue. A higher output level leads to an increase in revenue from indirect taxes due to higher spending. Similarly, a positive relationship between indirect taxes, average tax rate and inflation is predicted.

The elasticity of taxes with respect to income is assumed to be about unity (Elliott, Kwack and Tavlas, 1986). Such a response implies that the tax system, on average, is neither progressive nor regressive.

4.3.3.3. Government Expenditure

Government expenditure (EX_t^G) consists of current expenditure ($EXCUR$), development expenditure ($EXDEV$) and expenditure on capital disbursement ($EXCD$). The total government expenditure is therefore given by:

$$EX_t^G = EXCUR_t + EXDEV_t + EXCD_t \tag{4.16}$$

This model treats development expenditure and expenditure on capital disbursement as exogenous variables, while current expenditure on goods and services is taken as endogenous variable. The government current expenditure is assumed to be influenced by nominal income and inflation rate. As nominal income increases, the expenditure on development projects is also expected to increase. Similarly, a rise in inflation rate is also expected to increase government's development expenditures. Therefore, we specify the following function for government expenditures.

$$EXCUR_t = f(NY_t, INF_t) \tag{4.17}$$

4.3.4. Foreign Trade Block

The trade block consists of two equations explaining the determination of exports and imports of goods and services.

4.3.4.1. Export Function

It is assumed that Pakistan is a small open economy and hence is price taker in the world markets. Accordingly, changes in the world prices affect the domestic production level, which in turn, affects export levels. Real exports of goods and services (X_t) depend positively on the real effective exchange rate ($REER$) as well as world income (Y_t^F) (Tjipe, Nielsen and Uanguta, 2004). Other important determinants in the export equation are domestic real income (Y), and the price of exports relative to domestic price (RP_t^X) level (Khan and Qasim, 1996; Zerfu, 2002). The export function can thus be specified as:

$$X_t = f(Y_t, REER_t, Y_t^F, RP_t^X) \quad (4.18)$$

Domestic real income, foreign income and relative price of exports are expected to influence real export demand positively, while real effective exchange rate exerts negative impact on exports because an increase in the real effective exchange rate (i.e. real depreciation) affects export demand negatively.

4.3.4.2. Import Function

The demand for real imports (IM_t) is assumed to be determined by domestic economic activity (i.e. real income), real effective exchange rate, foreign capital (K_t^F) and relative price of imports (RP_t^{IM}), which is given by the ratio of imports price index (P_t^{IM}) to domestic price level (P). Thus, we can specify the real imports equation as:

$$IM_t = f(REER_t, Y_t, K_t^F, RP_t^{IM}) \quad (4.19)$$

Depreciation in real effective exchange rate or an increase in the price of imports relative to domestic price level leads to a contraction in import demand. While an increase in the domestic real income and foreign direct investment results in an increase in imports.

4.3.4.3. Trade Balance

Finally, the trade balance (TB) is defined as:

$$TB_t = X_t - IM_t \tag{4.20}$$

4.3.5. Monetary and Price Block

The monetary block of the model explains the behavior of money demand, short-term interest rate and the domestic price level.

4.3.5.1. Money Demand Function

The main objective of monetary policy is to provide adequate liquidity for economic growth while maintaining price stability and the effectiveness of monetary policy depends on the stability of money demand function. Mainstream literature suggests that the demand for real money balances ($M2$) is positively related to the level of real income. If the level of real income increases, there is an opportunity for the agents to hold more money.

The literature also suggests that demand for real money balances is negatively related to the opportunity cost of holding money (i.e. short-term interest rate). The functional form of real money balances can be expressed as:

$$\left(\frac{M_t^D}{P_t}\right) = f(Y_t, i_t) \tag{4.21}$$

Where:

${M_t d}/{P_t}$	=	Demand for real money balances
i	=	short term nominal interest rate
Y	=	real income ($RGDP$)
P	=	Domestic price level (CPI)
M	=	Money Supply ($M2$)

4.3.5.2. Interest Rate

This model treats short-term interest rate as monetary policy instrument. The short-term interest rate can be modeled as a function of money supply (M), domestic price level (P) and policy discount rate (DR). Therefore, the monetary policy reaction function can be expressed as:

$$i_t = f(M_t, P_t, DR_t) \tag{4.22}$$

4.3.5.3. General Price Equation

The general price equation is given as:

$$P_t = f(M_t, Y_t, i_t, P_t^F) \tag{4.23}$$

Where:

P_t^F = Foreign price proxied by the unit value of imports

The above equation is in line with the monetarist and structuralist theories of inflation which postulate that the general price level is determined by domestic monetary conditions, domestic economic activity and foreign prices of imports in the context of an open economy.

4.4. Conclusion

This chapter has presented a detailed specification of the macro-econometric model. The key building blocks of the model include the production block, aggregate demand block, fiscal block, foreign trade block and monetary block. In each of the blocks, the chapter has highlighted how various variables are expected to influence key macroeconomic variables and how macroeconomic policy variables interact to generate the macroeconomic outcomes. The following chapters present the country-wise estimations of variants of the basic model laid out in the present chapter.

Chapter 5 - Afghanistan: Simulation Exercise

5.1. Introduction

On account of the continuous political instability in Afghanistan, a very short synchronized data set is available. The largest available data set spans the years 2002 to 2015. Due to unavailability of relevant macro variables we are unable to present a complete macro-econometric model for Afghanistan; however, we highlight the theoretical phenomenon describing properties of important macro variables.

By tracing projected trends of macro-economic variables, instead of estimating a complete macro-econometric model, we present significant features of Afghanistan's economy.

5.2. Simulation Exercise

Security concerns and overall law and order situation has remained a major hurdle in Afghanistan's economic activity. Its deteriorating security has a negative impact on business confidence and private investment. Economic growth rate increased from 1.3 percent in 2015 to 2.4 percent in 2016, mainly due to the strong growth in the agriculture sector. By contrast, manufacturing exhibited negative growth in 2016. Medium term forecasts in Table 5.1) indicate that Afghanistan's economic activity will increase modestly at the rate of 2.7 percent by 2020. With Afghanistan's population growth rate at nearly 3 percent, economic growth rate of 2.7 percent implies a decline in per capita income.

Table 5.1: Growth Rate Forecasts of Real Variables - Afghanistan

	2016	2017	2018	2019	2020
GDP	2.4	4.1	2.2	2.2	2.4
Agriculture Value Added	6.0	4.3	2.3	2.2	2.2
Manufacturing Value Added	-0.8	4.0	1.9	1.9	1.8
Services Value Added	2.2	4.0	2.3	2.4	2.8
Private Consumption	13.9	0.1	4.6	4.4	4.2
Public Consumption	0.3	14.9	5.2	4.9	4.7
Gross Fixed Capital Formation	-6.0	20.8	5.2	5.0	4.7
Net Exports (in terms of GDP)	-42.1	-39.4	-39.3	-39.3	-39.3
Inflation	2.2	5.9	1.9	1.6	2.3
Tax Revenue	14.0	7.7	7.2	6.7	6.3

Note: Growth rates for 2016 are actual data; while projections from 2017 to 2020 based on past trends.

Moderate growth is expected in all the three sectors on the supply side. Agricultural growth in Afghanistan depends on weather conditions. Changing climatic conditions does not seem to favor agriculture growth in the medium term. While service and industry sectors are projected to grow at about 2.9 percent and 2.4 percent by 2020 respectively. In terms of GDP, no significant change is expected on the supply side. The shares of all the three production sectors, agriculture, industry and services will remain the same by 2020.

On the demand side, net exports in terms of GDP will remain around -40 percent by 2020. Negative net exports will be compensated (to some extent) by public consumption and investment. Gross fixed capital formation in real terms is projected to grow by 8.7

percent by 2020. While public and private consumption are projected to grow by 7.4 percent and 3.3 percent respectively by 2020.

Economic growth is slow and projected to remain the same as continued insecurity will restrain private investment and consumer demand. Medium term growth prospects in Afghanistan depend on improved security situation leading to the recovery of business confidence. The government needs to attract private investment to help boost economic growth, create more jobs, and reduce country's dependence on donor support[71].

The fiscal position in Afghanistan has remained strong for the last couple of years. Although the government relies heavily on foreign grants, its revenues (taxes as well as non-taxes) have continued to improve[72]. Afghanistan will remain dependent on aid inflows in the medium term. Theses inflows are expected to keep Afghanistan's current account in surplus.

On the monetary side, inflation fell markedly in 2014; while in 2015, Afghanistan experienced mild deflation with consumer prices averaging -1.5 percent. Both food and non-food prices declined reflecting weak domestic demand as well as declining global prices for fuel and other commodities. Inflation increased to 2.2 percent in 2016, driven by delayed effects of the currency depreciation and a recovery in global food prices. As most of

[71] ADB (2018) Asian Development Outlook 2018, as quoted by Modern Diplomacy staff: https://moderndiplomacy.eu/2018/04/13/private-sector-investment-needed-to-support-growth-in-afghanistan/

[72] Balanced budget in 2017_ under-execution of the development budget compensating a deficit in expected grants. Revenue performance continues to improve, driven largely by stronger compliance. Revenues reached 11.9 percent in 2017, up from 8.5 percent in 2014 (Source: World Bank Country Overview – Afghanistan; available at: http://www.worldbank.org/en/country/afghanistan/overview)

the consumer goods in Afghanistan are imported, global prices and exchange rate movements tend to impact domestic prices significantly. Inflation is expected to accelerate in 2017 due to increase in food prices and depreciation during the early period of the year. But monetary tightening is expected to slow down inflation from 2018 onwards.

5.2.1. Real Per Capita Income

Analyzing the ACF and PACF of Real Per Capita Income (Figure 5.1) reveals the structure of the macro variable that helps employing an appropriate simulation technique. The graph clearly indicates an ARMA process which fades immediately. With this short data span, an ARFIMA (1, 0, 0) process is employed to derive the projected trend for real GDP per capita (log-likelihood: 16.574 ; T = 2002-2015).

Figure 5.1: ACF and PACF Plots of Log Real GDP Per Capita

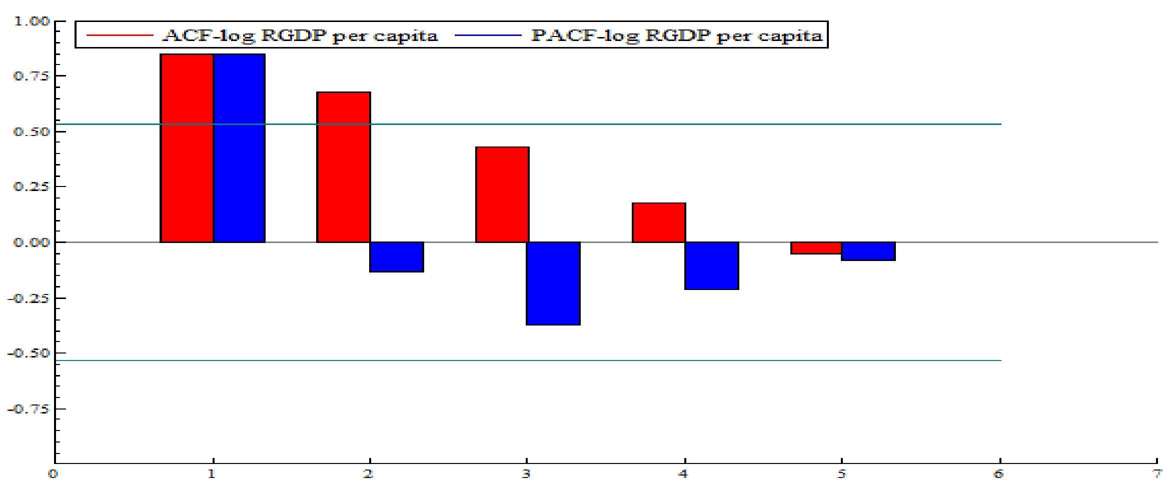


Figure 5.2 presents the projected trend for log of real income per capita from 2016 to 2018. A clear decreasing trend can be seen throughout the projected period 2016-2018.

Figure 5.2: Projected Trends for Log RGDP Per Capita (2016-18)

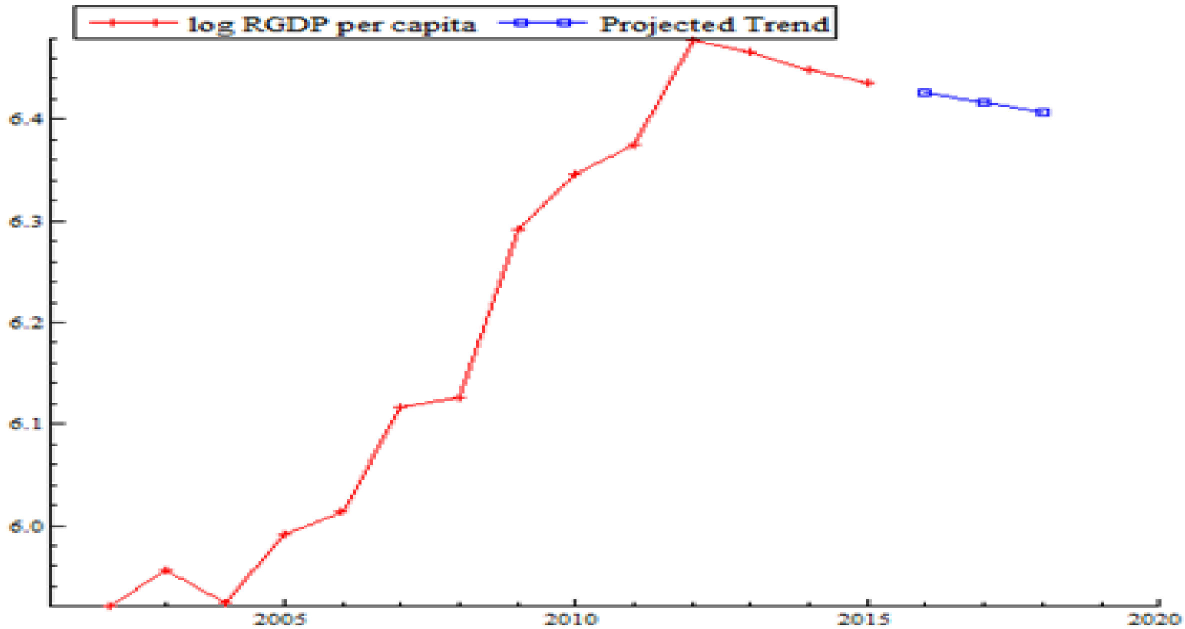
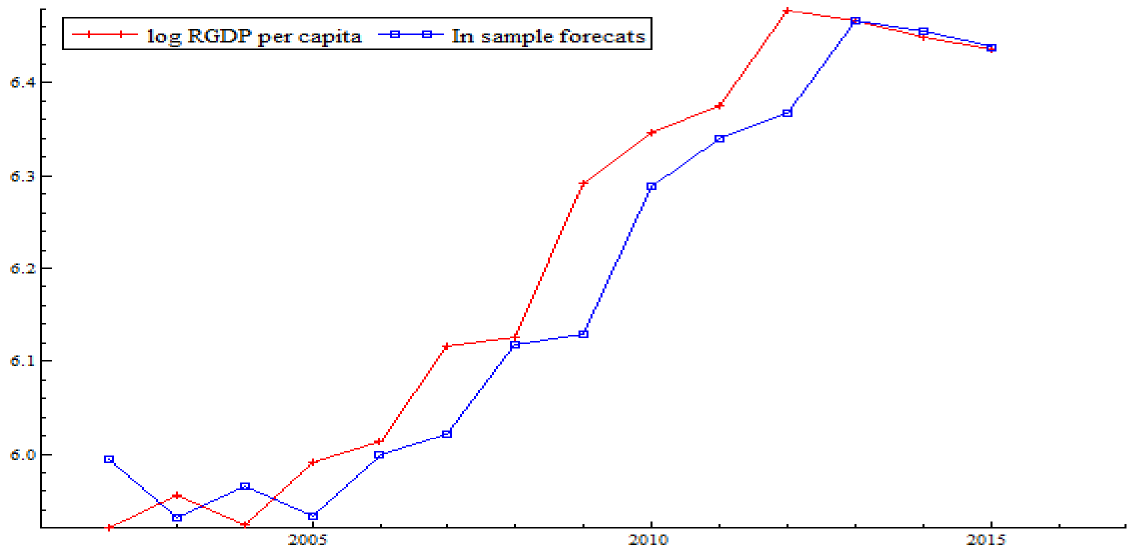


Figure 5.3 presents in-sample forecasts, both actual and predicted series. The graph indicates how closely the model predicts the actual series. After a sharp decline in 2002 a continuous increasing trend of real income per capita can be seen clearly which indicates a positive growth trajectory for Afghanistan's economy.

Figure 5.3: In-sample Forecast of Log RGDP Per Capita (2002-15)



5.2.2. Inflation

For the period under study, the highest inflation rate of 22.38 percent is observed in 2007; within a decade the inflation had decreased to single digit figures which further stabilized at about 0.24 percent in 2014. Hyperinflation in the Afghanistan economy is not observed for the given time period. Figure 5.4 below presents ACF and PACF plots for inflation. The graph clearly indicates an ARMA (0, 0) process at 95 percent confidence level. An ARFIMA (1, 0, 0) process is employed to obtain the projected trend for inflation (log-likelihood -42.138 ; T = 2003-2015).

Figure 5.4: ACF and PACF Plots for Inflation in Afghanistan

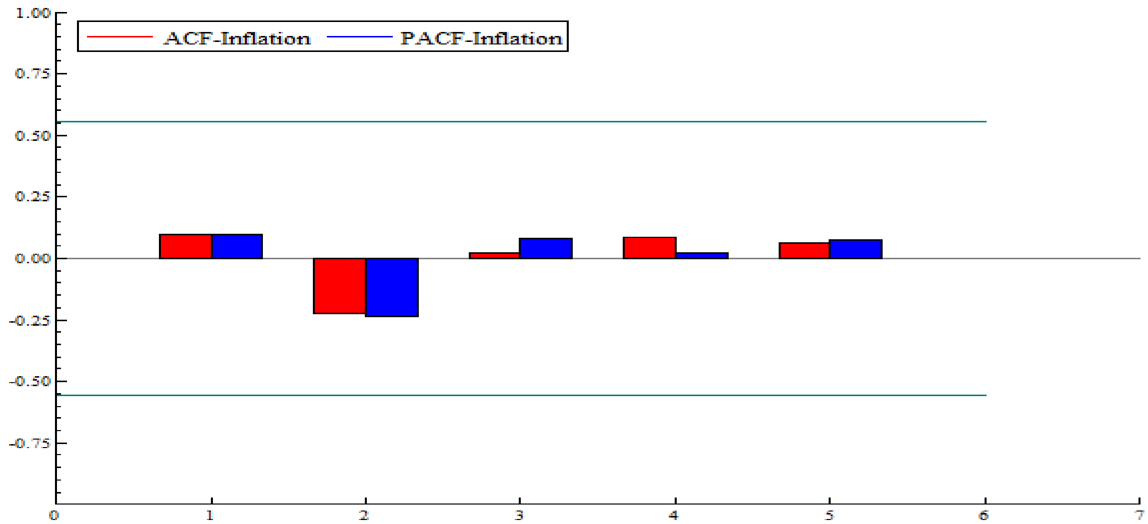


Figure 5.5 presents projected trend for inflation from 2016 to 2018. A continuous increasing trend can be seen throughout the projected period from 2016 to 2018.

Figure 5.5: Projected Trends for Inflation (2016-18)

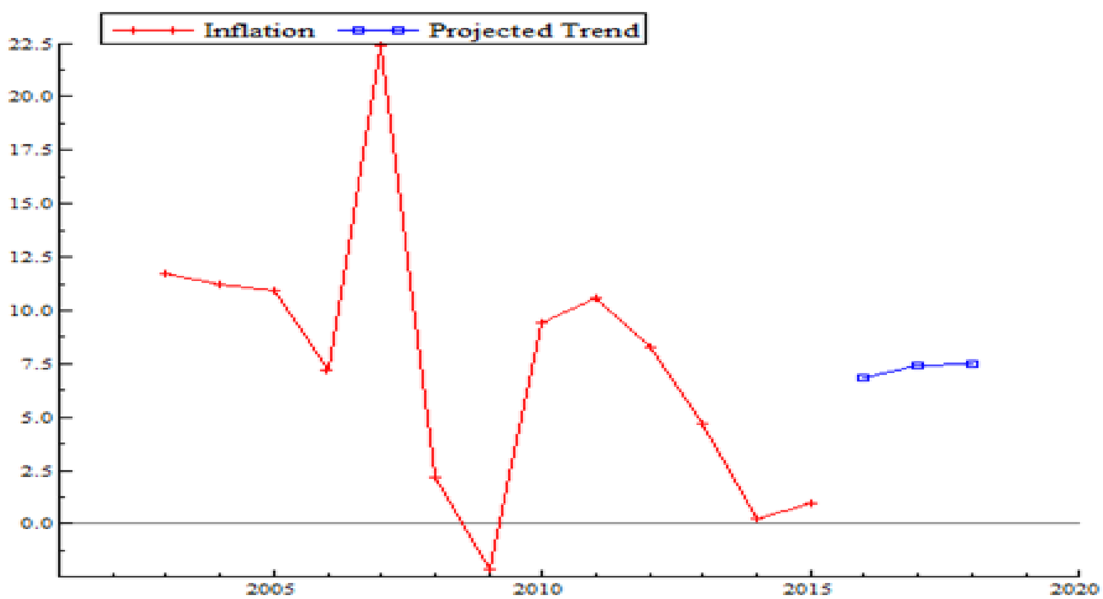
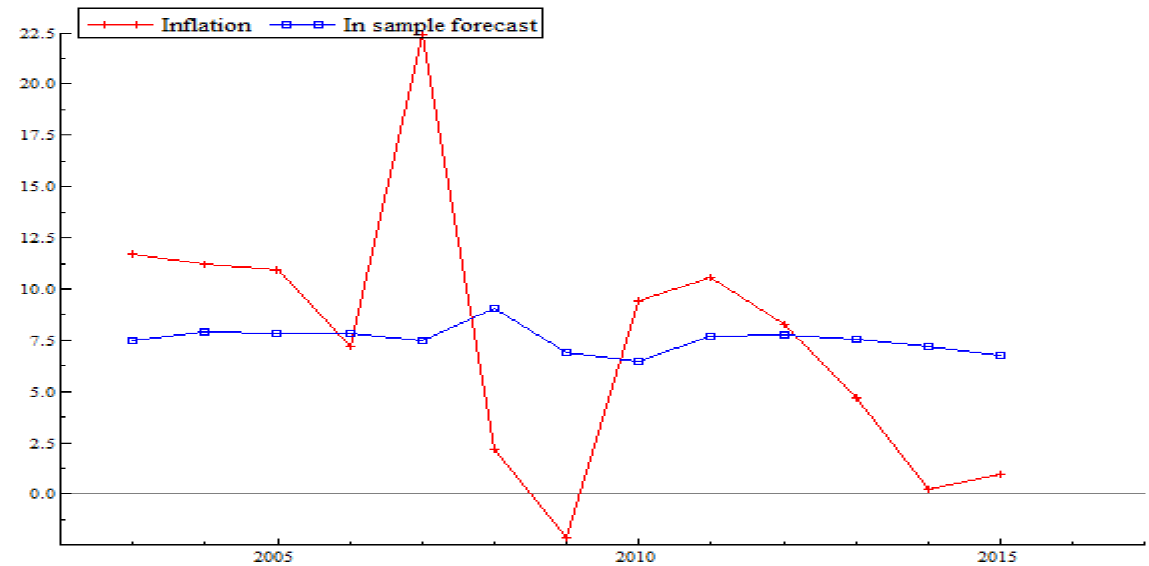


Figure 5.6 presents in-sample forecasts, for both the actual and predicted series and show that the model predictions do correlate with the actual series, though there are some deviations from the average.

Figure 5.6: In-sample Forecasts for Inflation (2003-15)



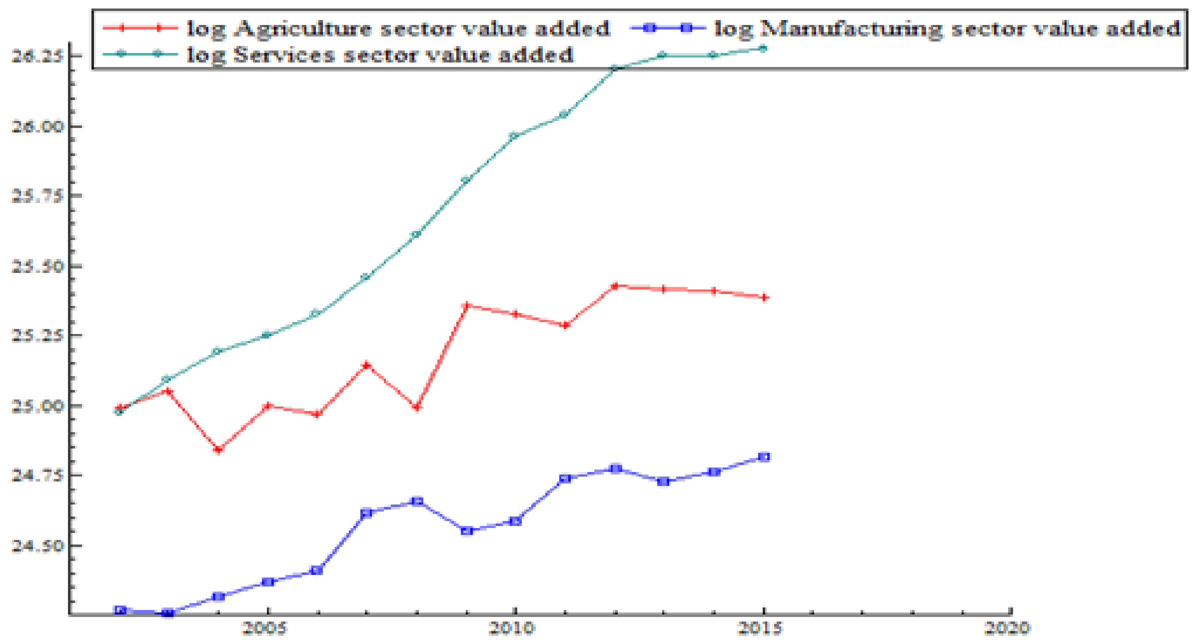
5.2.3. Production Block

To model the production activities, we have disaggregated the production into three major sub-sectors: (1) agriculture, (2) manufacturing, and (3) services. The selection of the sectors is primarily based on the structure of the economy.

In production block, agriculture value added, services sector value-added and manufacturing sector value added are expressed as percentage of GDP. Given the nominal GDP we transform these value-added into nominal value-added by just multiplying each value added to nominal GDP.

Figure 5.7 below shows that services sector value addition remained highest through the data span while manufacturing sector value addition remained the lowest. Also, it can be seen that all three sectors have continuously increasing trends.

Figure 5.7: Log Nominal Agriculture, Manufacturing and Services Sectors Value Added



5.4. Conclusion

This chapter has presented the simulation results for Afghanistan's economy. The estimations show that the economy is beset by an adverse security situation which continues to negatively affect the economy's performance. Our simulations show that while the economy will grow at a moderate rate in the medium term, the high rate of population growth will offset any gains in the real sector thereby reducing per capita income. This has important implications for macroeconomic policy in Afghanistan. In particular, there is a need to tackle the security challenges to prepare the ground for an economic revival that focuses on boosting the commodity producing sectors while at the same time maintaining macroeconomic stability.

Chapter 6 - Azerbaijan: Modelling Exercise and Forecasts

6.1. Modelling Exercise

The modelling exercise for Azerbaijan has focused on key macroeconomic variables for which time series data of adequate duration is available. The model specifications have also been dictated by data availability and consequently there may be some missing variable bias.

6.1.1. Production Block

To model the production activities, we have disaggregated the production into three major sub-sectors: (1) agriculture, (2) manufacturing, and (3) services. The selection of the sectors is primarily based on the structure of the economy. However, data availability constraints have also played a role in the selection of sectors for disaggregation of production. Because of small data span the actual effect of regressor on regressand cannot be observed properly and we might find unusual relation between dependent and independent variables; the results should thus be interpreted cautiously. Unavailability of some relevant regressor may cause omitted variable bias that may manifest in residual analysis.

On account of the limited amount of data available only one model i.e. for services sector value added has been estimated here.

6.1.1.1. Services Sector

The estimation of the services sector value added suggests that services contribution to the total production is significantly determined by aggregate demand in the long-run (Table 6.1). The contribution of aggregate demand in the services value added is 1.56 in the long -run. The ADF statistic of residuals of long run relation is found to be -4.222 (Table 6.2), which is significant, indicating a long-run relationship between services value added and aggregate demand in Azerbaijan economy.

Table 6.1: Services Sector Long Run Estimates

$$y_t^s = -15.13 + 1.56ad_t \quad (6.1)$$

(SE) (3.54) (0.15)

t:	1994 – 2012		
Sigma:	0.457	**RSS:**	3.546
Adj. R²:	0.857	**F (1,17):**	109.1 [0.000]**
		Log-likelihood:	-11.012

Table 6.2: ADF Test of Residuals from Long Run Service Sector Function

ADF Statistics:	-4.222	
Lags:	**0**	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values: Davidson and MacKinnon (1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The short-run ECM model corresponding to the long-run services value added relationship is given by Eq (6.2). The results (Table 6.3) suggest that in short run change in services sector value added depends on change in aggregate demand positively. The short-run model should be interpreted carefully as we find some problems in residual analysis. Negative and significant error correction term (ECT) confirms the long run relation.

Table 6.3: Short Run Estimates of Services Sector Function

	$\Delta y_t^s = 1.112 \Delta ad_t \; - 0.728 ECT_{t-1}$		(6.2)
(SE) (0.537) (0.178)			
t:	1995 – 2012		
Sigma:	0.327	RSS	1.709
Log Likelihood	4.348		
AR 1-2 Test:	F (2, 14) = 37.648 [0.000]**		
ARCH 1-1 Test:	F (1, 16) = 0.730 [0.406]		
Normality Test:	Chi^2 (2) = 3.393 [0.183]		
Hetero Test:	F (4, 13) = 48.014 [0.000]**		
Hetero-X Test:	F (5, 12) = 35.827 [0.000]**		
RESET23 Test:	F (2, 14) = 30.170 [0.000]**		

6.1.1.2. Agriculture Sector

In the agriculture sector we observe a decline in labor force engaged in agriculture sector (Figure 6.1) due perhaps to rapid urbanization and use of less labor intensive and innovative agricultural tools and techniques. In the past decade a negative relationship is observed (Figure 6.2) in agricultural value added and labor force engaged in agriculture sector. A higher value addition coupled with decrease in labor indicates that agriculture sector is relying more on labor-saving innovative agricultural tools and techniques.

Figure 6.1: Agricultural Sector Employment in Value Addition

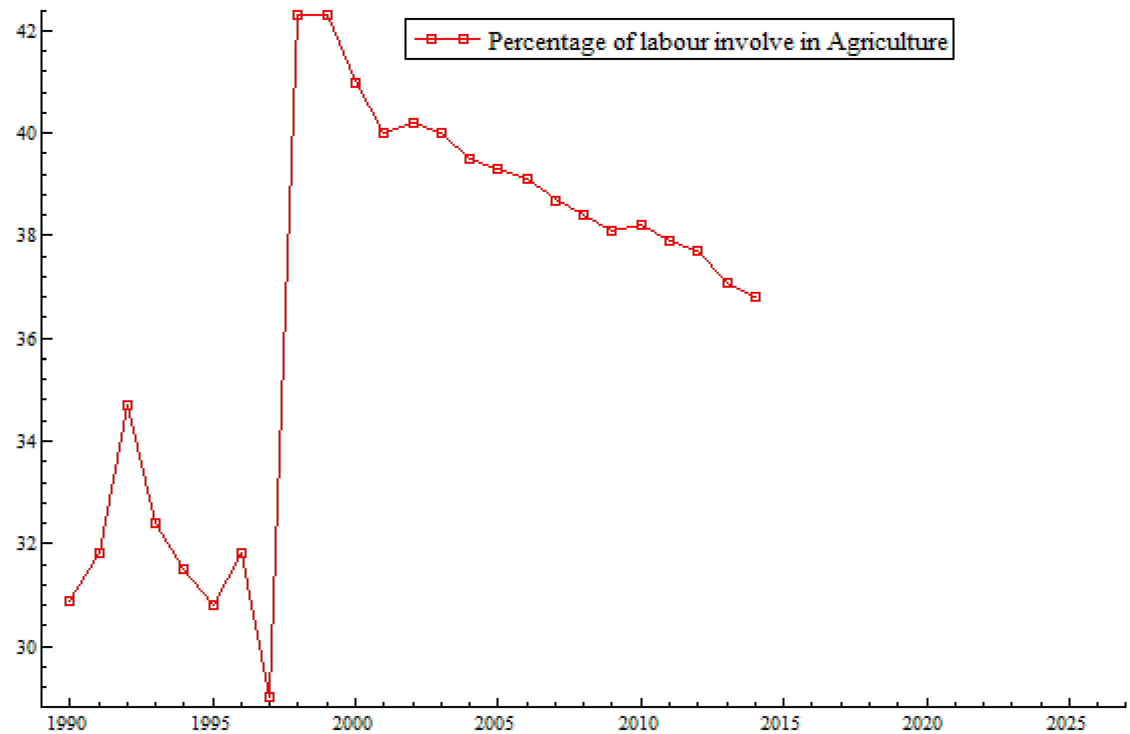


Figure 6.2: Agriculture Sector Value Addition and Labor Employed

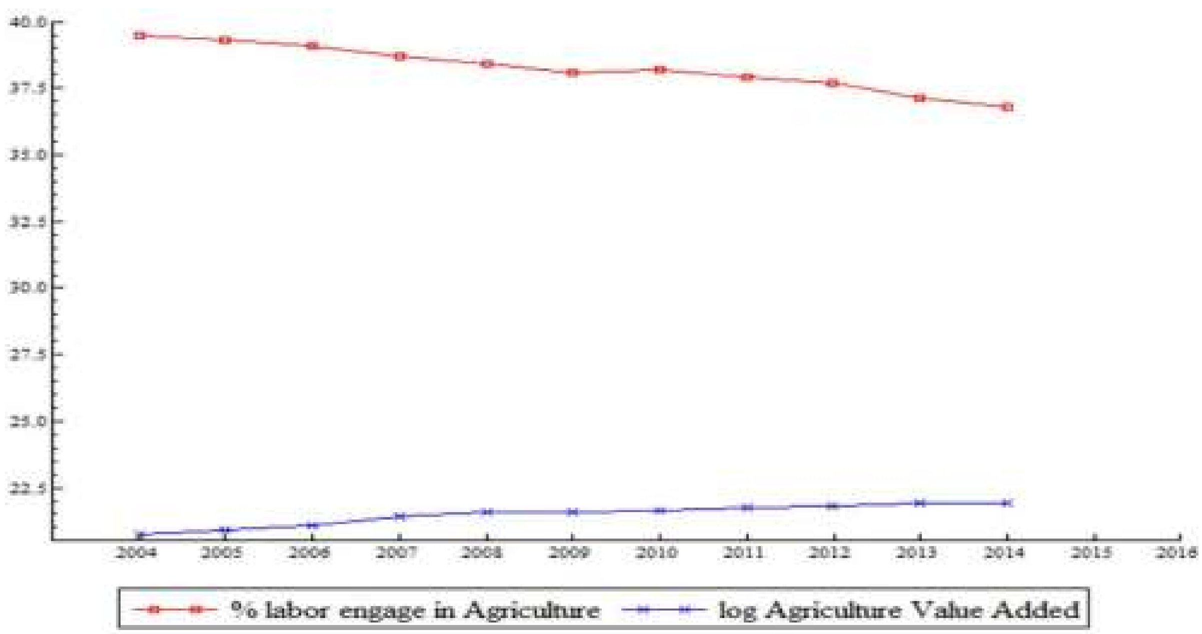
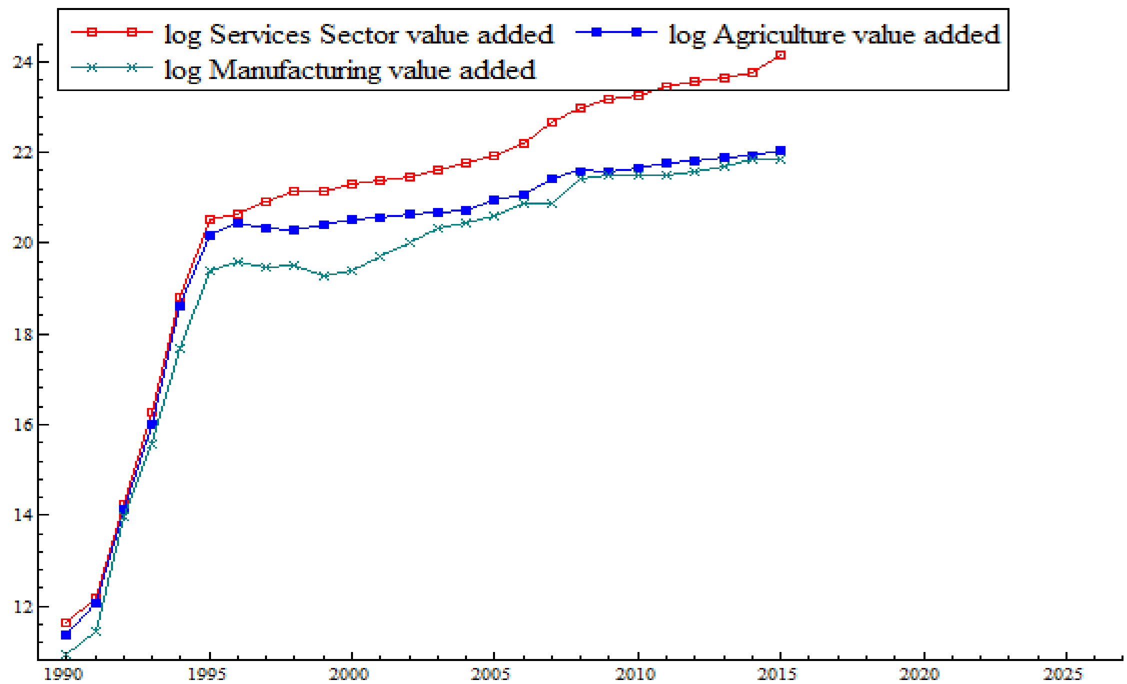


Figure 6.3 below shows the continuous increasing pattern in all three sectors value added. Services sector value addition remained the highest through the data span while manufacturing sectors value addition remained the lowest.

Figure 6.3: Value Added by Sector



6.1.2. Aggregate Demand Block

Aggregate demand can be decomposed into consumption and investment sub-sectors. The consumption sub-sector is further disaggregated into private and government consumption. Due to data unavailability we will present selected macro-econometric models for different components of the block.

6.1.2.1. Government Consumption

In Azerbaijan, government consumption depends on total government revenues as reflected in the long run relation in Eq (6.3). Government revenues exert substantial positive influence on government consumption. Inflation also has positive significant effect on government consumption. The *ADF* statistic for testing the stationarity of the long run residuals is equal to -4.155, indicating presence of a long-run relationship among macroeconomic variables during the period under estimation. Hence, an ECM is estimated to get short run relation, presented in Eq (6.4).

The results reported by Eq (6.4) reveal that previous government consumption affects the current government consumption; also, government revenue is a significant determinant of government consumption in the short-run. Negative and significant ECT validates the long run relation and in the short run inflation has a negative and significant effect. The model passes all the diagnostic tests except for normality test which is significant at 1 percent level of significance.

Table 6.4: Government Consumption Long Run Estimates

$c_t^g = 8.561 + 0.592 r_t^g + 0.001 INF_t$ (6.3) (SE) (0.596) (0.027)(0.001)			
t:	1994 – 2012		
Sigma:	0.155	**RSS:**	0.387
Adj. R²:	0.969	**F (2,16):**	278.900 [0.000]**
		Log-likelihood:	10.041

Table 6.5: ADF Test of Residuals from Long Run Government Consumption Function

ADF Statistics:	-4.155	
Lags:	**0**	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values: Davidson and MacKinnon (1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Table 6.6: Short Run Estimates of Long Run Government Consumption Function

$$\Delta c_t^g = 0.364\Delta c_{t-1}^g + 0.405\Delta r_t^g - 0.002INF_t - 0.412ECT_{t-1} \quad (6.4)$$

(SE) (0.183) (0.103) (0.000)(0.217)

t:	1994 – 2012		
Sigma:	0.113	RSS	0.178
Log Likelihood	16.027		
AR 1-2 Test:	F (2, 12) = 2.073 [0.169]		
ARCH 1-1 Test:	F (1, 16) = 1.174 [0.295]		
Normality Test:	Chi^2 (2) = 0.022 [0.989]		
Hetero Test:	F (8, 9) = 0.736 [0.662]		
Hetero-X Test:	(not enough observations)		
RESET23 Test:	F (2, 12) = 0.284 [0.758]		

6.1.2.2. Private Investment

The long-run estimates of the real private investment are given by Eq (6.5). It is evident from the results that real private investment is significantly determined by nominal income NY (data for real income is not available). Nominal income is highly significant with positive impact on real private investment. These results partially confirm the earlier findings by (Guru-Gharana, 2000) in the case of Pakistan and also in our ECO project estimations for Pakistan. The positive and significant coefficient of nominal income verifies the famous accelerator principle. The corresponding value of the *ADF* statistic for the long run residual stationarity is -3.257, indicating the presence of cointegration among the real private investment and its determinants. Based on the long-run estimates we have estimated short-run ECM model and Eq (6.6) reports the results.

Table 6.7: Private Investment Long Run Estimates

$$i_t^p = 8.276 + 0.608 ny_t \tag{6.5}$$

(SE) (1.340) (0.059)

t:	1993 – 2014		
Sigma:	0.493	**RSS:**	4.860
Adj. R^2:	0.836	**F (1,20):**	107.80 [0.000]**
		Log-likelihood:	14.606

Table 6.8: ADF Test of Residuals from Long Run Private Investment Function

ADF Statistics:	-3.257	
Lags:	**1**	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values: Davidson and MacKinnon (1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The short-run estimates suggest that nominal income is the important determinant of private investment with positive and significant coefficients. The private sector credit remains insignificant in the short-run also. The first lag of change in private investment is significant; econometrically this signifies the possible presence of one common factor (COMFAC). The lagged error-correction term is significant with theoretical expected sign.

Diagnostic tests associated with the short-run ECM model do not detect any serious specification problem.

Table 6.9: Short Run Estimates of Long Run Private Investment Function

	$\Delta i_t^p = 0.657\Delta i_{t-1}^p - 0.215ECT_{t-1}$			(6.6)
(SE) (0.137) (0.090)				
t:	1995 – 2014			
Sigma:	0.189	RSS	0.640	
Log Likelihood	6.040			
AR 1-2 Test:	F (2, 16) = 0.223 [0.802]			
ARCH 1-1 Test:	F (1, 18) = 0.046 [0.832]			
Normality Test:	Chi^2 (2) = 4.965 [0.084]			
Hetero Test:	F (4, 15) = 0.237 [0.913]			
Hetero-X Test:	F (5, 14) = 0.197 [0.959]			
RESET23 Test:	F (2, 16) = 2.091 [0.156]			

6.1.3. Fiscal Block

6.1.3.1. Government Expenditure

Due to the lack of adequate number of observations (1992-2015) for variables in the Fiscal Block, estimations should be considered cautiously. Eq (6.7) reports the long-run estimates for government expenditure $\left(ex_t^g = LEX_t^g\right)$. The result reveals that nominal income (NY) and inflation (INF) contribute positively to government expenditure. Though significant, the effect of inflation remains very nominal. This result supports the theoretical view that government expenditure is positively correlated with nominal income and inflation. The estimated long-run income elasticity of government expenditure is 0.804 indicating that a one percent increase in nominal income leads to about a unit increase in government expenditure. The ADF test performed on the residuals generated by Eq (6.7) is equal to -2.816 which is significant, indicating that a long-run relationship exists between the macro variables in the relation presented by Eq (6.7). The stationarity of the residuals guides us to estimate an ECM model and Eq (6.8) reports the results. The short-run income elasticity of government expenditure is 0.733. These results have very important implications in the context of Azerbaijan. The ECT is negative and significant which implies the existence of cointegration among the variables.

Table 6.10: Government Expenditure Long Run Estimates

$$ex_t^g = 4.471 + 0.000INF_t + 0.804ny_t \quad (6.7)$$

(SE) (0.559) (0.000) (0.024)

t:	1992-2015		
Sigma:	0.168	**RSS:**	0.591
Adj. R²:	0.991	**F (2,21):**	1,327 [0.000]**
		Log-likelihood:	10.395

Table 6.11: ADF Test of Residuals from Long Run Government Expenditure Function

ADF Statistics:	-2.816	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Table 6.12: Short Run Estimates of Long Run Government Expenditure Function

	$\Delta ex_t^g = 0.733\Delta ny_t - 0.690ECT_{t-1}$		(6.8)
(SE) (0.049) (0.263)			
t:	1993 – 2015		
Sigma:	0.290	RSS	2.942
Log Likelihood	-5.660		
Mean (Δex_t^g)	0.316	SE (Δex_t^g)	0.532
AR 1-2 Test:	F (2, 19) = 0.202 [0.819]		
ARCH 1-1 Test:	F (1, 21) = 5.195 [0.033]*		
Normality Test:	Chi^2 (2) = 2.724 [0.256]		
Hetero Test:	F (4, 18) = 30.290 [0.000]**		
Hetero-X Test:	F (5, 17) = 42.166 [0.000]**		
RESET23 Test:	F (2, 19) = 25.798 [0.000]**		

6.1.4. Foreign Trade Block

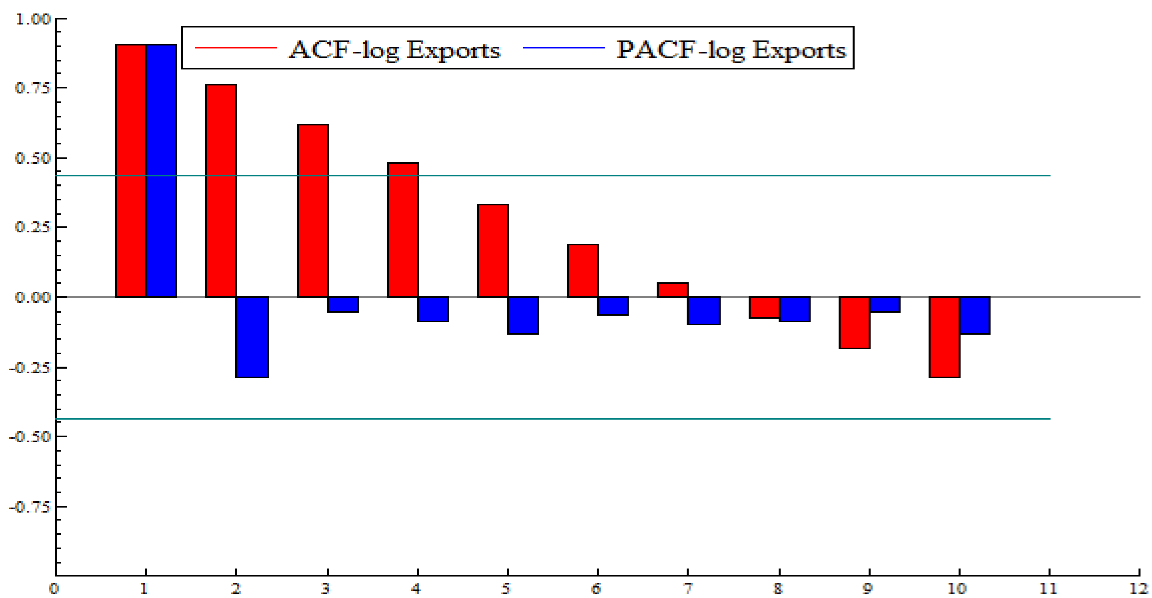
Below we present brief discussion on the trend of exports and imports of Azerbaijan's economy. We employ contemporary simulation techniques and estimate projected trends for exports and imports.

The analysis of Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) of the macroeconomic variables will reveal the structure of variables in terms of the Autoregressive and Moving average components of the series. This is of use in deciding the appropriate simulation technique to be employed.

6.1.4.1. Exports

Theoretically speaking, exports of goods and services are determined by world income, the real effective exchange rate and relative price of exports. Based on the functional form specified in Section (2.4.4.1.), we do not have sufficient data available for the relevant macro variables to estimate the export specification for the Azerbaijan economy. We thus continue with a discussion on trends and projected trends of exports. Figure 6.4 below presents ACF and PACF for log exports. The figure clearly indicates an ARMA process which fades out after few lags.

Figure 6.4: ACF and PACF Plots of Log of Exports



With this short data span, we employ ARFIMA (1,0,1) process to get projected trend for real exports (log-likelihood:5.956 ; T = 1994 – 2014). Figure 6.5 presents projected trend for log real exports from 2015 to 2019. As evident from the graph, a decrease in exports is projected through 2015 – 2019.

Figure 6.5: Projected Trends for Log of Exports (2015-2019)

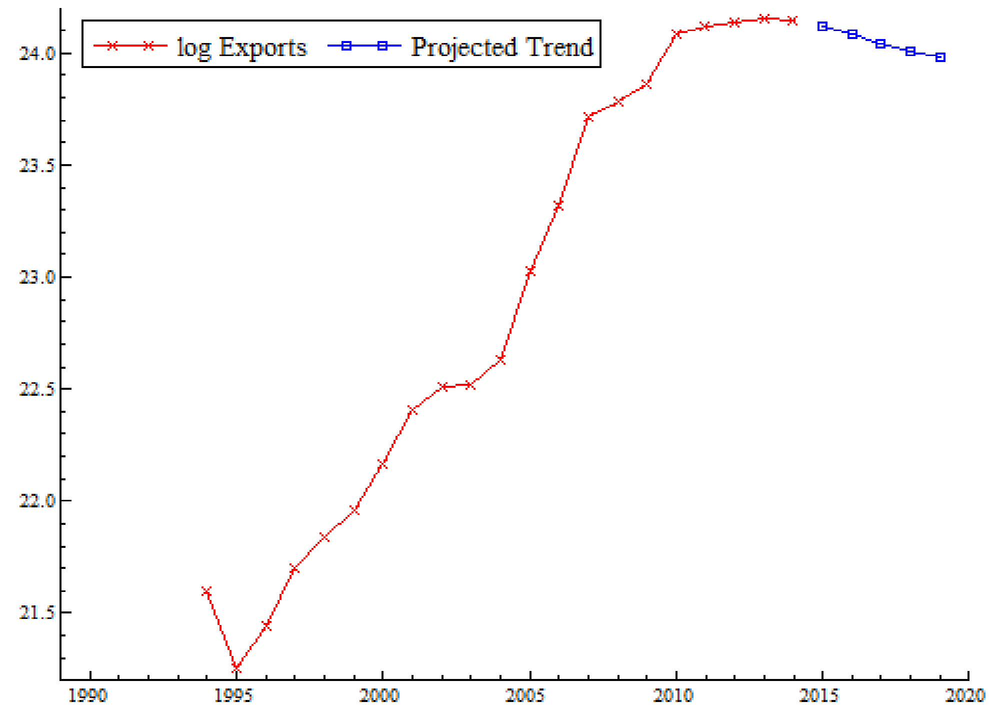
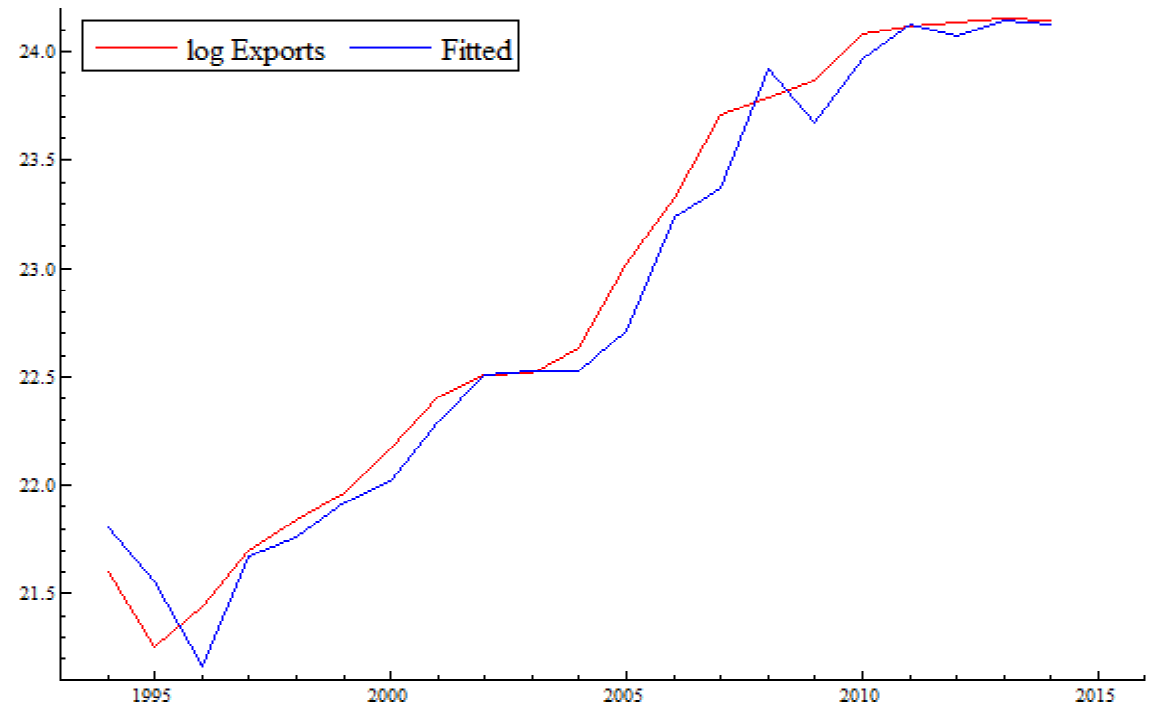


Figure 6.6 presents in-sample forecasts, both actual and predicted series. The figure indicates how closely our model predicts the actual series. After a sharp decline in 1996 a continuous increasing trend of exports can be seen in the sample 1994 – 2014.

Figure 6.6: In-sample Forecasts for Log of Exports (1994 - 2014)

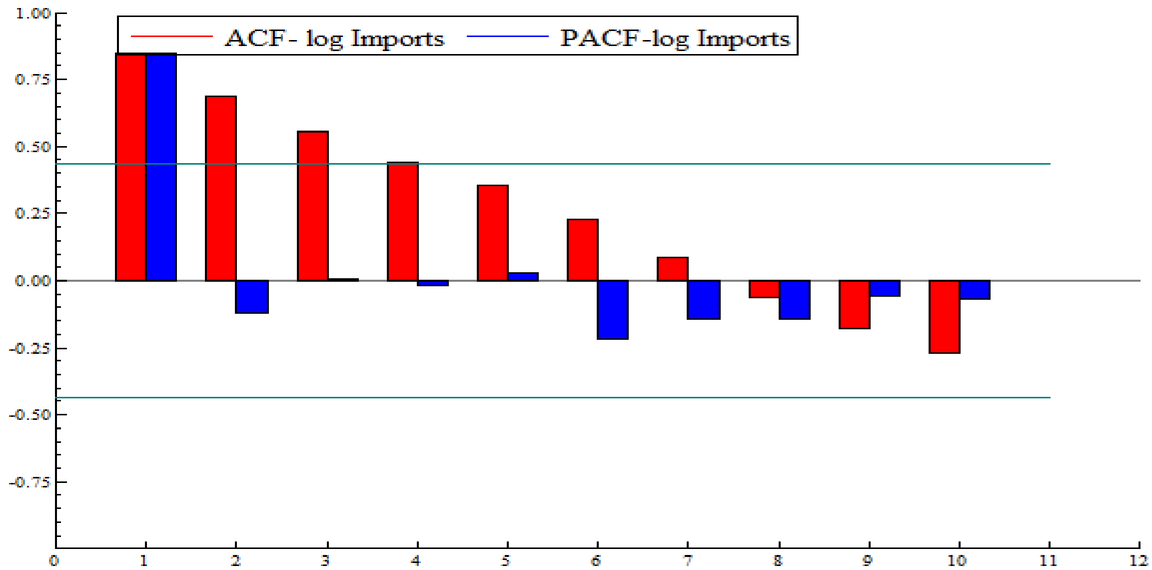


6.1.4.2. Imports

The import of goods and services is estimated as function of real domestic income, real effective exchange rate, relative price of imports and foreign capital inflows. Due to lack of sufficient data available for relevant macro variables, it is not possible to estimate an import equation for the Azerbaijan economy. We instead provide a time series analysis to project import trends for the economy.

Figure 6.7 below presents ACF and PACF for log imports. The figure clearly indicates ARMA process which fades out after few lags.

Figure 6.7: ACF and PACF Plot for Log of Imports



With this short data span, an ARFIMA (1,0,1) process is employed to generate projected trend for real imports (log-likelihood 4.480, T = 1994 – 2014). Figure 6.8 presents projected trend for log real imports from 2015 to 2019. A decrease in imports is projected through 2015 – 2019.

Figure 6.9 presents in-sample forecasts, for both actual and predicted series and indicates how closely our model predicts the actual series. A continuous increasing trend of imports can be seen in sample 1994 – 2014.

Figure 6.8: Projected Trends for Log of Imports: 2015 – 2019

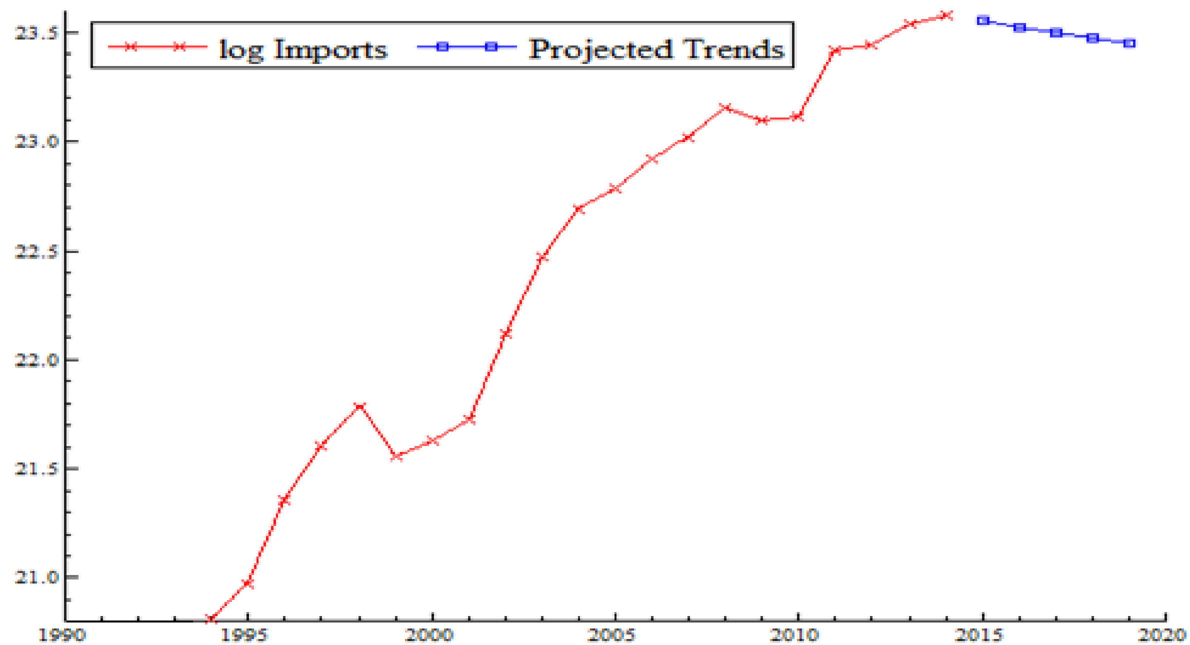
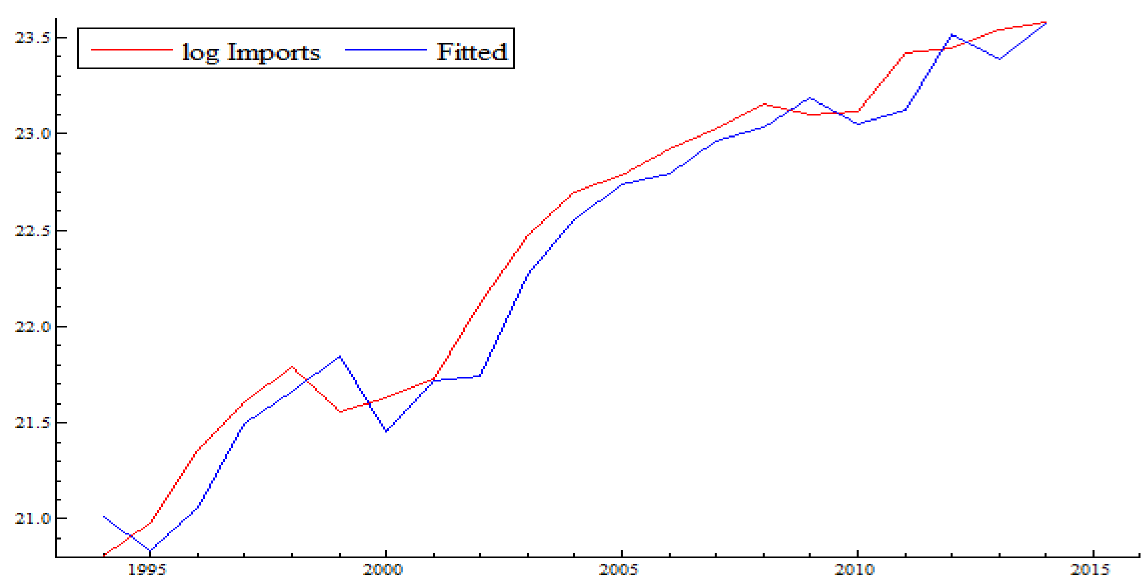
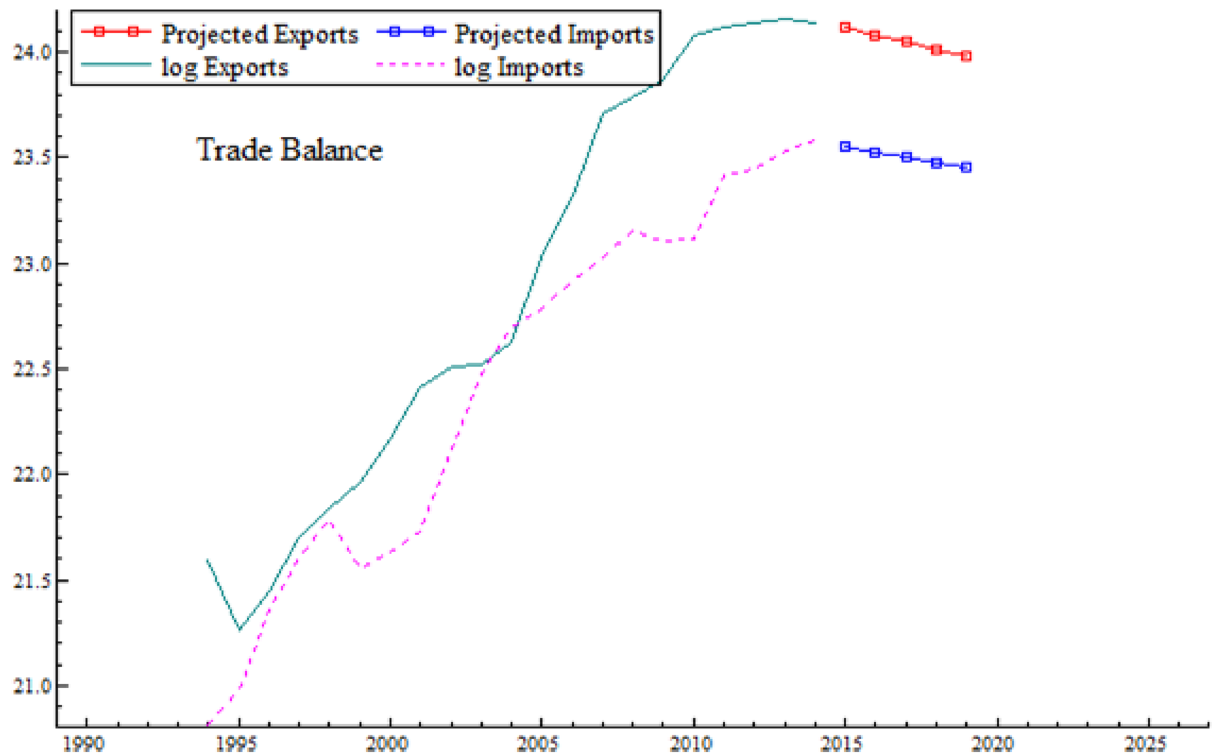


Figure 6.9: In Sample Forecasts for Log of Imports: 1994 - 2014



From Figure 6.10 below it is observed that real exports outpaced imports throughout the sample span and also in projected trends, except for one year only (2004) when imports marginally exceeded exports.

Figure 6.10: Balance of Trade



6.1.5. Monetary and Price Block

6.1.5.1. Money Demand

In the case of Azerbaijan, in this block data for real per capita income and broad money (M_2 definition) are available. Contemporary simulation techniques are employed and projected trends for real per capita income and demand for money are estimated.

Analysis of ACF and PACF of the series yields insight into the structure of the variables; more specifically the Autoregressive and Moving average structure that helps determine the appropriate simulation technique.

6.1.5.2. Real Income Per Capita

Figure 6.11 below presents ACF and PACF for log real GDP per capita. The figure clearly indicates ARMA process which fades out after few lags. With this short data span, an ARFIMA (1,0.389,1) process is employed to derive the projected trend for real GDP per capita (log-likelihood = 29.757, T = 1990 – 2015).

Figure 6.11: ACF and PACF Plots for Log of Real GDP Per Capita

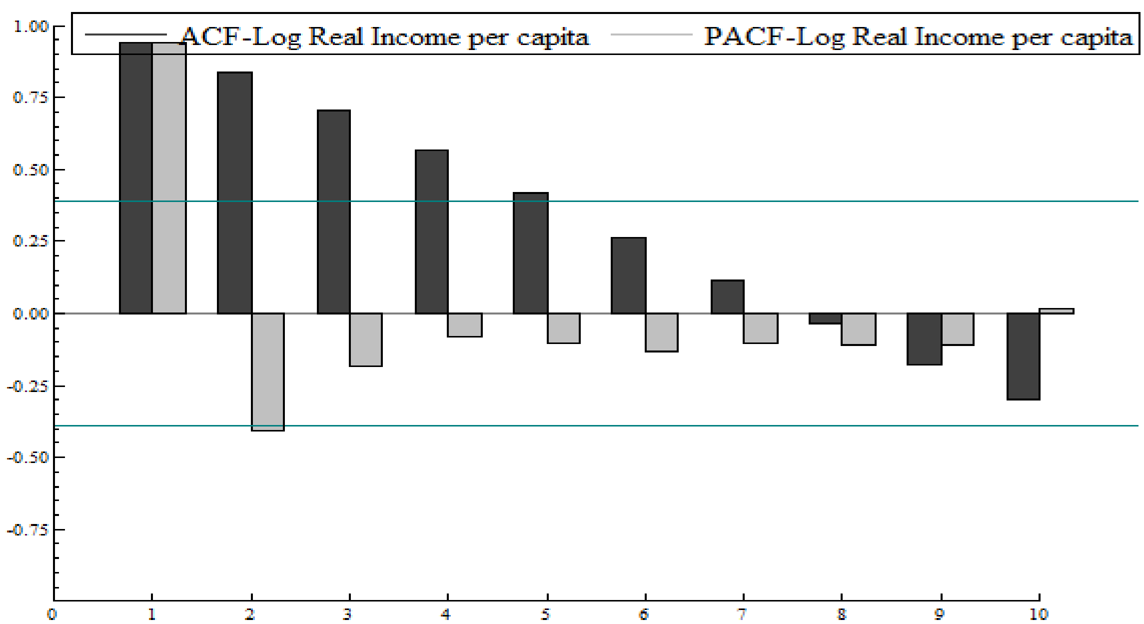
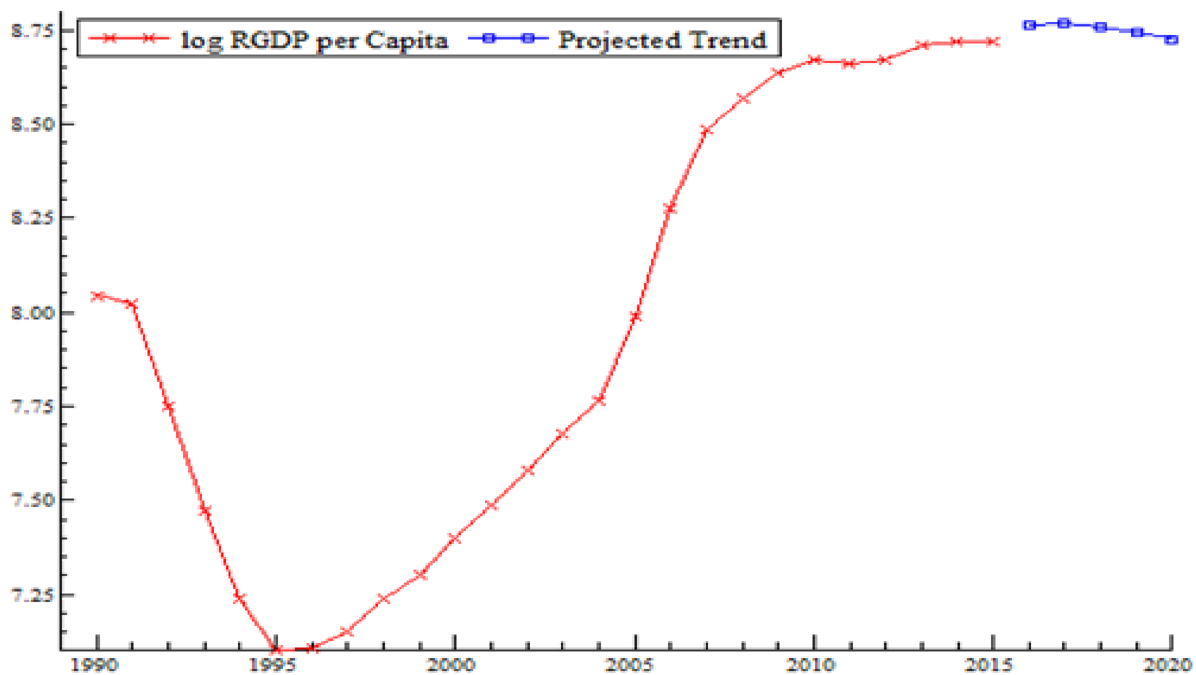


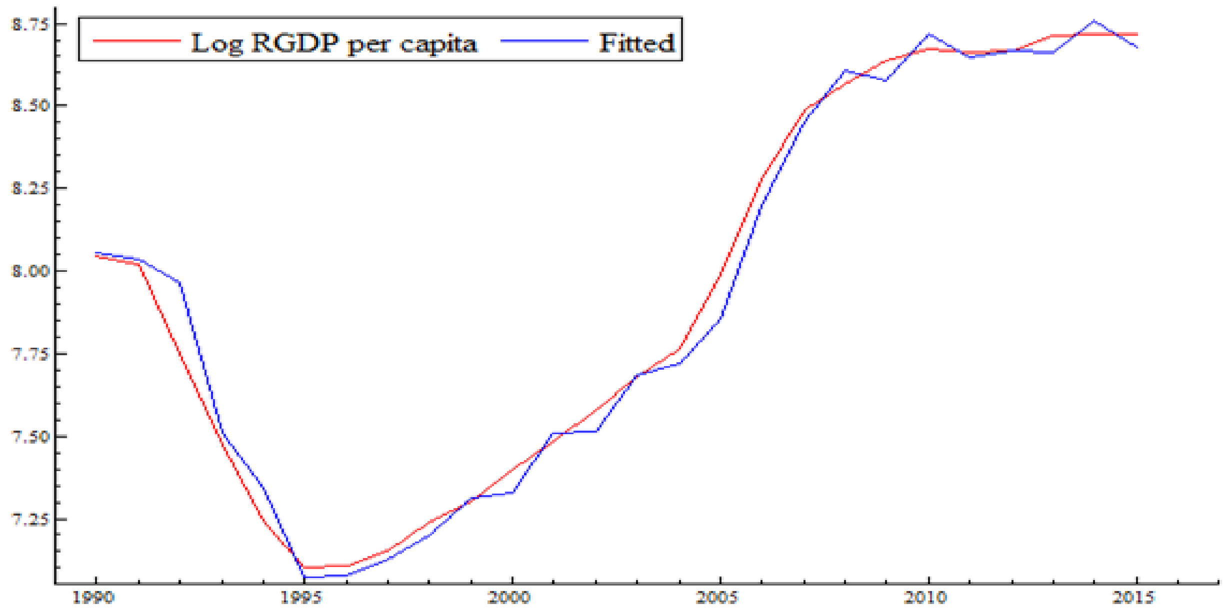
Figure 6.12 presents projected trend for log real income per capita from 2016 to 2020. A clear increasing trend can be seen in first two years 2016-2017 then a decreasing trend is shown; this decrease is still greater than in the whole sample span from 1990 – 2015. Therefore, growth in Azerbaijan economy can be expected to continue in the years to come.

Figure 6.12: Projected Trends for Log RGDP Per Capita: 2016 - 2020



In-sample forecasts, for both actual and predicted series are presented in Figure 6.13. The figure indicates how closely our model predicts the actual series. After a sharp decline in 1995 a continuous increasing trend of real income can be seen clearly which indicates the positive prospects of growth in Azerbaijan's emerging economy.

Figure 6.13: In Sample Forecasts for Log RGDP Per Capita: 1990 - 2015



6.1.5.3. Demand for Money

Figure 6.14 below presents ACF and PACF for log of money supply. The figure clearly indicates an ARMA process which fades out after limited number of lags, as in the case of real income. We employ an ARFIMA (1,0,1) process to get projected trend for log money supply (log-likelihood: -7.871, T = 1995 – 2015).

Figure 6.15 presents projected trend for log money supply from 2016 to 2020. A decreasing trend can be seen in demand for money while in the same period per capita real income is increasing.

Figure 6.14: ACF and PACF Plots for Log of Money Supply M2

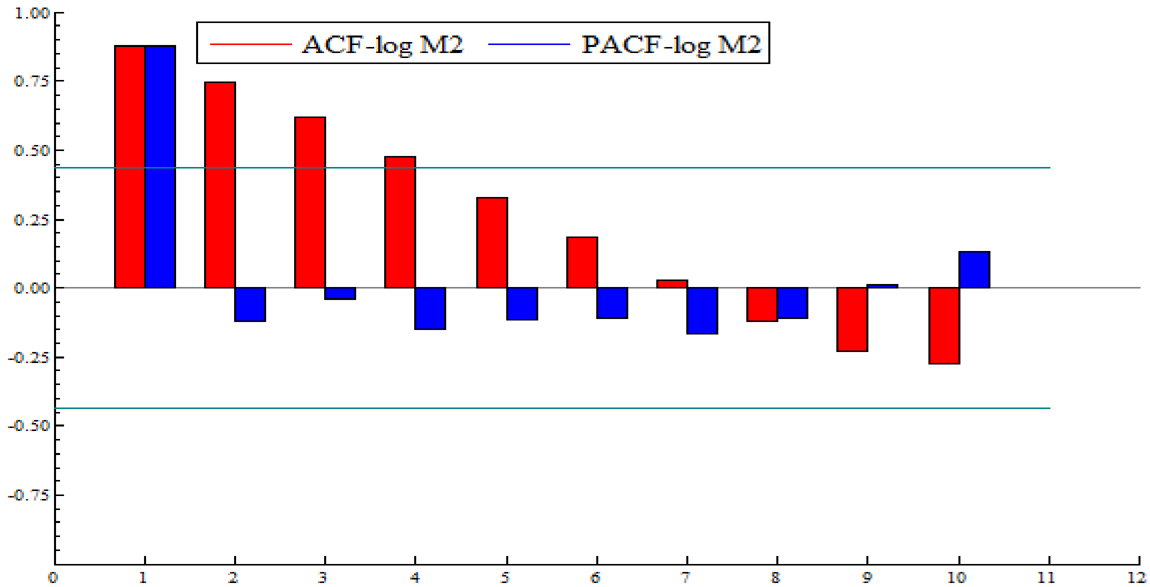


Figure 6.15: Projected Trends for Log RGDP Per Capita: 2016 - 2020

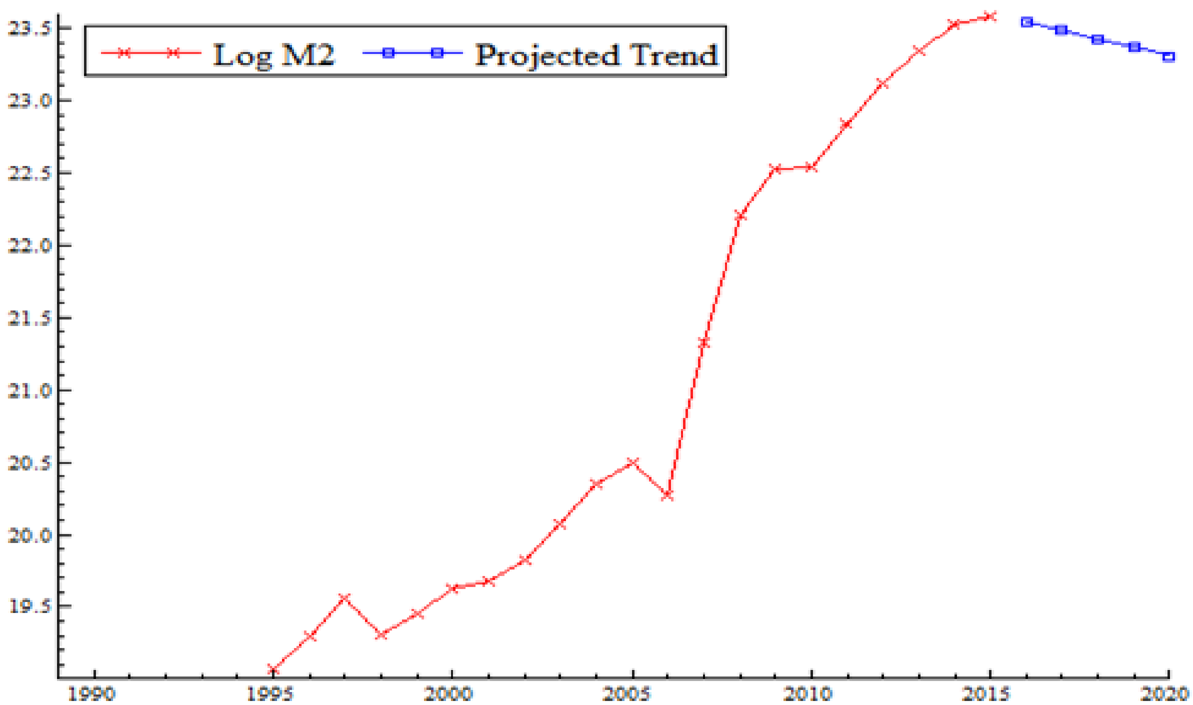
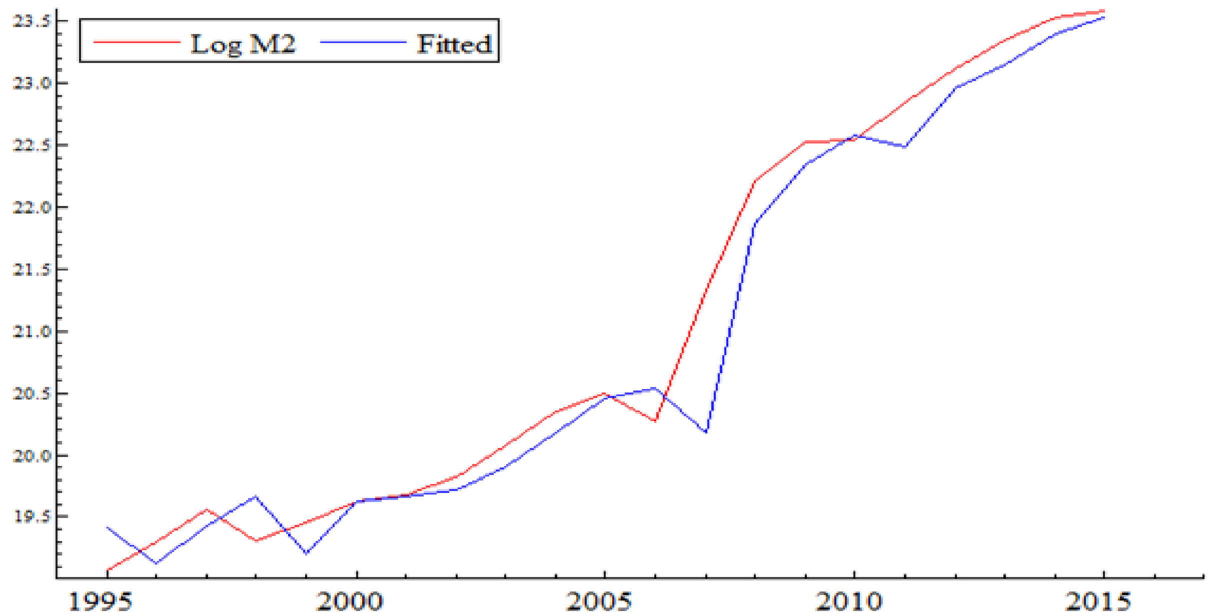


Figure 6.16 presents in-sample forecasts, for both actual and predicted series and the graphs indicate how closely our model predicts the actual series. Since 1995 a continuous increasing trend for demand of money can be seen clearly without any sharp decline.

Figure 6.16: In sample Forecasts for Log M2: 1995 - 2015



6.2. Policy Simulations

The Azerbaijan economy is a dual economy in the sense that the oil sector coexists with a non-oil sector. However, oil is dominating since hydrocarbon exports account for more than 90 percent of Azerbaijan's total export. As the medium-term forecasts[73] indicate in Table 6.13, growth in real terms is expected to strengthen in 2018 after contraction for

[73] Due to data limitations it was not possible to estimate macro-econometric model for Azerbaijan. Some rough projections are made using econometric technique, Auto Regressive Integrated Moving Average (ARIMA) models.

consecutively two years[74], driven mainly by a fiscal stimulus, a rise in hydrocarbon prices, and an increase in gas exports[75]. However, it will slow down again in 2019 and 2020. Contraction in 2016 and 2017 is the continuing impact of 2015 oil price decline, which leads to reduction in production and exports of the oil sector.

Table 6.13: Growth Forecasts of Real Variables - Azerbaijan

	2016	2017	2018	2019	2020
GDP	-3.1	-4.8	2.1	0.04	0.03
Nominal GDP	11.1	4.2	4.0	3.9	3.7
Agriculture Value Added	2.6	3.4	0.8	3.2	0.9
Manufacturing Value Added	-4.2	-3.6	2.5	0.1	-0.02
Services Value Added	-1.9	-3.2	7.1	-1.6	-0.6
Private Consumption	13.3	10.8	9.3	8.9	8.5
Public Consumption	17.6	10.6	8.9	12.1	11.9
Gross Fixed Capital Formation	-0.9	2.7	4.0	3.8	3.7
Imports	39.3	11.8	5.9	9.4	8.6
Exports	36.5	4.2	4.0	3.9	3.7
Trade balance (Share in GDP)	2.8	-0.44	-1.3	-3.8	-6.2
Prices (CPI)	4.2	4.2	4.0	3.7	3.4
Current Expenditures	10.4	3.9	3.8	3.6	3.5
Revenue from Taxes	10.6	4.0	3.8	3.7	3.4

Note: For 2016 it is actual data; while projections from 2017 to 2020.

Growth in 2018 would possibly be because of the OPEC deal that has been extended until the end of 2018; Azerbaijan's crude oil output is not expected to decline much further in 2018. Moreover, average oil prices are expected to rise in 2018 relative to 2017 and are projected to stabilize at robust levels in the medium term. However as per our projected trends, growth will slow down in 2019 and 2020 with the termination of OPEC deal.

[74] The impact of low oil prices in 2015 had a prolonged impact on growth in Azerbaijan.

[75] World Bank Country Overview – Azerbaijan; available at: http://www.worldbank.org/en/country/azerbaijan/overview#3

Prior to the decline in global oil prices since 2014, Azerbaijan's high economic growth was mainly accredited to rising energy exports. Oil exports through the Baku-Tbilisi-Ceyhan Pipeline, the Baku-Novorossiysk, and the Baku-Supsa Pipelines remained the main economic driver. Now efforts to boost Azerbaijan's gas production are underway and the main pipeline that will deliver gas to Europe from the Shah-Deniz II field will be operational by end-2018. Therefore, growth in 2019 and onwards would be driven by an expansion of natural gas production and its exports (however, it will depend on its timely operationalization).

On the supply side, value added in agriculture is likely to expand by 2 percent by 2020. While manufacturing and services are projected to expand noticeably only in 2018, thus having its impact on overall growth. While on the demand side, private consumption and public consumption are expected to increase by 9.3 percent and 10.9 percent respectively by 2020. Investment climate is projected to remain relatively weak as total investment is projected to grow by 3.5 percent by 2020.

In Azerbaijan the unexpected decline in oil production and exports is likely to narrow down the trade balance. After contraction in 2014, imports are rising much faster than exports since 2015. This trend is likely to continue, with imports growing faster than exports, the trade surplus will turn into deficit in 2017. Trade deficit is projected to expand by 2020. However, exports could possibly increase faster than the projected value depending upon the increase in gas production and its exports.

On the monetary side, to curb inflation the central bank will continue to tighten the monetary policy stance by actively absorbing Manat liquidity using deposit auction operations and the issuance of notes. Inflation is projected to remain around 4 percent from 2016 to 2020.

On the fiscal side, plunging oil prices has increased fiscal deficit in Azerbaijan to 1.2 percent of GDP in 2015 maximum since the year 2000, compelling for tightening of fiscal policy. Fiscal consolidation led to a decline in deficit (0.4 percent of GDP) in 2016. Lower oil revenues and increases in wages, pensions, and targeted social assistance were offset by cuts in public investment and significantly lower than planned spending by the Oil Fund. Consolidation efforts are expected to continue till 2020. Although the government of Azerbaijan has planned a fiscal stimulus in 2018 by boosting capital spending[76], fiscal balance is likely to remain positive. Improvement in oil prices is projected to increase non-tax revenue by almost 5.5 percent by 2020. While both current expenditures and revenues from taxes are projected to rise by about 4 percent each by 2020.

Declining oil prices along with sharp reduction in the manufacturing and construction sector caused contraction in GDP in 2016 and 2017. The economic decline was accompanied by higher inflation (relative to 2014 when CPI inflation was only 1.4 percent) and a weakened banking sector. Azerbaijan's financial sector continued to struggle even in 2017. Structural economic inefficiencies along with other institutional

[76] Which will be primarily financed by an increase in budget transfers from the sovereign wealth fund.

weaknesses in the form of public and private sector corruption have hindered overall growth prospects, particularly in the non-energy sector. No doubt, the government is making efforts to reform institutional weaknesses. In late 2016, the Government of Azerbaijan approved a strategic roadmap that identified key non-energy segments of the economy for development such as agriculture, logistics, and tourism. Another major impediment in Azerbaijan's economic progress is insufficient foreign investment in the non-energy sector and the continuing conflict with Armenia over the Nagorno-Karabakh region[77].

External trade remains extremely important from growth's perspective; and international oil prices will continue to influence its growth as along as the country is unable to improve business environment and diversify its economy. Development of the non-oil sector and the promotion of innovation activities are important to create a knowledge-based economy. Azerbaijan has expanded trade with Turkey and Europe and is seeking new markets for non-oil and gas exports; but trade with Russia and the other former Soviet republics will remain important in future. And as said earlier, the expected completion of the geopolitically important Southern Gas Corridor between Azerbaijan and Europe will play an extremely important role in future.

6.3. Conclusion

This chapter has presented macro-econometric estimations and time series analysis for key macroeconomic segments of the Azerbaijan economy. The projections show that

[77] For details see Coutsoukis (2018)

while the economy exhibits a robust trend for economic growth, there is a need to diversify the economy and bolster non-oil manufacturing and services sectors for sustained economic growth. Currently the macroeconomic environment in the economy depends on fluctuations in oil prices which determine government revenues and hence the level of fiscal deficit. A more diversified economy will lead to more stable revenues thus enabling the government to undertake crucial development spending to enhance productivity and boost economic growth.

Chapter 7 - Iran: Modelling Exercise and Forecasts

The modelling exercise for Iran has focused on key macroeconomic variables for which time series data of adequate duration was available. The model specifications have also been dictated by data availability and consequently there may be some missing variable bias.

7.1. Modelling Exercise

7.1.1. Production Block

To model the production activities, the production can be disaggregated into three major sub-sectors: (1) agriculture, (2) manufacturing, and (3) services. The selection of the sectors is primarily based on the structure of the economy. However, data availability constraints have also played a role in the selection of sectors for disaggregation of production. In this block there is a mixture of stationary and non-stationary variables; in a situation like this ARDL modelling is a better option. In the following subsections the distinct subsectors of the Production Block are described with appropriate macro channel, while in Section 7.2 a limited set of predictable equations is presented. Section 7.3 wraps up the discussion on this macroeconomic modelling exercise for Iran.

Starting with the long run static equation; in post estimation diagnostic tests the residual series of static equation is found to be non-stationary indicating no cointegration. Autocorrelation is also found in residual series of long run static equation, indicating presence of COMFAC. Then lags of regressors and regressand are introduced and the insignificant regressors are dropped to derive a parsimonious model. These equations constitute our final model presented earlier. To get these results (models) econometrically significant with i.i.d residuals, Autometrics technique (automatic model selection routine of the PcGive estimation package) has been employed as needed.

7.1.1.1. Agriculture Sector

Following Naqvi *et al.*, (1983); Zerfu (2002); Iqbal, et. al., (2003) agriculture sector production is assumed to be a function of labor force engaged in agriculture (L^A), disbursement of credit to agriculture sector (CD^A) and availability of machinery used in agriculture (M^A) proxied by number of tractors for agriculture. The functional form described earlier is:

$$Y_t^A = f(L_t^A, CD_t^A, M_t^A) \tag{7.1}$$

Where:

Y_t^A	=	Agriculture value added
L_t^A,	=	Labor force engaged in agriculture
CD_t^A	=	Credit disbursement to agriculture sector
M_t^A	=	machinery used in agriculture, proxied by number of tractors

Factors other than the ones included in above functional form that may influence agricultural output include land, fertilizer, pesticides, tractors other inputs like seeds of high yield variety. These, excluding land, are typically purchased using credit. This is especially true for inputs like seeds (Dhansekaran, 1999; Iqbal, Ahmad and Abbas, 2003). Thus, the inclusion of agriculture credit disbursement accounts for the influence of these factors. The influence of infrastructure like farm to market roads and electricity on agricultural output needs no emphasis. Parikh (1983) assumes that infrastructure and water availability influences agricultural output significantly. To capture the effect of infrastructure ($IFRS^A$) the functional form incorporates road length as a proxy for infrastructure. The functional relation cited above now takes the following form:

$$Y_t^A = f(L_t^A, CD_t^A, M_t^A, IFRS_t^A) \tag{7.2}$$

Where:

Y_t^A	=	Agriculture value added
L_t^A,	=	Labor force engaged in agriculture
CD_t^A	=	Credit disbursement to agriculture sector
M_t^A	=	machinery used in agriculture; proxied by number of tractors
$IFRS_t^A$	=	Infrastructure; proxied by road length

In the present context it is hypothesized that all the right-hand side variables in (7.2) exert a positive influence on agriculture sector value added. The parsimonious results of the production function for agriculture sector are reported in Eq (7.3) below:

Table 7.1: Agriculture Production Long Run Estimates

$$y_t^a = 0.948y_{t-1}^a + 0.144ma_{t-1}^a \tag{7.3}$$

(SE) (0.014) (0.035)

t:	1962 – 2000			
Sigma:	0.096	**RSS:**	0.344	
Log-likelihood:	36.908			
AR 1-2 test:	F (2,35):	0.250 [0.781]		
ARCH 1-1 test:	F (1,37):	0.316 [0.578]		
Normality test:	$Chi^2(2)$:	7.751 [0.021]*		
Hetero test:	F (4,34):	0.651 [0.630]		
Hetero-X test:	F (5,33)	0.819 [0.545]		
RESET23 test:	F (2,35)	0.306 [0.738]		

The results in suggest that agricultural machinery plays a major role in the productivity of the agriculture sector. The machinery used in last year has a positive impact on agricultural value added. Also, similar to the case of Pakistan (in the short run), agriculture sector value added lagged by one year positively influences agriculture value added in the current year. The post-estimation residual analysis suggests no serial correlation and no heteroscedasticity problem.

7.1.1.2. Manufacturing Sector

The value added in the manufacturing sector of Iran is significantly explained by raw material provided by the agriculture sector to industries (Eq (7.4)). In addition, the manufacturing value added lagged by one year, and agriculture value added lagged by one year are found to influence manufacturing value added in the current year significantly as reported in Table 7.2.

Table 7.2: Manufacturing Sector Long Run Estimates

$$y_t^m = 0.958y_{t-1}^m + 0.310drm_t^m - 0.263drm_{t-1}^m \qquad (7.4)$$

(SE) (0.035) (0.147) (0.138)

t:	1961-2015		
Sigma:	0.113	**RSS:**	0.665
Log-likelihood:	43.392		47.293
AR 1-2 test:	F (2,50)	3.004 [0.059]	
ARCH 1-1 test:	F (1,53)	1.551 [0.219]	
Normality test:	$Chi^2(2)$	15.775 [0.000]**	
Hetero test:	F (6,48)	1.527 [0.190]	
Hetero-X test:	F (9,45)	2.226 [0.038]*	
RESET23 test:	F(2,50)	3.122 [0.053]	

The diagnostic tests do not indicate any misspecification problem. Overall, the result of the manufacturing sector is quite satisfactory.

7.1.1.3. Services Sector

The estimation of the services sector value added suggests that the contribution of services to the total production is not significantly determined by real aggregate demand, it merely depends on its first two lags. There is no contribution of real aggregate demand in the services value added in the time-period under study. We start employing ARDL (2) model with assumption of at most two common factors. Following the general to specific modelling technique of (Davidson *et al.*, 1978) we have derived the specific relation presented by Eq (7.5). Diagnostic tests suggest the model does not have any problem of serial correlation, functional form, or heteroscedasticity.

Table 7.3: Services Sector Long Run Estimates

$$y_t^s = 1.520y_{t-1}^s - 0.522y_{t-2}^s + 0.0005rad_t^s \quad (7.5)$$

(SE) (0.118) (0.119) (0.002)

t:	1962-2014			
Sigma:	0.067	**RSS:**	0.226	
Log-likelihood:	69.465			
AR 1-2 test:	F(2,48)	1.854 [0.168]		
ARCH 1-1 test:	F(1,51)	0.283 [0.597]		
Normality test:	Chi^2(2)	8.597 [0.014]*		
Hetero test:	F(6,46)	0.684 [0.663]		
Hetero-X test:	F(9,43)	0.732 [0.677]		
RESET23 test:	F(2,48)	1.334 [0.273]		

Overall no relation was observed between real aggregate demand and services sector value addition during the whole data span i.e. 1960 – 2014. This unusual result needs explanation; the relation between services sector value addition and real aggregate demand was found to be distinct before and after Islamic Revolution of 1979 in Iran. The relation is positive (as expected from theory) before Islamic Revolution and negative (unusual) afterwards.

As shown in Figure 7.1, services sector value addition has a persistent increasing trend before and after the Iranian Revolution, while Real Aggregate Demand has an increasing trend before the Islamic Revolution and negative subsequently. Another reason of changing demand pattern might be the effect of the decade long Iran-Iraq war.

The relation between aggregate demand and services value addition in the sub periods before [Eq (7.6): 1960-1979] and after the Iranian Revolution [Eq (7.7): 1980-2014] has also been estimated.

Figure 7.1: Period-wise Services Sector Value Added

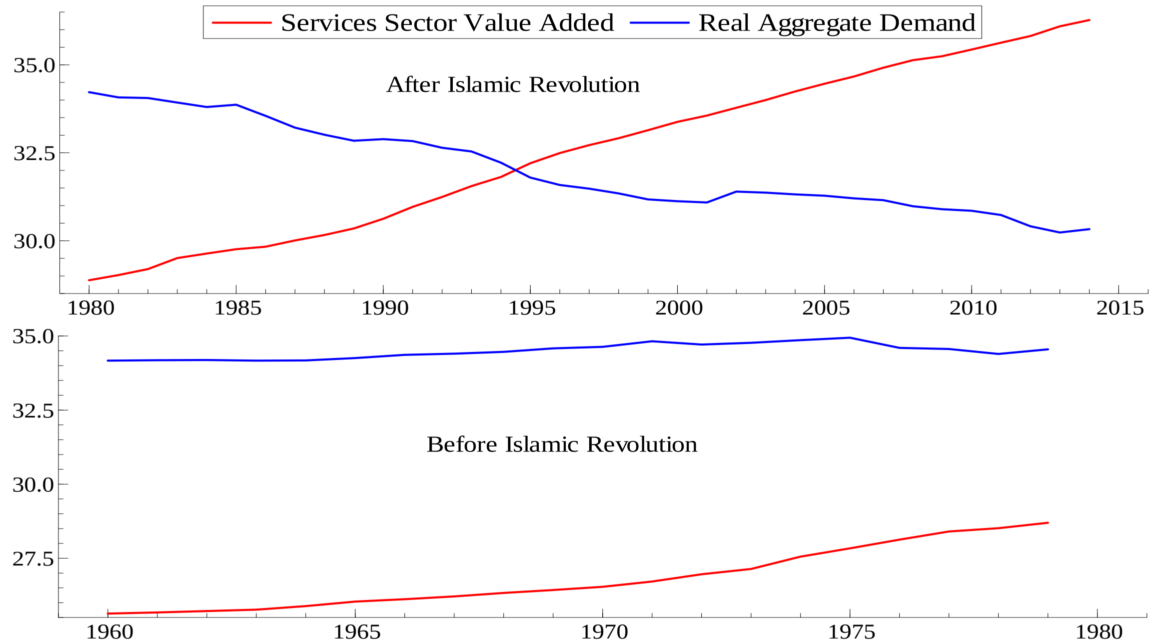


Table 7.4: Services Sector Long Run Estimates

$$y_t^s = 1.030 y_{t-1}^s - 8.980 + 0.241 rad_t^s \quad (7.6)$$

(SE) (0.019) (2.350) (0.075)

t:	1961-1979		
Sigma:	0.067	**RSS:**	0.071
Adj R²	0.996	**F(2,16)**	2,111 [0.000]**
Log-likelihood:	26.177		
AR 1-2 test:	F (2,14)	0.452 [0.645]	
ARCH 1-1 test:	F (1,17)	0.255 [0.620]	
Normality test:	$Chi^2(2)$	3.329 [0.189]	
Hetero test:	F (4,14)	0.940 [0.470]	
Hetero-X test:	F (5,13)	0.788 [0.577]	
RESET23 test:	F (2,14)	3.140 [0.075]	

Table 7.5: Services Sector Long Run Estimates

$$y_t^s = 0.956y_{t-1}^s + 4.540 + 0.091rad_t^s$$ (7.7)				
(SE) (0.019) (1.720) (0.036)				
t:	1981-2014			
Sigma:	0.063	**RSS:**	0.124	
Adj R²	0.999	**F(2,31)**	2.173e+004 [0.000]**	
Log-likelihood:	47.169			
AR 1-2 test:	F (2,29)	2.125 [0.138]		
ARCH 1-1 test:	F (1,32)	1.264 [0.269]		
Normality test:	Chi^2(2)	1.470 [0.480]		
Hetero test:	F (4,29)	1.297 [0.294]		
Hetero-X test:	F (5,28)	1.002 [0.435]		
RESET23 test:	F (2,29)	1.483 [0.244]		

7.1.2. Aggregate Demand Block

Aggregate demand for goods and services is the sum of domestic absorption and the trade balance (Zerfu, 2002; Basdevant and Kaasik, 2003):

$$Y_t = A_t + (X_t - M_t) \tag{7.8}$$

Where:

Y_t = Aggregate demand for goods and services
A_t = Domestic absorption comprised of Consumption (C), Investment (I) and Government Expenditures (G)
X_t = Exports of goods and services
M_t = Imports of goods and services

Based on Eq (7.8), national income is defined as:

$$Y_t = C_t + I_t + G_t + (X_t - M_t) \tag{7.9}$$

This relationship always holds as an identity. Aggregate demand can be decomposed into consumption and investment sub-sectors. The consumption sub-sector is further disaggregated into private consumption and government consumption.

The following subsections characterize theoretical macro-modelling channels, which may differ from the estimation results given earlier. In the case of Iran, data non-availability issues may lead to missing variable bias. In some cases, data span is too short to employ meaningful time series modelling. As a result, the estimations and interpretations given here should be interpreted with some caution.

7.1.2.1. Private Consumption

Table 7.6 reports the results for long-run estimates (Eq (7.10))of private consumption. It can be seen from the results that in the long-run, real disposable income exerts a positive and significant impact on real private consumption, while money supply is found to be insignificant. The marginal propensity to consume (*MPC*) in this case is 0.522, which implies that individuals spend only 52 percent of their income on consumption in the long run. This means that marginal propensity to save out of real disposable income in Iran over the time-period considered is moderate (1-0.52 =0.48).

The *ADF* statistic for testing the non-stationarity of the residuals is -4.004, as reported in Table 7.7, higher than that of critical value at any conventional level of significance which supports the existence of a long-run relationship.

Table 7.6: Private Consumption Long Run Estimates

$$c_t^p = 17.300 + +0.522 y_t^d + 0.014 rm_t \quad (7.10)$$

(SE) (2.620) (0.125) (0.0414)

t:	1991-2009			
Sigma:	0.071	**RSS:**	0.080	
Adj. R^2:	0.931	**F (2,16):**	122.600 [0.000]**	
		Log-likelihood:	25.035	

Table 7.7: ADF Test of Residuals from Long Run Private Consumption Function

ADF Statistics:	-4.004	
Lags:	**1**	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Therefore, the short-run dynamics of this system can be estimated in the form of an ECM represented by Eq (7.11), and the results are reported in Table 7.8 below. In the short-run, change in consumption depends significantly on change in real disposable income. The error-correction term is negative and significant, confirming that the error-correction mechanism is working as expected and the deviations are corrected at the rate of 36 percent per year to achieve the long-run equilibrium path. The diagnostic tests indicate no misspecification of the estimated model.

Table 7.8: Short Run Estimates of Long Run Private Consumption Function

	$\Delta c_t^p = 0.395\Delta y_t^d + 0.362ECT_{t-1}$			(7.11)
(SE) (0.099) (0.177)				
t:	1992 – 2009			
Sigma:	0.047	RSS	0.035	
Log Likelihood	30.626			
AR 1-2 Test:	F (2, 14) = 1.213 [0.327]			
ARCH 1-1 Test:	F (1, 16) = 0.872 [0.364]			
Normality Test:	Chi^2 (2) = 2.371 [0.306]			
Hetero Test:	F (4, 13) = 0.685 [0.615]			
Hetero-X Test:	F (5, 12) = 0.656 [0.663]			
RESET23 Test:	F (2, 14) = 1.236 [0.320]			

7.1.2.2. Government Consumption

In Iran, government consumption solely depends on total government revenues in the time period under study (Eq (7.12)). The results reported in Table 7.9 suggest that in the long-run the government revenues exert a positive influence on government consumption.

Table 7.9: Government Consumption Long Run Estimates

	$c_t^g = 31.600 + 0.037r_t^g$			(7.12)
(SE) (0.385) (0.013)				
t:	1972-2009			
Sigma:	0.187	**RSS:**	1.262	
Adj. R^2:	0.172	**F (1,36):**	8.706 [0.006]**	
		Log-likelihood:	10.774	

The ADF statistic for testing the non-stationarity of the long run residuals of -2.71, as reported in Table 7.10 indicates the presence of a long-run relationship between government consumption, and government revenues during the period under consideration.

Table 7.10: ADF Test of Residuals from Long Run Government Consumption Function

ADF Statistics:	-2.711	
Lags:	**2**	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Hence, an ECM is estimated to derive the short run relation, presented in Eq (7.13). The results given in Table 7.11 indicate that government consumption lagged by one year and government revenues are significant determinants of government consumption in the short-run.

Table 7.11: Short Run Estimates of Long Run Government Consumption Function

$\Delta c_t^g = 0.308\Delta c_{t-1}^g + 0.132\Delta r_t^g - 0.189ECT_{t-1}$			(7.13)
(SE) (0.132) (0.047) (0.091)			
t:	1974 – 2009		
Sigma:	0.083	RSS	0.228
Log Likelihood	40.014		
AR 1-2 Test:	F (2, 31) = 3.089 [0.060]		
ARCH 1-1 Test:	F (1, 34) = 0.406 [0.528]		
Normality Test:	Chi^2 (2) = 8.247 [0.016]*		
Hetero Test:	F (6, 29) = 20.734 [0.000]**		
Hetero-X Test:	F (9, 26) = 12.847 [0.000]**		
RESET23 Test:	F (2, 31) = 9.817 [0.001]**		

7.1.2.3. Private Investment

The long-run estimates of real private investment given by Eq (**7.14**) are reported in Table 7.12. It is evident from the results that real private investment is significantly determined by real income, ratio of private sector credit to GDP, credit to private sector and government investment. The real income is highly significant with a positive impact on real private investment showing that real private investment responds positively to a pick-up in overall economic activity. These results are partially in line with the earlier findings by (Guru-Gharana, 2000) in the case of Pakistan. The positive and significant coefficient of real income verifies the famous accelerator principle. In the case of Iran, government investment does not have a crowding-out effect on real private investment. These findings conform to the majority of empirical studies in this area including, for example Sakr (1993); Looney (1997); Looney and Frederiken (1997); Hyder and Qayyum (2001); Naqvi (2002); Atukeren (2005); Rashid and Ahmad (2005).

Table 7.12: Private Investment Long Run Estimates

$$i_t^p = -11.1100 - 0.175crpy_t + 0.248y_t + 0.750i_t^g + 0.054psc_t \qquad (7.14)$$

(SE) (1.610) (0.055) (0.086) (0.049) (0.009)

t:	1960-2014		
Sigma:	0.082	**RSS:**	0.340
Adj. R^2:	0.988	**F (4,50):**	1,096 [0.000]**
		Log-likelihood:	61.821

The corresponding value of the ADF statistic for the long run residuals stationarity is -5.362 (see Table 7.13), indicating the presence of cointegration among the real private investment and its determinants.

Table 7.13: ADF Test of Residuals from Long Run Private Investment Function

ADF Statistics:	-5.362	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Based on the long-run estimates a short-run ECM, Eq (7.15), has been estimated and Table 7.14 reports the results. The short-run estimates suggest that real income and public investment are the important determinant of private investment with positive and significant coefficients. The lagged error-correction term is significant with theoretical expected sign. Diagnostic tests associated with the short-run ECM model do not detect any specification problem.

Table 7.14: Short Run Estimates of Long Run Private Investment Function

$\Delta i_t^p = 0.499\Delta y_t + 0.548\Delta i_t^g - 0.704ECT_{t-1}$				(7.15)
(SE) (0.127) (0.063) (0.125)				
t:	1961 – 2014			
Sigma:	0.070	RSS	0.251	
Log Likelihood	68.387			
AR 1-2 Test:	F (2, 49) = 0.361 [0.699]			
ARCH 1-1 Test:	F (1, 52) = 0.553 [0.461]			
Normality Test:	Chi^2 (2) = 0.073 [0.964]			
Hetero Test:	F (6, 47) = 0.092 [0.997]			
Hetero-X Test:	F (9, 44) = 0.489 [0.874]			
RESET23 Test:	F (2, 49) = 2.092 [0.134]			

7.1.3. Fiscal Block

The fiscal block modelling exercise for Iran comprises of separate estimates for direct tax revenues, and indirect tax revenues, as described in the sections below.

7.1.3.1. Direct Tax Revenue

Eq (7.16) reports the long-run estimates for direct tax revenues ($dtxr = LNDTXR$). The result in Table 7.15 reveals that nominal income (ny) contributes positively to the collection of direct tax revenues. This result supports the theoretical view that direct taxes are positively correlated with nominal income. The variables average tax rate and inflation turn out to be insignificant; therefore, these variables have been left out from the analysis. The estimated long-run elasticity of direct taxes with respect to nominal income is 1.070 representing that a one percent increase in nominal income translates into more than unity increase in direct taxes. This result is in line with previous findings of Mukarram (2001) and Chaudhary and Hamid (2001).

Table 7.15: Direct Tax Revenues Long Run Estimates

$dtxr_t = -6.050 + 1.070ny_t$ (7.16)			
(SE) (0.645) (0.020)			
t:	1972-2009		
Sigma:	0.298	**RSS:**	3.206
Adj. R^2:	0.987	**F (1,36):**	2,836 [0.000]**
		Log-likelihood:	-6.941

The *ADF* test performed on the residuals generated by Eq (7.16) generates a statistic equal to -4.447 (Table 7.16) which is significant, indicating a long-run relationship between direct tax revenues and nominal income. The stationarity of the residuals implies an ECM model such as that represented by Eq (7.17).

Table 7.16: ADF Test of Residuals from Long Run Direct Tax Revenue Function

ADF Statistics:	-4.447	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Table 7.17 reports the results of this model. The long-run direct tax elasticity with respect to nominal income (NY) is 1.070, whereas the short-run direct tax elasticity is 0.929. These results have very important implications in the context of Iran's fiscal policy which aims to attain fiscal discipline through prudent taxation and expenditure policies.

The ECT is negative and significant implying the existence of cointegration among the variables.

Table 7.17: Short Run Estimates of Long Run Direct Tax Revenue Function

$\Delta dtxr_t = 0.929\Delta ny_t - 0.748ECT_{t-1}$ (7.17)			
(SE) (0.195) (0.167)			
t:	1973 – 2009		
n	37	parameters	2
Sigma:	0.290	RSS	2.942
Log Likelihood	-5.660		
AR 1-2 Test:	$F(2, 33) = 0.771$ [0.471]		
ARCH 1-1 Test:	$F(1, 35) = 1.616$ [0.212]		
Normality Test:	$Chi^2(2) = 15.088$ [0.001]**		
Hetero Test:	$F(4, 32) = 2.137$ [0.099]		
Hetero-X Test:	$F(5, 31) = 1.663$ [0.173]		
RESET23 Test:	$F(2, 33) = 2.647$ [0.086]		

7.1.3.2. Indirect Tax Revenue

As in the case of direct tax revenue, indirect tax revenue is also assumed to depend on nominal income. The long-run results are reported by Eq (7.18), and short run results are reported by Eq (7.19).

It is found that nominal income (ny) exerts a positive impact on indirect tax revenues in the long-run. The long-run elasticity of indirect tax revenue with respect to nominal income is 0.395, which implies that indirect tax system is neither regressive nor progressive.

Table 7.18: Indirect Tax Revenues Long Run Estimates

$$indtxr_t = 13.200 + 0.395ny_t \qquad (7.18)$$

(SE) (1.030) (0.032)

t:	1972 – 2009		
Sigma:	0.477	**RSS:**	8.190
Adj. R^2:	0.801	**F (1, 36):**	150.3 [0.000]**
		Log-likelihood:	24.760

The *ADF* statistic of residuals of long run relation is -2.288 (Table 7.19), implying the existence of an ECM model among the variables.

Table 7.19: ADF Test of Residuals from Long Run Indirect Tax Revenue Function

ADF Statistics:	-2.288	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

According to the results of this model (Table 7.20), in the short-run nominal income (ny) exerts a positive impact on indirect tax revenues. The error-correction term is negative and significant showing the existence of cointegration among the variables.

Table 7.20: Short Run Estimates of Long Run Indirect Tax Revenue Function

$\Delta indtxr_t = 0.342\Delta ny_{t-1} - 0.232ECT_{t-1}$ (7.19)			
(SE) (0.191) (0.102)			
t:	1973 – 2009		
n	37	n	2
Sigma:	0.283	RSS	2.810
Log Likelihood	-4.810		
AR 1-2 Test:	$F(2, 33) = 0.944$ [0.399]		
ARCH 1-1 Test:	$F(1, 35) = 0.528$ [0.472]		
Normality Test:	$Chi^2(2) = 14.731$ [0.001]**		
Hetero Test:	$F(4, 32) = 4.647$ [0.005]**		
Hetero-X Test:	$F(5, 31) = 7.088$ [0.000]**		
RESET23 Test:	$F(2, 33) = 0.699$ [0.504]		

7.1.4. Foreign Trade Block

The modelling exercise for the foreign trade block of Iran comprises of separate models estimated for exports and imports, respectively, as detailed below.

7.1.4.1. Exports

Theoretically speaking, exports of goods and services are determined by world income, the real effective exchange rate and relative price of exports. Based on the functional form specified earlier, the long-run equation for exports given in Eq (7.20) has been estimated.

Table 7.21: Export Function Long Run Estimates

$x_t = -156.000 + 5.490y_t + 0.341REER_t - 0.611rp_t^x$ (7.20)				
(SE) (13.800) (0.386) (0.179) (0.111)				
t:	1980-2015			
Sigma:	0.452	**RSS:**	6.526	
Adj. R²:	0.974	**F (3,32):**	435 [0.000]**	
		Log-likelihood:	-20.343	

It is evident from the results reported in Table 7.21 that both the variables real income and real effective exchange rate possess the expected signs and are statistically significant at conventional levels of significance in the long-run. The statistical insignificance of foreign income suggests that Iranian exports were not much in demand during the period due perhaps to international sanctions. The relative price of exports influences real exports negatively.

The estimated relationship between exports of goods and services, and other variables in the model is found to be cointegrating as the *ADF* statistic for residuals stationarity is equal to -3.419 (Table 7.22), which is significant at the one percent level of significance.

Table 7.22: ADF Test of Residuals from Long Run Export Function

ADF Statistics:	-3.419	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

On account of the long-run relationship, an ECM model as represented by Eq (7.21) has been estimated, and estimation is reported in Table 7.23. In the short-run real domestic income exerts a positive and significant effect on exports. The coefficient on the error-correction term possesses expected negative sign and is statistically significant, which implies that the deviations from the equilibrium path are corrected in the following period. Overall, the diagnostic statistics indicate that the model is well specified.

Table 7.23: Short Run Estimates of Long Run Export Function

$$\Delta x_t = 4.650\Delta y_t - 0.483ECT_{t-1} \quad (7.21)$$

(SE) (0.831) (0.134)

t:	1981 – 2015		
Sigma:	0.309	RSS	3.157
Log Likelihood	-7.565		
AR 1-2 Test:	F (2, 31) = 1.943 [0.160]		
ARCH 1-1 Test:	F (1, 33) = 1.061 [0.311]		
Normality Test:	Chi^2 (2) = 2.966 [0.227]		
Hetero Test:	F (4, 30) = 2.750 [0.046]*		
Hetero-X Test:	F (5, 29) = 2.346 [0.066]		
RESET23 Test:	F (2, 31) = 1.764 [0.188]		

7.1.4.2. Imports

The import of goods and services is estimated as a function of real domestic income, real effective exchange rate, relative price of imports and foreign capital inflows. The long-run and short-run estimates of Eq (7.22) and (7.23) are reported in Table 7.24 and Table 7.26 respectively. It can be seen from the results presented in Table 7.24 that domestic real income exerts a positive impact on imports of goods and services, while the relative price of imports is negative and significant in the long-run.

Table 7.24: Import Function Long Run Estimates

$$im_t = -135.000 + 4.820y_t - 0.559rp_t^{im} \quad (7.22)$$

(SE) (12.600) (0.356) (0.090)

t:	1980-2015		
Sigma:	0.367	**RSS:**	4.446
Adj. R^2:	0.978	**F (2, 33):**	785.7 [0.000]**
		Log-likelihood:	13.435

The *ADF* statistic for the residuals' stationarity is -3.027 (Table 7.25), which is significant at the one percent level, confirming the long-run relationship among the variables.

Table 7.25: ADF Test of Residuals from Long Run Import Function

ADF Statistics:	-3.027	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The results of the short-run model in Table 7.26 suggest that only real domestic income produces positive and significant impact on real imports in the short -run. The error-correction term is negative and significant confirming the existence of cointegration among the variables entered in the model. The overall fit of the model is good as indicated by the diagnostic statistics.

Table 7.26: Short Run Estimates of Long Run Import Function

$\Delta im_t = 0.582\Delta im_{t-1} + 2.500\Delta y_t - 0.437ECT_{t-1}$				(7.23)
(SE) (0.107) (0.534) (0.103)				
t:	1982 – 2015			
Sigma:	0.178	RSS	1.009	
Log Likelihood	12.402			
AR 1-2 Test:	F (2, 30) = 0.676 [0.516]			
ARCH 1-1 Test:	F (1, 33) = 0.654 [0.424]			
Normality Test:	Chi^2 (2) = 4.363 [0.113]			
Hetero Test:	F (6,28) = 6.602 [0.000]**			
Hetero-X Test:	F (9, 25) = 5.046 [0.001]**			
RESET23 Test:	F (2, 30) = 0.203 [0.818]			

7.1.5. Monetary and Price Block

7.1.5.1. Money Demand

Theory suggests that the demand for broad money M/P or in logarithms $(m - p)$ is influenced by real income (Y) as a scale variable. Eq (7.24) reports the estimated long-run results for estimating this relationship for Iran. It is evident from the estimates presented in Table 7.27 that real income (y) possesses the expected sign and is statistically significant in the long-run, while the income elasticity of money demand is 2.060.

Table 7.27: Money Demand Function Long Run Estimates

$(m - p)_t = -41.600 + 2.060y_t$				(7.24)
(SE) (3.470) (0.100)				
t:	1960-2015			
Sigma:	0.409	**RSS:**	9.044	
Adj. R^2:	0.884	**F (1, 54):**	419.100 [0.000]**	
		Log-likelihood:	28.410	

The ADF test for non-stationarity of the residuals is -2.358 in Table 7.28, which is significant at the 5 percent level of significance, indicating significant long-run co-movements among the variables.

The results of the ECM model presented in Equation (7.25) suggest that the growth of real income exerts a significant effect on real money balances in the short-run. The error-correction term has the theoretically expected sign and is statistically significant. The correct sign and the significance of the error-correction term is an indication of the existence of a valid long-run relationship. The overall fit of the model is good as indicated by the various diagnostic tests.

Table 7.28: ADF Test of Residuals from Long Run Money Demand Function

ADF Statistics:	-2.358	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Table 7.29: Short Run Estimates of Money Demand Function

$\Delta(m-p)_t = 1.150\Delta y_t + 0.005\Delta i_t - 0.322ECT_{t-1}$				(7.25)
(SE) (0.246) (0.001) (0.139)				
t:	1975 – 2015			
Sigma:	0.085	RSS	0.276	
Log Likelihood	44.346			
AR 1-2 Test:	F (2, 36) = 1.044 [0.363]			
ARCH 1-1 Test:	F (1, 39) = 1.101 [0.301]			
Normality Test:	Chi^2 (2) = 2.817 [0.245]			
Hetero Test:	F (6, 34) = 2.819 [0.025]*			
Hetero-X Test:	F (9, 31) = 2.480 [0.029]*			
RESET23 Test:	F (2, 36) = 1.204 [0.312]			

7.1.5.2. Prices

The domestic price level, proxied by consumer price index (CPI), is determined by real income and nominal money balances. Eq (7.26) and Eq (7.27) report the long-run and short-run estimates respectively.

The results reported in Table 7.30 show that money supply and real income are the main factors accelerating inflationary pressure in Iran in the long-run. The impact of money supply is on the order of 0.837 on domestic price level. On the other hand, the coefficient of real output of -1.100 implies that an increase in real GDP would significantly depress inflationary pressures in the economy in the long-run. In overall terms, the result supports the view that monetarist and structuralist factors are responsible in determining inflationary pressure in the long-run.

Table 7.30: Price Equation Long Run Estimates

$$p_t = 13.500 + 0.837m_t - 1.100y_t \tag{7.26}$$

(SE) (5.000) (0.025) (0.164)

t:	1960-2015		
Sigma:	0.307	**RSS:**	4.979
Adj. R²:	0.985	**F (1,42):**	1,856.000 [0.000]**
		Log-likelihood:	11.700

To examine the cointegration among the variables an ADF test is employed on the residuals obtained from Equation (7.26). The ADF statistic (Table 7.31) is equal to -2.100, which is statistically significant, indicating the existence of cointegration among the variables. Therefore, an ECM model is estimated to examine the short-run dynamics.

Table 7.31: ADF Test of Residuals from Long Run Price Equation Function

ADF Statistics:	-2.100	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The results of the ECM model as reported in Eq (7.27) suggest that expected inflation (i.e. Δp_{t-1}) significantly influences the inflation rate in Iran in the short-run just as it does in case of Turkey and Pakistan. These findings are also consistent with earlier findings of Khan and Qasim (1996). The error-correction term in Table 7.32 is negative and significant, indicating that the past period's deviations are corrected in the current period at the rate of

7 percent per year. However, this speed of convergence is very low. Overall the model fits well as indicated by the results of the diagnostic tests.

Table 7.32: Short Run Estimates of Long Run Price Equation Function

$\Delta p_t = 0.558\Delta p_{t-1} + 0.287\Delta m_{t-1} - 0.073ECT_{t-1}$ (7.27)			
(SE) (0.097) (0.069) (0.028)			
t:	1962 – 2015		
n:	54	Parameters:	3
Sigma:	0.058	RSS	0.172
Log Likelihood	78.602		
AR 1-2 Test:	F (2, 49) = 2.927 [0.063]		
ARCH 1-1 Test:	F (1, 52) = 3.476 [0.068]		
Normality Test:	Chi^2 (2) = 2.811 [0.245]		
Hetero Test:	F (6, 28) = 2.400 [0.042]*		
Hetero-X Test:	F (9, 44) = 2.571 [0.018]*		
RESET23 Test:	F (2, 49) = 0.174 [0.841]		

7.2. Simulations and Forecasts

7.2.1. In-Sample Forecasts

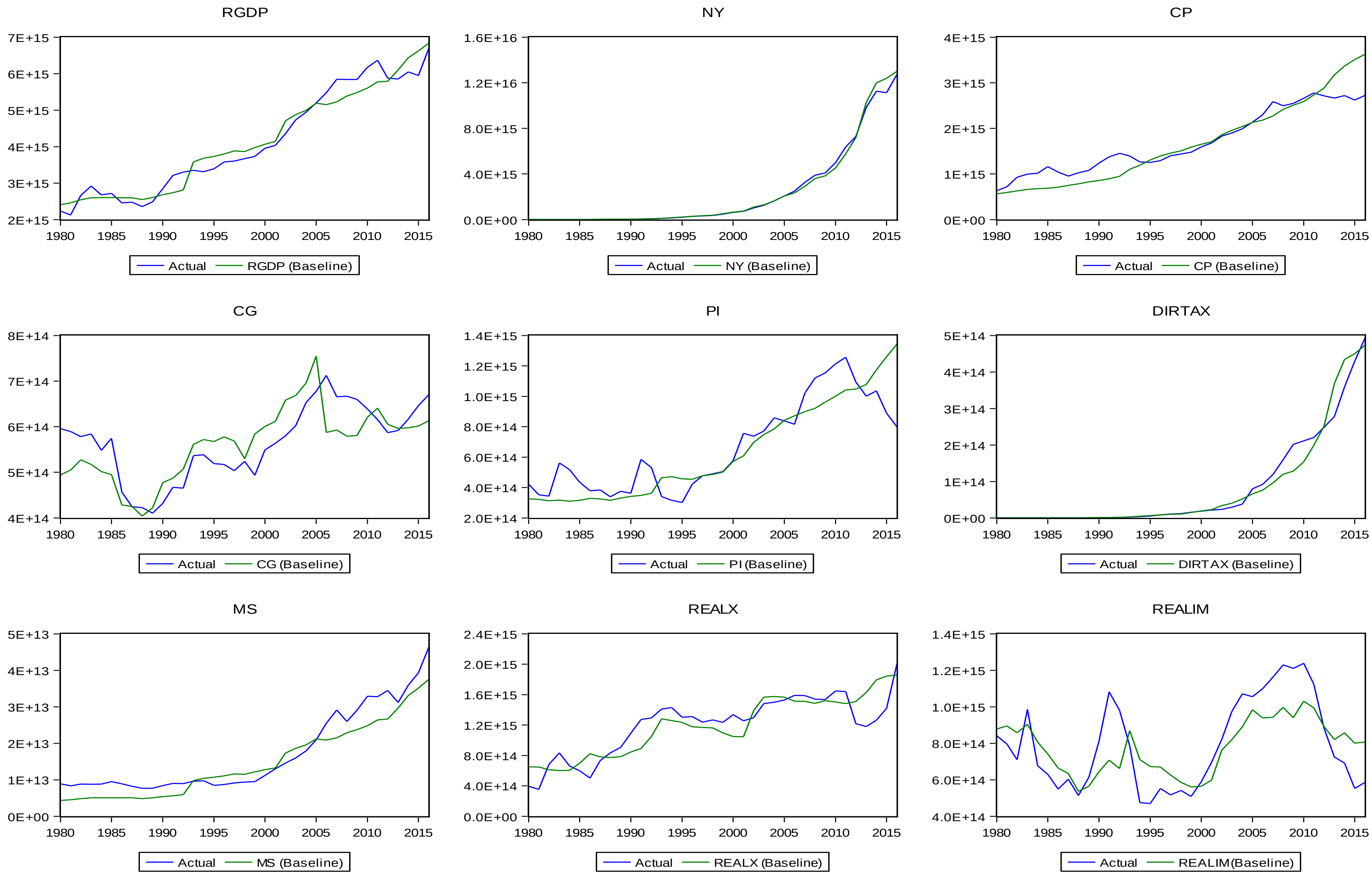
The model estimated for Iran is evaluated for in-sample predictive performance. Table 5.5 summarizes the forecast evaluation for key endogenous variables. The Mean Absolute Percentage Error (MAPE) is reasonable and lies within the range of 0.35 to 1.01 percent for all the endogenous variables, with an exception of indirect taxes and consumer price equation. For equation estimating indirect taxes it is (4.52 percent); while for price equation it is very high (47.4 percent). Similarly, the Theil's inequality coefficient (U) is less than unity and close to zero for all the endogenous variables (except for indirect taxes and price equation). In other words, the overall forecasting ability of estimated equations is satisfactory, with an exception of above-mentioned variables. We therefore, omitted these two equations from the model for simulations and forecasts.

Table 7.33: Model Validation Statistics - Iran

	MAPE	Theil's Inequality (U)
Agriculture Value Added	0.53	0.003
Manufacturing Value Added	0.69	0.005
Services Value Added	0.52	0.003
Real Private Consumption	0.41	0.003
Real Government Consumption	0.32	0.002
Real Private investment	0.51	0.003
Money Demand	1.07	0.007
Consumer Prices	47.4	0.05
Direct tax Revenues	0.72	0.005
Indirect tax revenues	4.52	0.03
Export Demand	0.46	0.003
Import Demand	0.35	0.002

Next, we solve the model for the period 1990 to 2016 to assess the in-sample forecasting ability of the model and compare the actual values for all the endogenous variables (estimated) with the in-sample simulated values. Figure 7.2 illustrates the paths of the ex post simulation along with the actual values of the endogenous variables. The simulated values of each variable track the actual trajectories quite reasonably for almost all the estimated variables.

Figure 7.2: In-sample forecasts (1990 2016) - Iran



7.2.2. Out-of-Sample Forecasts

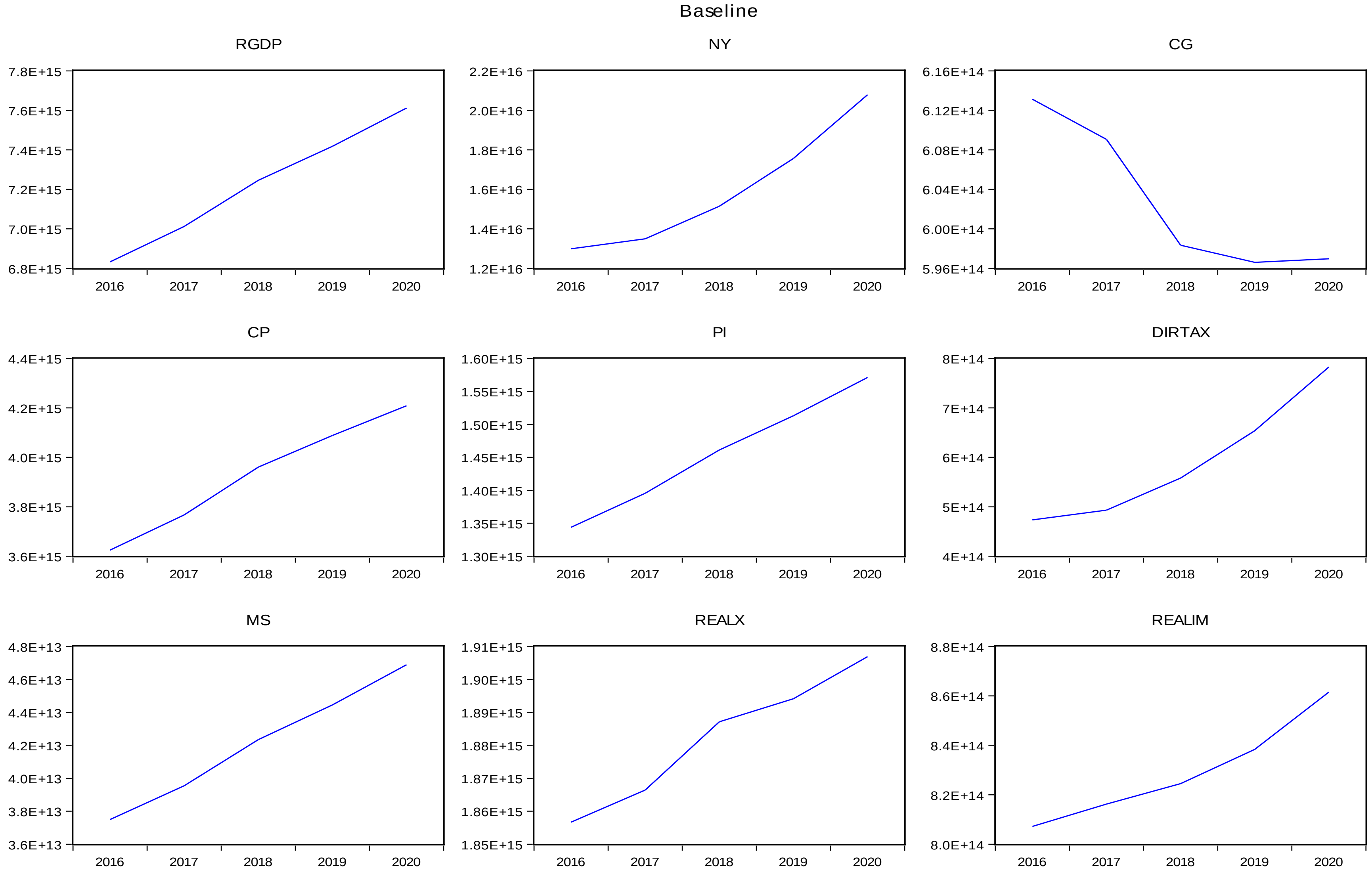
Iran's economic growth (in real terms at the constant prices of 2011) will slide to about 3 percent in 2017 from 8 percent in 2016 but is expected to expand to about 4 percent next year (2018). However, it will slow down again in 2019 and 2020. It is expected that besides the effect of a slowdown in its oil sector following an exceptionally high activity in 2016; growth would be affected by weak foreign investor confidence associated with geopolitical tensions (including new sanctions and hardened nuclear-deal stance by the United States).

On the supply side in real terms (at the constant prices of 2011), it is only the services sector which is expected to show a moderate progress of 4 percent, but not the other two sectors. Although, government has introduced stimulus package for the production sector[78], t it will likely not be much effective as the sector is expected to grow by only about 2 percent by 2020. On the demand side, strengthening private consumption and investment are anticipated to support growth. Slowdown in private consumption and investment after 2018 will have an effect on overall economic growth and real GDP growth will also slowdown accordingly.

As Iranian banks face the challenge of delays in establishing correspondent banking relationship with large international banks (due to sanctions), foreign direct investment inflows to Iran and trade relationships with the rest of the world are restrained. As a result, exports and imports at constant prices of 2011 will grow by only 0.7 percent and 1.7

[78] The government injected 300-trillion-rial (USD 8 billion) stimulus package into the ailing manufacturing units in early June 2017.

Figure 7.3: Out of sample forecasts (2017-2020) - Iran



percent respectively by 2020. Consequently, decline in trade balance by about 1 percentage point in terms of GDP is expected by 2020.

Table 7.34: Out-of-Sample Growth Forecasts - Iran

(%)

	2016	2017	2018	2019	2020
GDP	8.1	2.7	3.9	2.3	2.6
Value Added in Agriculture	0.45	0.44	0.44	0.44	0.43
Value Added in Manufacturing	1.8	1.8	1.8	1.8	1.8
Value Added in Services	4.7	3.5	4.9	3.0	3.4
Inflation	8.6	13.1	17.3	10.2	8.2
Exports	0.79	0.53	1.11	0.37	0.68
Imports	0.87	1.12	1.02	1.68	2.76
Direct taxes	5.2	4.2	13.1	17.2	19.7
Indirect Taxes	4.0	3.2	9.9	12.9	14.8
Real Private Consumption	3.3	4.0	5.1	3.2	2.9
Real Government Consumption	1.9	-0.7	-1.8	-0.3	0.06
Real Private Investment	6.7	3.8	4.7	3.6	3.8
Real Trade Balance in terms of GDP	20.5	20.0	19.5	19.0	18.5
Fiscal Deficit in terms of GDP	-2.2	-1.5	-1.3	-1.0	-0.8

Iran has adopted a comprehensive strategy involving market-based reforms as reflected in the government's 20-year vision document and the sixth five-year development plan for the 2016-2021 period. However, as per the forecasts, it seems that this reform agenda is not likely to bring the growth dividend in the medium term.

The fiscal deficit is estimated at 2.2 percent of GDP in 2016, up from a deficit of 1.1 percent of GDP in 2014. Government revenue is estimated to have risen in line with the continued rise in tax revenues and the disposal of non-financial assets[79], while oil revenues

[79] Iran despite of its dependence on oil revenue (which reduced in 2015 because of lowering in global fuel prices) has made some progress in terms of broadening tax base, increasing the VAT rate, stepping up tax administration efforts, and enacting tax legislation that simplifies direct taxation and removes exemptions to

remained stagnant with the rise in export volume being offset by the oil price decline. This trend is expected to continue, as tax revenues are expected to increase by about 13 percent by 2020. With some support from oil sector (despite the marginal growth in exports) as international oil prices are expected to rise by 2020, total government revenues are projected to increase by about 15 percent.

On the expenditure side, government expenditure goes up roughly around 20 percent from 2014 to 2016, led by the rise in current expenditures. Income transfers through the Cash Subsidy Program[80] declined due to the exclusion of high-income households and the elimination of the earlier indexation of cash transfers to inflation. From 2016 to 2020, government expenditures are projected to rise by about 13 percent. Fiscal deficit is projected to decline by more than one percentage point by 2020 (i.e., from -2.2 percent of GDP in 2016 to -0.8 percent of GDP in 2020).

Inflationary pressures have continued to fall under a less accommodative monetary policy stance (contractionary monetary policy), with the consumer price inflation falling to 13.7 percent in 2015, from a peak of 39.3 percent in 2013[81]. In 2016, inflation rate fell even further to 8.6 percent. This fall can further be explained by the relative stability in the foreign exchange market. However, currency depreciation, on concerns over a return of

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some large non-taxpayers. This has compensated to some extent for the fall in oil revenue. For details see World Bank country page for Iran at http://www.worldbank.org/en/country/iran/overview.

[80] The Iranian government has implemented a major reform of its subsidy program on key staples such as petroleum products, water, electricity and bread, which has resulted in a moderate improvement in the efficiency of expenditures and economic activities.

[81] Factors responsible for inflationary pressures in Iran's economy include economic sanctions in recent years that have resulted in disrupted supply chains and higher operating costs; withdrawal of subsidies on food staples, electricity, water, and gas, all pushed up prices.

crippling sanctions, is expected to push prices up. Inflation rate is expected to rise in 2017 and even more in 2018. However, with tight monetary policy, inflationary pressures will subside by 2020.

The outlook for the Iran's economy in the medium term depends to a great extent on future oil prices; the prospects for continued trade and financial sanctions; and country's determination to pursue structural reforms needed to improve the business environment_ particularly financial sector reforms, improvement in corporate governance and modernization of infrastructure.

7.3. Conclusion

The estimated macro-econometric model for Iran's economy has highlighted key macroeconomic relationships in the long run as well as their short run dynamics. The model projections show that the economy will grow at a sluggish rate not lease because of continued sanctions that may stifle international trade and investment. Macroeconomic stability in Iran is expected to prevail on the back of low fiscal deficit and prudent monetary management to contain inflationary pressures. The economy continues to rely largely on the oil sector and there is a need to achieve greater diversification for broad-based growth. The current economic reforms program can be instrumental in encouraging private investment through improvement in business climate and provision of better physical infrastructure.

Chapter 8 - Kazakhstan: Modelling Exercise and Forecasts

8.1. Modelling

The modelling exercise for Kazakhstan has focused on key macroeconomic variables for which time series data of adequate duration was available. The model specifications have also been dictated by data availability and consequently there may be some missing variable bias.

8.1.1. Production Block

Since the span of the available data is very small, the effect of regressor on regressand cannot be observed accurately and there is a possibility of observing unusual relation between dependent and independent variables; the results should be interpreted with caution. Furthermore, unavailability of a relevant regressor may cause omitted variable bias that may manifest in residual analysis. Data unavailability is a serious issue in case of Kazakhstan economy; only one model has been estimated in the production block, for services sector value added.

8.1.1.1. Services Sector

The estimation of the services sector value added suggests that services contribution to the total production is significantly determined by aggregate demand in the long-run (see Eq (8.1)). The contribution of aggregate demand in services value added is 2.310 in the long – run. The *ADF* statistic of residuals of long run relation is estimated to be

-4.182, which is significant and indicative of a long-run relationship between services value added and aggregate demand in Kazakhstan economy.

The short-run ECM model corresponding to the long-run services value added relationship is given by Eq (8.2). The results suggest that in short run change in services sector value added depends on change in aggregate demand positively. The short-run model should be interpreted carefully as some problems are observed in the residual analysis. A negative and significant ECT confirms the existence of a long run relation.

Table 8.1: Services Sector Long Run Estimates

$$y_t^s = -34.500 + 2.310 ad_t^s \tag{8.1}$$

(SE) (4.210) (0.166)				
t:	1994 – 2014			
Sigma:	0.322	**RSS:**	1.967	
Adj. R2:	0.906	**Log-likelihood:**	-4.934	

Table 8.2: ADF Test of Residuals from Long Run Services Sector Function

ADF Statistics:	-4.182	
Lags:	**0**	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Table 8.3: Services Sector Short Run Estimates

$\Delta y_t^s = 0.455 y_{t-1}^s + 1.460 \Delta ad_t - 0.517 ECT_{t-1}$				(8.2)
(SE) (0.114) (0.358) (0.149)				
t:	1995 – 2014			
Sigma:	0.114	**RSS:**	0.208	
Log-likelihood:	15.943			
AR 1-2 test:	F (2,14)	1.241 [0.319]		
ARCH 1-1 test:	F (1,17)	2.876 [0.108]		
Normality test:	Chi^2 (2)	0.482 [0.786]		
Hetero test:	F (6,12)	3.954 [0.021]*		
Hetero-X test:	F (9,9)	8.754 [0.002]**		
RESET23 test:	F (2,14)	0.459 [0.641]		

8.1.1.2. Agriculture Sector

In Kazakhstan, a decline in the labor force engaged in agriculture sector is observed (Figure 8.1); a reason for this decline might be rapid urbanization and use of less labor intensive and more innovative agricultural tools and techniques.

In the past decade, a negative relationship is also evident (Figure 8.2) in agricultural value added and labor force engaged in the agriculture sector. A higher value addition with lesser labor involved suggests that the sector is relying more on innovative agricultural tools and techniques.

Figure 8.1: Percentage Labor Force Employed in Agriculture Sector

Figure 8.2: Agriculture Sector Value Added and Percentage Labor Employed

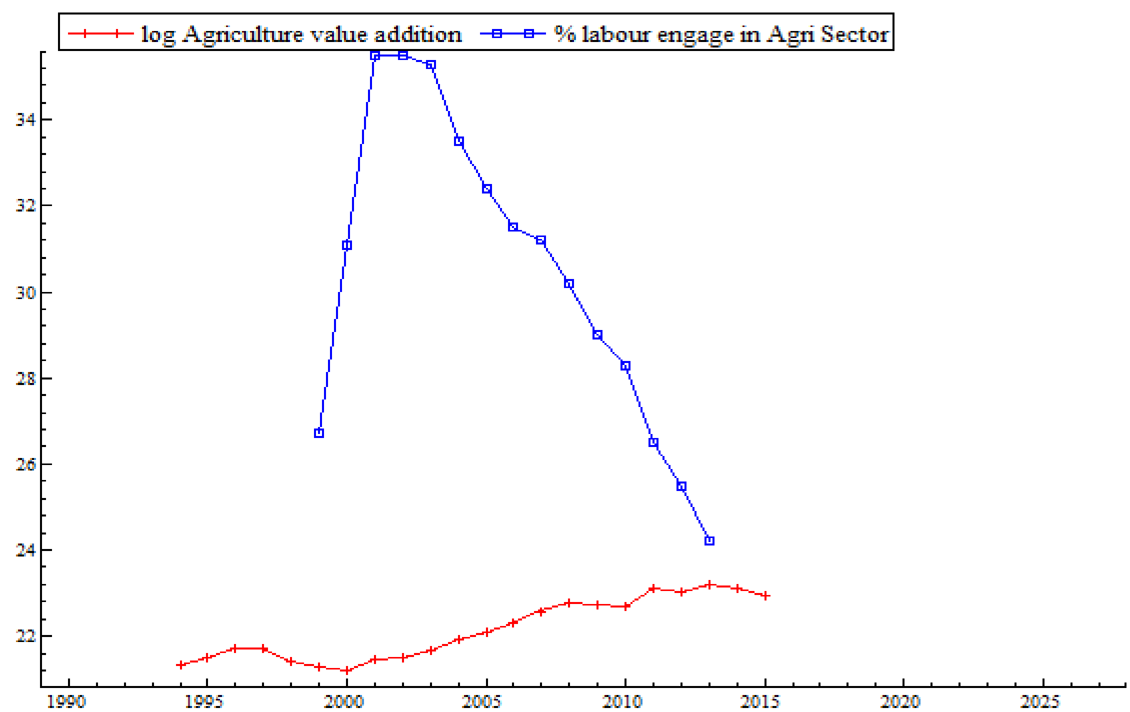
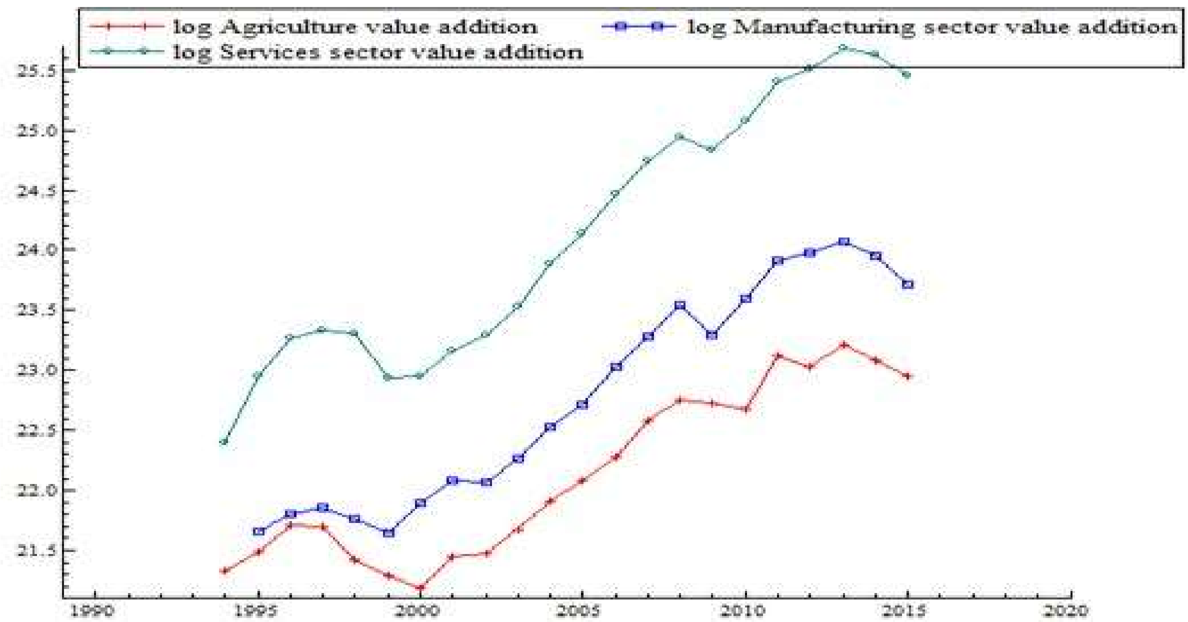


Figure 8.3 below shows the continuous increasing pattern in all three sectors value added. Services sector value addition remained the highest throughout the data span while agriculture sector value addition remained the lowest.

Figure 8.3: Value Addition Across Sectors in Kazakhstan



8.1.2. Aggregate Demand Block

Due to unavailability of relevant macro variables, we present here the macro-econometric model only for private investment in Kazakhstan.

8.1.2.1. Government Consumption

In the case of Kazakhstan, real government consumption is available in Aggregate Demand Block, while data for its potential determinants is not available. Therefore, a brief discussion on the trend of this macro variable in the Kazakhstan economy is presented. We employ contemporary simulation techniques and estimate projected trends for both available macro variables. Also, in-sample forecast is depicted to show the suitability of simulation technique employed.

To get an idea about the structure of real GDP per capita, the ACF and PACF of these variables are analyzed. From the ACF and PACF plots we can get some idea of Autoregressive and Moving average structure of the series that helps in employing appropriate simulation model.

Figure 8.4 below presents ACF and PACF for log real Government Consumption. The figure clearly indicates ARMA process which fades out after few lags. With this short data span, we employ an ARFIMA (1, 0,0) process to get projected trend for real Government Consumption (log-likelihood = 18.849, T = 1990 – 2014).

Figure 8.4: ACF and PACF Plots of Log Real Government Consumption

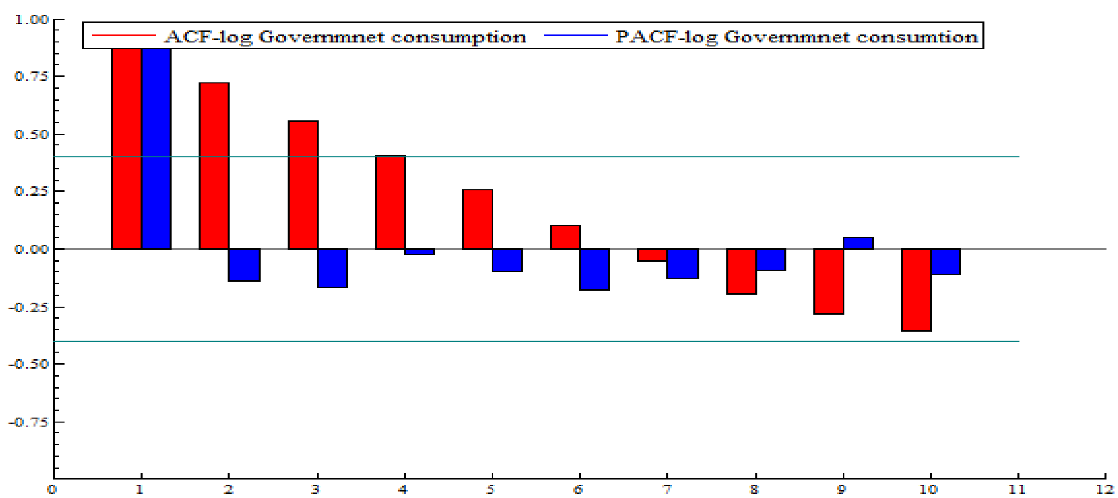


Figure 8.5 presents projected trend for real Government Consumption from 2015 to 2019. A clear decreasing trend can be seen throughout the projected span.

Figure 8.5: Projected Trends for Real Government Consumption: 2015 - 2019

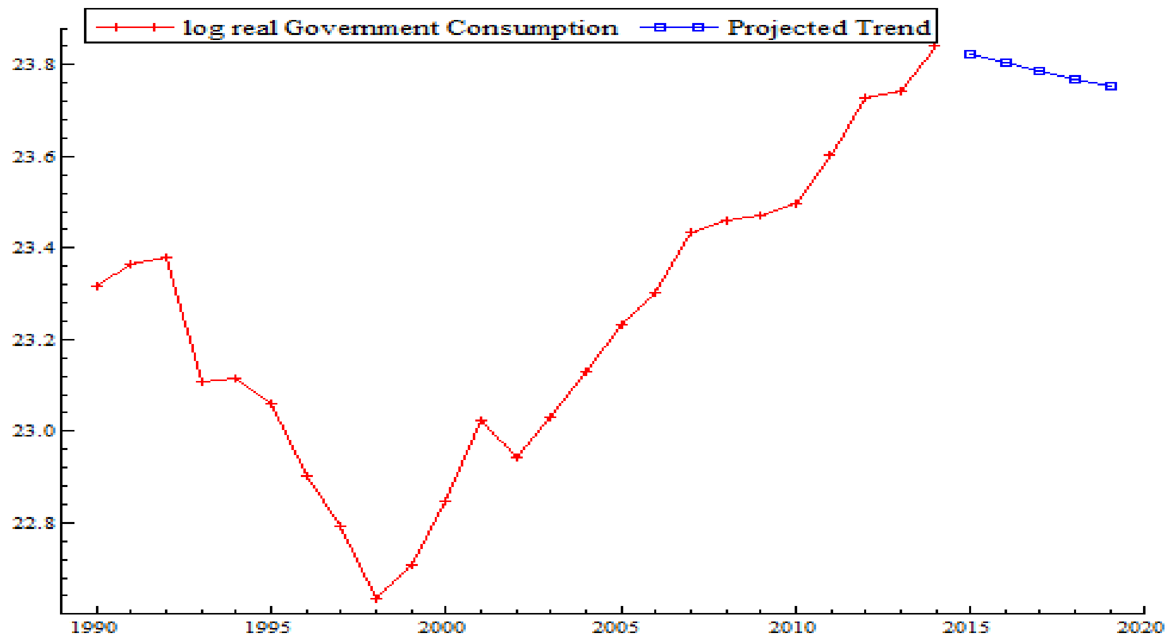
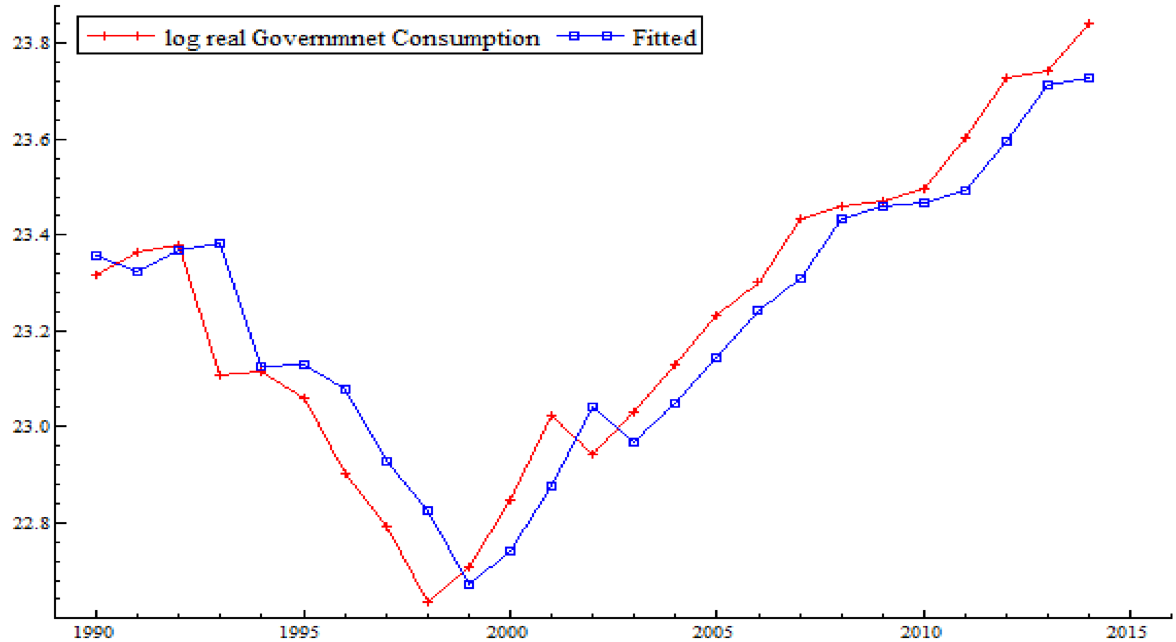


Figure 8.6 presents in-sample forecasts for both actual and predicted series of real government consumption. The graph indicates how closely the model predicts the actual series.

Figure 8.6: In-Sample Forecast and Actual Government Consumption: 1990 – 2014



8.1.2.2. Private Investment

The long-run estimates of the real private investment are given by Eq **(8.3).** Credit to private sector is an important determinant of private investment and influences the investment positively (Jongwanich and Kohpaiboon, 2008). Furthermore, government investment, which concentrates mostly on infrastructure, exerts positive 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).

Table 8.4: Private Investment Long Run Estimates

$$i_t^p = -1.320 + 1.010 i_t^g + -0.011 crpy_t \quad (8.3)$$

(SE) (2.02) (0.084) (0.002)

t:	1993 – 2014		
Sigma:	0.113	**RSS:**	0.242
Adj. R²:	0.964	**F (2,19):**	282 [0.000]**
		Log-likelihood:	18.404

Table 8.5: ADF Test of Residuals from Long Run Private Investment Function

ADF Statistics:	-4.162	
Lags:	**1**	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The short-run estimates suggest that private investment and the private sector credit exert positive and significant influence, while the negative and significant ECM term validates the long run mechanism. Diagnostic tests associated with the short-run ECM model do not detect any serious specification problem.

Table 8.6: Short Run Estimates of Long Run Private Investment Function

$$\Delta i_t^p = 0.763\Delta i_t^g + 0.005\Delta crpy_t - 0.766ECT_{t-1} \qquad (8.4)$$

(SE) (0.199) (0.003) (0.156)

t:	1994 – 2014		
Sigma:	0.074	RSS	0.100
Log Likelihood	26.369		
AR 1-2 Test:	F (2, 16) = 4.423 [0.030]*		
ARCH 1-1 Test:	F (1, 19) = 2.822 [0.109]		
Normality Test:	Chi^2 (2) = 3.259 [0.196]		
Hetero Test:	F (6, 14) = 0.726 [0.636]		
Hetero-X Test:	F (9, 11) = 0.541 [0.817]		
RESET23 Test:	F (2, 16) = 0.124 [0.885]		

8.1.3. Fiscal Block

In the case of Kazakhstan, data unavailability restricts us from estimating an econometric model of the entire fiscal block and we can only present estimation for government expenditure.

8.1.3.1. Government Expenditure

On account of the limited number of observations (1994 – 2014), in the Fiscal Block, estimations should be considered cautiously. Equation (8.5) reports the final ARDL estimates for government expenditure ($ex_t^g = LEX_t^g =$ log of Government Expenditure). The ARDL modelling is appropriate for a mix of distinct order of integrated variables as in the current case. The results reveal that nominal income (ny) and inflation (inf) contribute positively to government expenditure. Though significant, the effect of inflation remains nominal just as in the case of Azerbaijan. This result supports the theoretical view that government expenditure is positively correlated with nominal income and inflation. The long run elasticity for nominal GDP and inflation are found by solving the ARDL equation. The estimated long-run income elasticity of government expenditure income is 0.418 representing a one percent increase in nominal income translates to approximately 42 percent increase in government expenditure; this is about half of the elasticity observed in the case of Azerbaijan.

Table 8.7: Government Expenditure ARDL Estimates

$$ex_t^g = 10.9 + 0.264ex_{t-1}^g + 0.307ny_t + 0.0002Inf_t \quad (8.5)$$

(SE) (1.760) $(0.107)(0.040)(5.64e-005)$

t:	1994 – 2014		
Sigma:	0.050	**RSS:**	0.043
Adj. R^2:	0.984	**F (3, 17):**	408.100 [0.000]**
D-W Statistic:	1.789	**Log-likelihood:**	35.300
AR 1-2 test:	F (2,15) = 0.247 [0.784]		
ARCH 1-1 test:	F (1,19) = 0.903 [0.354]		
Normality test:	Chi^2 (2) = 0.553 [0.758]		
Hetero test:	F (6,14) = 0.198 [0.972]		
Hetero-X test:	F (9,11) = 0.571 [0.795]		
RESET23 test:	F (2,15) = 1.057 [0.372]		

8.1.4. Foreign Trade Block

The foreign trade block consists of two equations explaining the determination of volume of exports of goods and services and volume of imports of goods and services. Below we present brief discussion on the trend of Exports and Imports of Kazakhstan economy. We employ contemporary simulation techniques and estimate projected trends for Exports and Imports.

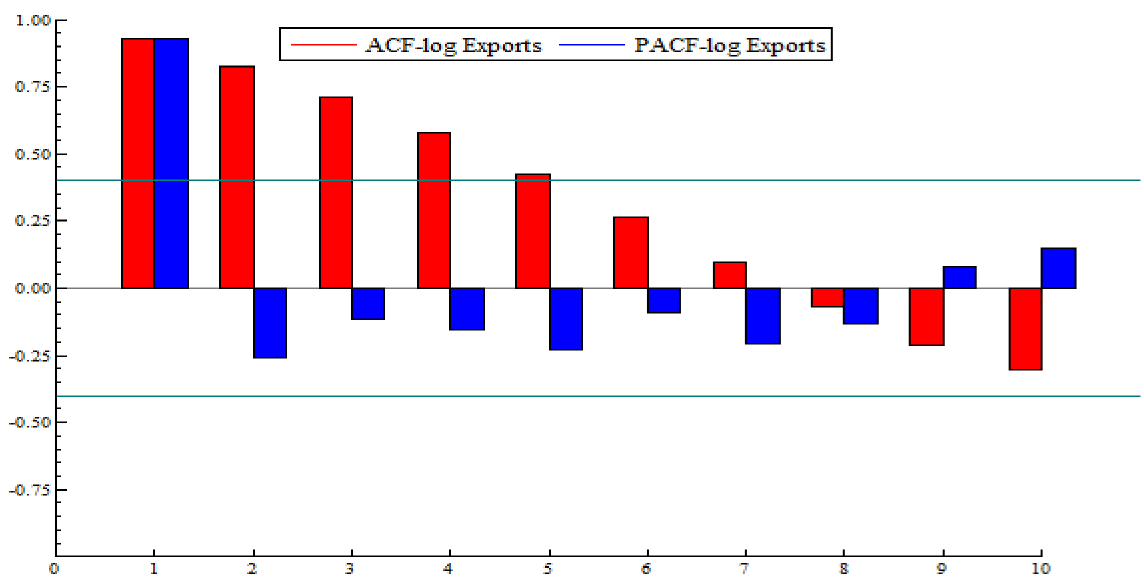
To get an idea about the structure of macro variable we analyze ACF and PACF of the variables. The ACF and PACF plots reveal the Autoregressive and Moving average structure of the series that helps in employing appropriate simulation technique.

8.1.4.1. Exports

Theoretically exports of goods and services are determined by world income, the real effective exchange rate and relative price of exports. Based on the functional form specified in Section (4.3.4.1), we lack sufficient observations for relevant macro variables to estimate macro-econometric model for exports of the Kazakhstan economy. However, we provide a discussion on prevailing trends and also present projected trends of exports.

Figure 8.7 below presents ACF and PACF for log exports. The figure clearly indicates an ARMA process which fades out after few lags.

Figure 8.7: ACF and PACF Plots for Log of Exports



With this short data span, an ARFIMA (1,0,0) process is employed to derive projected trend for real exports (log-likelihood: 23.697, T = 1990 – 2014). Figure 8.8 presents projected trend for log real exports from 2015 to 2019. After a sharp decline in

1998 a continuous increasing trend can be seen until 2014. A decrease in exports is projected through 2015-2019.

Figure 8.8: Projected and Actual Trends of Log of Exports - 2015 to 2019

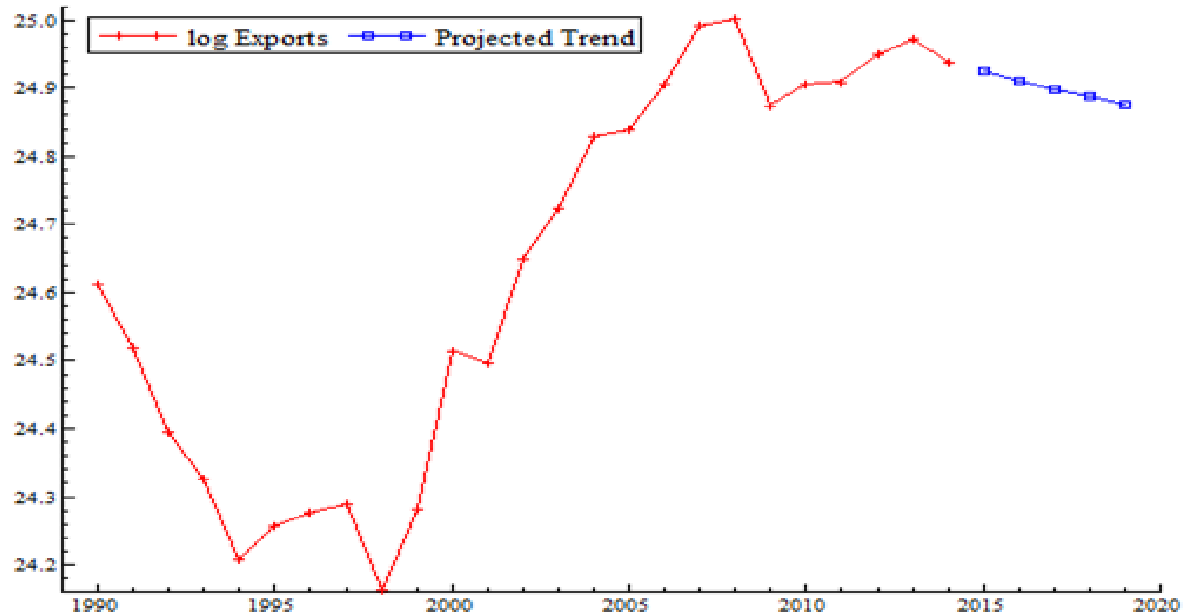
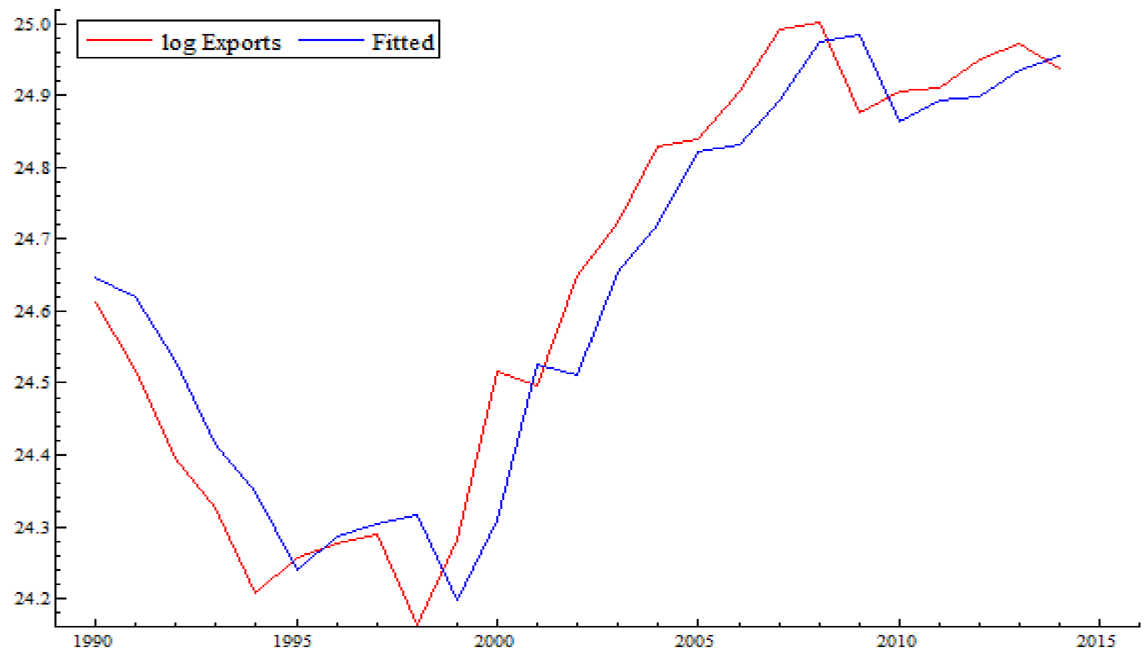


Figure 8.9 presents in-sample forecasts for both actual and predicted series for exports of Kazakhstan. The graph indicates how closely the model predicts the actual series. After a sharp decline in 1996 a continuous increasing trend of exports can be seen in sample 1990 – 2014.

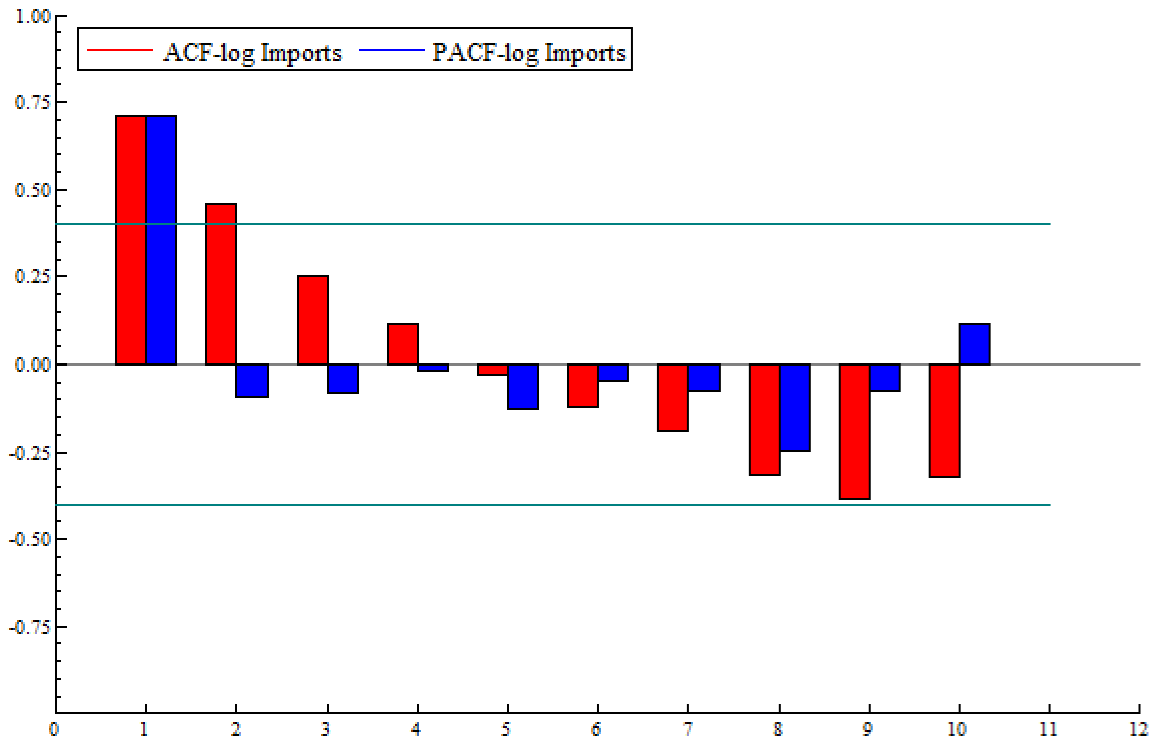
Figure 8.9: In Sample Forecast and Actual Log of Real Exports: 1990 - 2014



8.1.4.2. Imports

The import of goods and services is estimated as a function of real domestic income, real effective exchange rate, relative price of imports and foreign capital inflows. Due to the lack of data for relevant macro variables we are unable to estimate a macro-econometric model for imports. However, we examine the prevailing trends and also present projected trends of imports. Figure 8.10 below presents ACF and PACF for log imports. The figure clearly indicates an ARMA process which fades out quickly.

Figure 8.10: ACF and PACF for Log of Imports



An ARFIMA (1,0,0) process is employed to derive the projected trend for real imports (log-likelihood: 8.547, T = 1990 – 2014). Figure 8.11 presents projected trend for log real imports from 2015 to 2019. As evident from the graph, imports were highest since the independence of Kazakhstan, and imports bottomed out in 1999. An increase in imports is projected through 2015 – 2019.

Figure 8.11: Real and Projected Trends for Log of Exports - 2015 to 2019

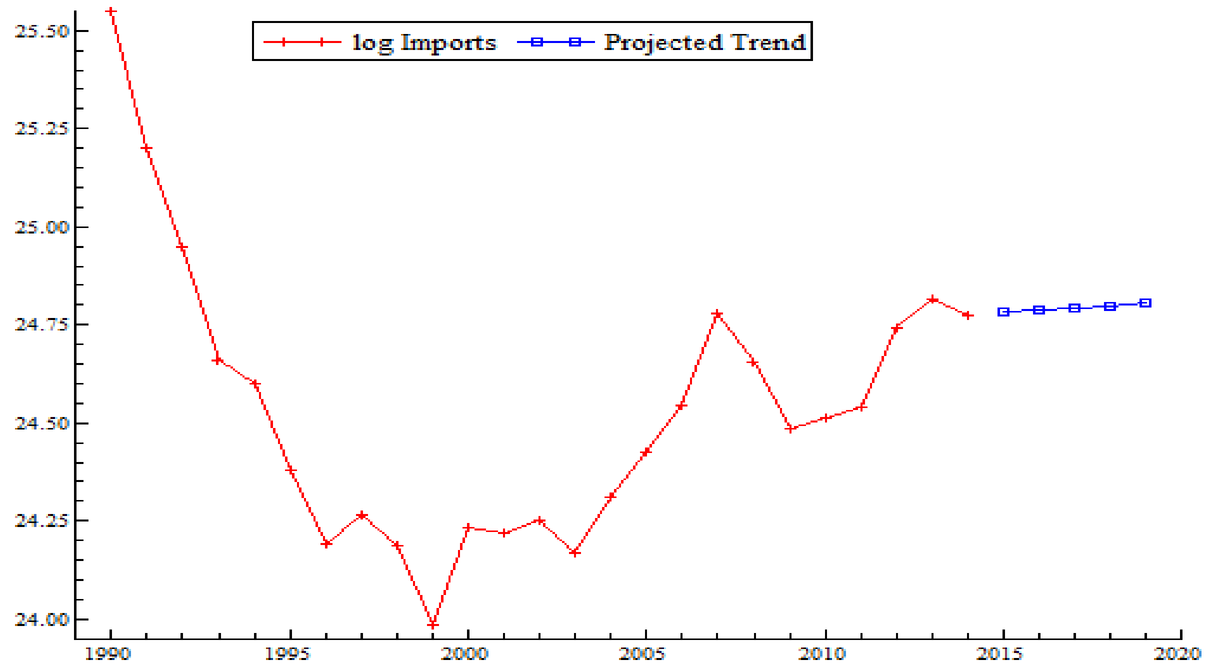
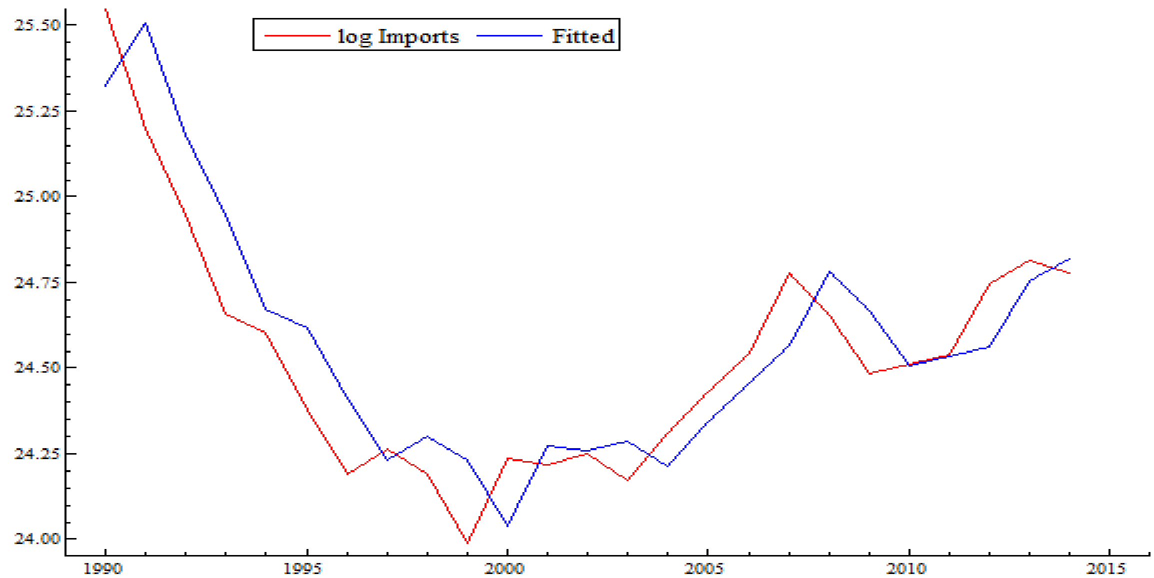


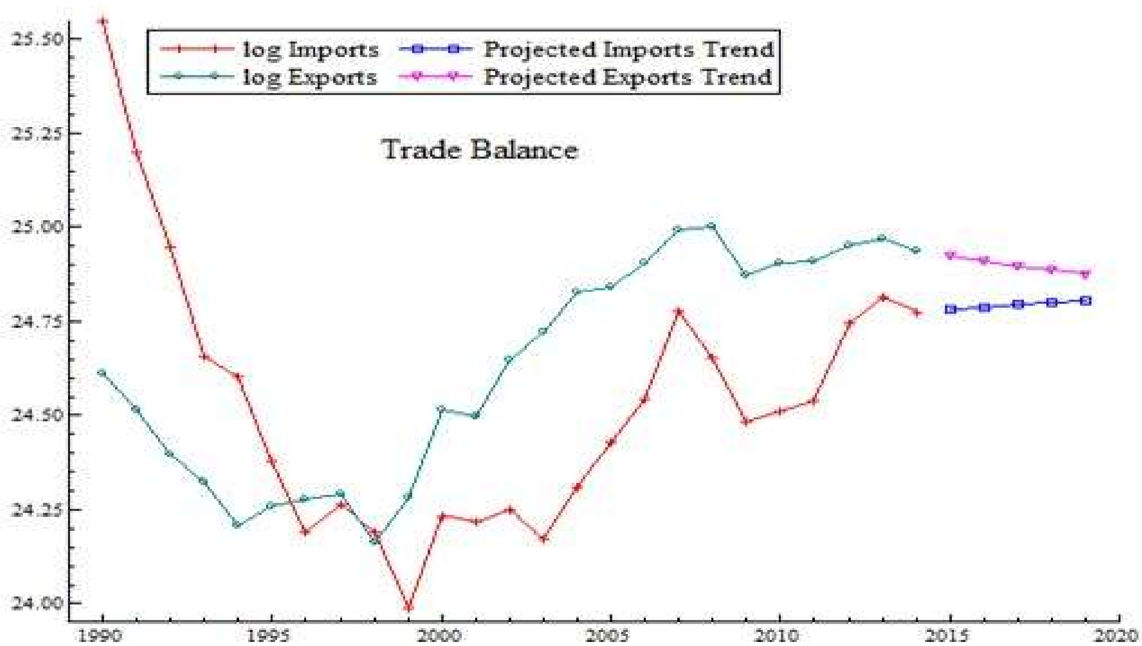
Figure 8.12 presents in-sample forecasts for both actual and predicted series of Kazakhstan's imports. The graph indicates how closely the model predicts the actual series. A decreasing and increasing trend symmetric about 1999 – 2000 can be seen in sample 1990 – 2014.

Figure 8.12: In Sample Forecast and Actual Trends of Log Imports – 1994 to 2014



It is also observed that real exports remained higher than imports after 1999 and the trend continues in the projected period 2015-2019 also (Figure 8.13 below).

Figure 8.13: Actual and Projected Balance of Trade - 1990 to 2019



8.1.5. Monetary and Price Block

In the case of Kazakhstan, only real per capita income is available. Below we present a brief discussion on the trend of this variable in the Kazakhstan economy. We employ contemporary simulation techniques and estimate projected trends for real per capita income and demand for money.

To shed light on the structure of real GDP per capita we analyze ACF and PACF of the series. From ACF and PACF plots we can get an idea about Autoregressive and Moving average structure of the series that helps in employing appropriate simulation technique.

8.1.5.1. Real Income Per Capita

Figure 8.14 below presents ACF and PACF for log real GDP per capita. The figure clearly indicates ARMA process which fades out after a few lags. With a short data span, we employ ARFIMA (1, 0.098, 1) process to get projected trend for real GDP per capita (log-likelihood: 47.445, T = 1990 – 2015).

Figure 8.14 presents projected trend for log real income per capita from 2016 to 2020. A clear increasing trend can be seen throughout the projected period 2016 – 2020, showing a positive growth outlook for the economy in the medium term.

Figure 8.14: ACF and PACF Plots for Log of Real GDP Per Capita

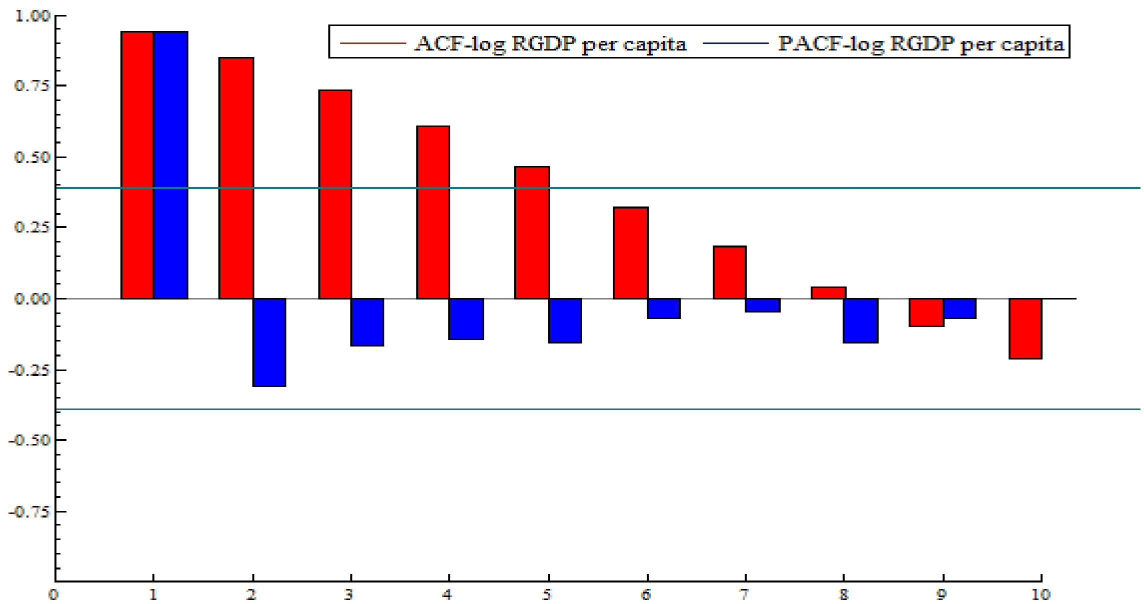


Figure 8.15: Projected and Actual Trends for Log of Real GDP Per Capita - 2016 to 2020

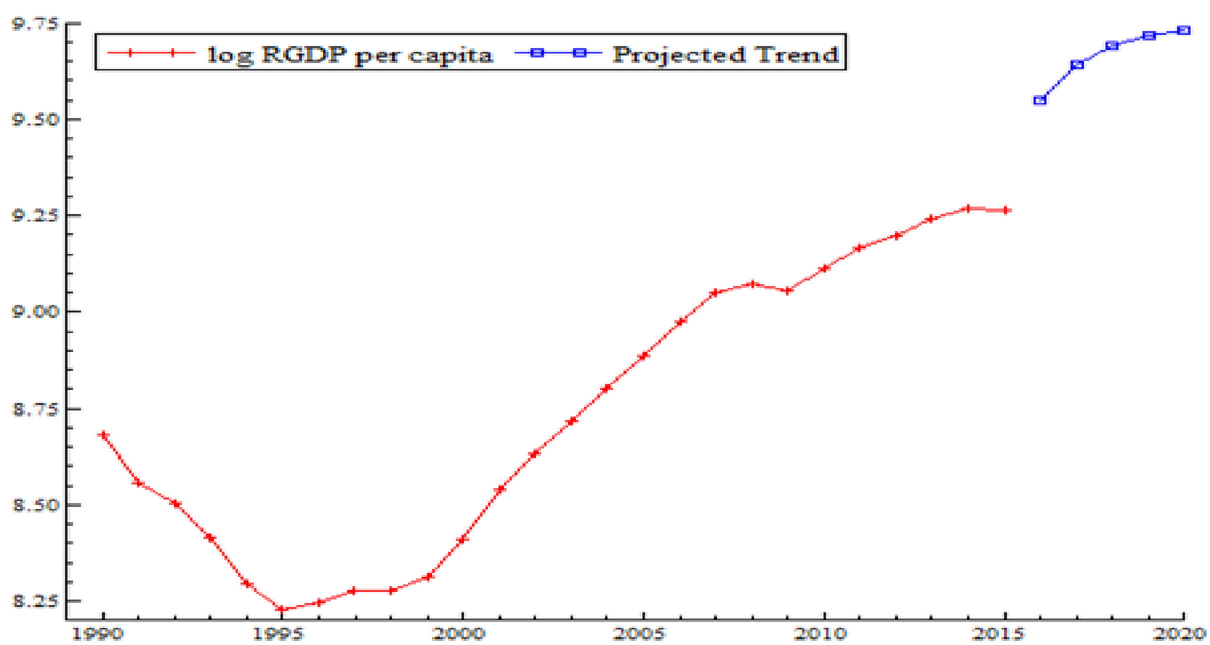
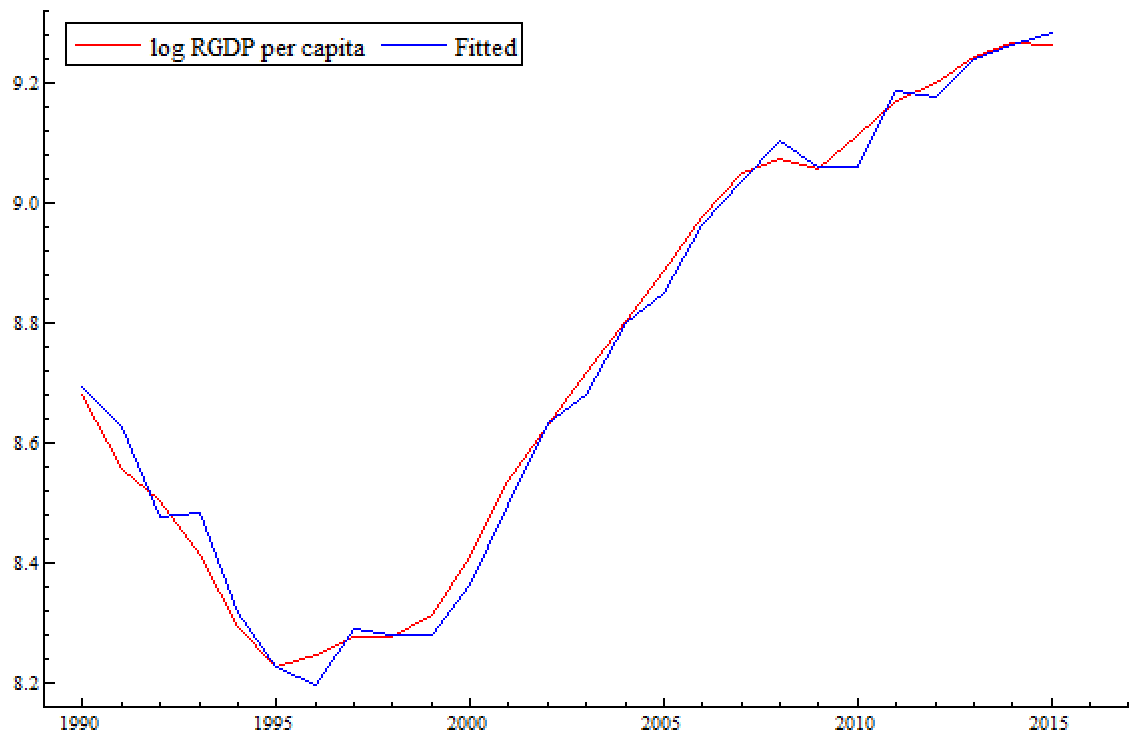


Figure 8.16 presents in-sample forecasts for both actual and predicted series for log of real GDP per capita for the period 1990 to 2015. The graph indicates how closely the model predicts the actual series. After a sharp decline in 1995 a continuous increasing trend of real income can be seen clearly which indicates the growth prospects of Kazakhstan's economy. The fitted (predicted) graph approximates the actual trend quite closely, suggesting the model is a good fit for the data.

Figure 8.16: In Sample Forecast & Actual Trends: Log RGDP Per Capita - 1990 to 2015



8.2. Forecasts

In less than two decades, Kazakhstan has moved from a lower middle-income status to an upper middle-income status[82] country. With a population of 17.8 million, Kazakhstan has the second highest per capita income (USD 10,582.5) in the group of ECO countries. Since 2002, GDP per capita has risen six times. The oil sector remained the main driver of economic growth. In terms of exports, oil and its products contribute almost 60 percent of total exports. Consequently, the economy's exposure to external shocks remains the main challenge to attain stable and sustainable development. External demand from China and the Russian Federation, Kazakhstan's main trading partners, as well as global oil demand and prices, are the key external factors impacting Kazakhstan's economic performance.

Kazakhstan's challenging external environment caused a broad-based economic slowdown in 2014 and put upward pressure on inflation. Kazakhstan's real GDP growth declined from 4.2 percent in 2014 to 1.0 percent in 2016 mainly because of the falling oil prices and also because of the weakened domestic and external demand[83]. On the supply side, growth in services has been slowing down since 2012 because of lower growth in trade, transport, and real estate. On the demand side, with fall in global oil prices in 2015 and 2016, net exports have declined significantly.

[82] In 2016, the country achieved an upper middle-income status.

[83] Lower external demand (a slowing Chinese economy and a protracted recession in Russia undermined external demand for oil, mineral and industrial products, which comprise Kazakhstan's major exports) led to a decline in the output of the extractive industries, while weaker domestic demand negatively affected the non-resource economy, thus impacting Kazakhstan's economy. Private sector demand weakened due to lower consumer and investor confidence as the pass-through effect of the depreciation eroded domestic purchasing power.

Medium term forecasts are reported in Table 8.8. Following two years of weak growth, Kazakhstan's economy was expected to recover in 2017, and real GDP growth was projected to be about 3.9 percent in 2017, up from 1.1 percent in 2016. However, according to the projections from the current model based on past trends, growth will slow down again in 2018 and onwards. On average from 2016 to 2020, Kazakhstan economy will grow by 2.4 percent. On the supply side, industry and services will contribute 0.8 percent per year and 1.6 percent per year respectively by 2020. Overall economic growth is expected to be supported by higher mining output and relatively high prices for oil and metals (Ashigali, Porokhova and Mukhina, 2017).

Table 8.8: Growth Projections - Kazakhstan

(%)

	2016	2017	2018	2019	2020
Real GDP	1.1	3.9	2.1	2.0	1.7
Real Agriculture Value Added	5.3	-3.8	-0.9	-5.2	-4.2
Real Manufacturing Value Added	1.1	4.2	1.9	1.6	1.2
Real Services Value Added	0.8	4.4	2.5	2.6	2.5
Private Consumption	17.5	5.0	15.5	9.7	7.3
Public Consumption	14.9	10.3	9.8	9.3	8.9
Gross Fixed Capital formation	10.5	10.5	9.6	8.7	8.1
Imports	3.1	1.9	0.7	-0.5	-1.6
Exports	1.1	1.0	1.0	1.0	1.0
Trade balance (percent of GDP)	-4.9	-5.1	-4.9	-4.3	-3.3
Inflation	14.5	9.5	6.9	5.5	4.7
Total Expenditures	17.5	19.0	19.0	19.0	19.0
Total Revenue	21.9	19.5	19.5	19.5	19.5
Fiscal balance (percent of GDP)	-1.6	-1.6	-1.6	-1.7	-1.7

Note: For 2016 is actual data; while projections from 2017 to 2020 based on past trends (from 1992 to 2016). Total expenditures include net lending; while total revenue includes grants.

In the forecast period, world GDP will grow moderately (from 2 percent to 2.5 percent) on average and prices of Kazakhstan's major export items are also expected to grow reasonably. For Kazakhstan, the OPEC's decision to extend the oil production cut will have a positive impact on growth in 2017[84]. However, from 2018 and onwards, the potential growth in oil shale production will cap the oil price growth, thus slowing down Kazakhstan's economy.

In 2017, both manufacturing and services sectors are projected to grow by about 4 percent each. After a restrained growth in 2015 and 2016, the industrial sector of Kazakhstan seems to be moving towards consistent development in 2017. However, in the forecast period, as the projected values indicates, the growth stimulus in the industries will weaken. The services sector has been showing signs of recovery. The growth of 2.5 to 2.6 percent is most likely.

Due to its heavy reliance on hydrocarbons and its exports, Kazakhstan's dependence on world's market trends and neighboring countries will remain high. Its exports in real terms are projected to grow moderately by 1.02 percent, while imports in real terms are projected to grow by only 0.1 percent. Consequently, Kazakhstan real trade balance in terms of GDP is projected to improve slightly by 2020.

In Kazakhstan, declining oil prices led to the devaluation of its currency, which increased inflation in 2014 (6.7 percent). In 2015, average annual inflation eased slightly (6.6 percent) as food prices dropped. However, sharp depreciation of the Tenge fuelled inflation in 2016, pushing the inflation rate to 14.6 percent. Non-food imports were the

[84] The increase in oil output was observed in the oil fields that were not covered by the OPEC-led cuts in 2017 (World Bank, 2018b)

primary source of inflation, as price controls for utilities and some food items constrained other price increases. However, as per our projections, it is expected that with ease in currency depreciation and with the inflation targeting policy of the central bank, inflation will slow down in 2017 and onwards.

The fiscal deficit in the Kazakhstan budget has remained below 3.0 percent since 2000. It was recorded at 2.2 percent in of GDP in 2015, which further declined to 1.6 percent of GDP in 2016. Lower revenue attributable to weak oil prices forced cuts in planned spending, thus narrowing down budget deficit in 2016. With continued consolidation in its fiscal accounts, Kazakhstan's overall fiscal deficit is projected to remain below 2 percent of GDP by 2020.

The government of Kazakhstan is reforming its industrial policy to diversify the economy and reduce overdependence on the oil sector by developing light industry. With improvement in investor sentiment and consumer confidence, the non-oil economy is expected to expand which will help in reducing its reliance on hydrocarbons; and moving towards a more diversified and regionally competitive economy.

8.3. Conclusion

The macro-econometric model of Kazakhstan's economy has focused on estimation of value added in services as a component of production block. On the demand side, estimations have been carried out for private investment and government expenditure highlighting key macroeconomic determinants of these variables. Simulation techniques have been used for key variables in monetary and foreign trade blocks to come up with macroeconomic projections. Like many other economies in the region, Kazakhstan also relies heavily on the energy sector though it has managed to establish a significant industrial base along with a services sector. Though Kazakhstan's recent economic performance has been lackluster, our projections show a positive growth outlook in the medium term as the non-oil economy is expected to grow on the back of policies aimed at greater economic diversification.

Chapter 9 - Kyrgyzstan: Modelling Exercise and Forecasts

9.1. Modelling

The modelling exercise for Kyrgyzstan has focused on key macroeconomic variables for which time series data of adequate duration was available. The model specifications have also been dictated by data availability and consequently there may be some missing variable bias.

9.1.1. Production Block

Data unavailability is a serious issue in case of Kyrgyz Republic; we thus estimate only one model i.e. for services sector value added. Moreover, on account of the small data span the effect of regressor on regressand is difficult to measure properly and we might find unusual relation between dependent and independent variables; the results should be interpreted very cautiously. Unavailability of some relevant regressor may cause omitted variable bias that may manifest in residual analysis.

9.1.1.1. Services Sector

ARDL modelling has been employed as it is appropriate for mix of distinct order of integrated variables just like in our case. Eq (**9.1**) presents the final ARDL model (automation model selection technique has been used here). The estimation of services sector value added suggests that services contribution to the total production is significantly determined by real aggregate demand in the long-run. The contribution of aggregate demand in the services value added is 3.44 in the long -run. On the whole, the model fits well as indicated by a battery of diagnostic tests.

Table 9.1: Services Sector ARDL Estimates

$$y_t^s = 0.996y_{t-1}^s + 0.659rad_t^s + 0.647rad_{t-2}^s \tag{9.1}$$

(SE) (0.033) (0.264) (0.249)

t:	1996 – 2014		
Sigma:	0.129	**RSS:**	0.268
Log-likelihood:	13.539		
AR 1-2 test:	F (2,14)	1.937 [0.181]	
ARCH 1-1 test:	F (1,17)	0.734 [0.404]	
Normality test:	Chi^2 (2)	1.355 [0.508]	
Hetero test:	F (6,12)	1.647 [0.217]	
Hetero-X test:	F (9,9)	1.253 [0.371]	
RESET23 test:	F (2,14)	1.335 [0.295]	

9.1.1.2. Agriculture Sector

In the Kyrgyzstan Republic, a decline in labor force engaged in agriculture sector is evident in Figure 9.1; reason might be rapid urbanization and/or use of less labor intensive and innovative agricultural tools and techniques. In past years a negative relationship is observed in agricultural value added and labor force engaged in agriculture sector. A higher value addition with lesser labor involved indicates that agriculture sector is relying more on innovative agricultural tools and techniques.

Figure 9.1: Log of Agriculture Value Added and Share of Labor Employed

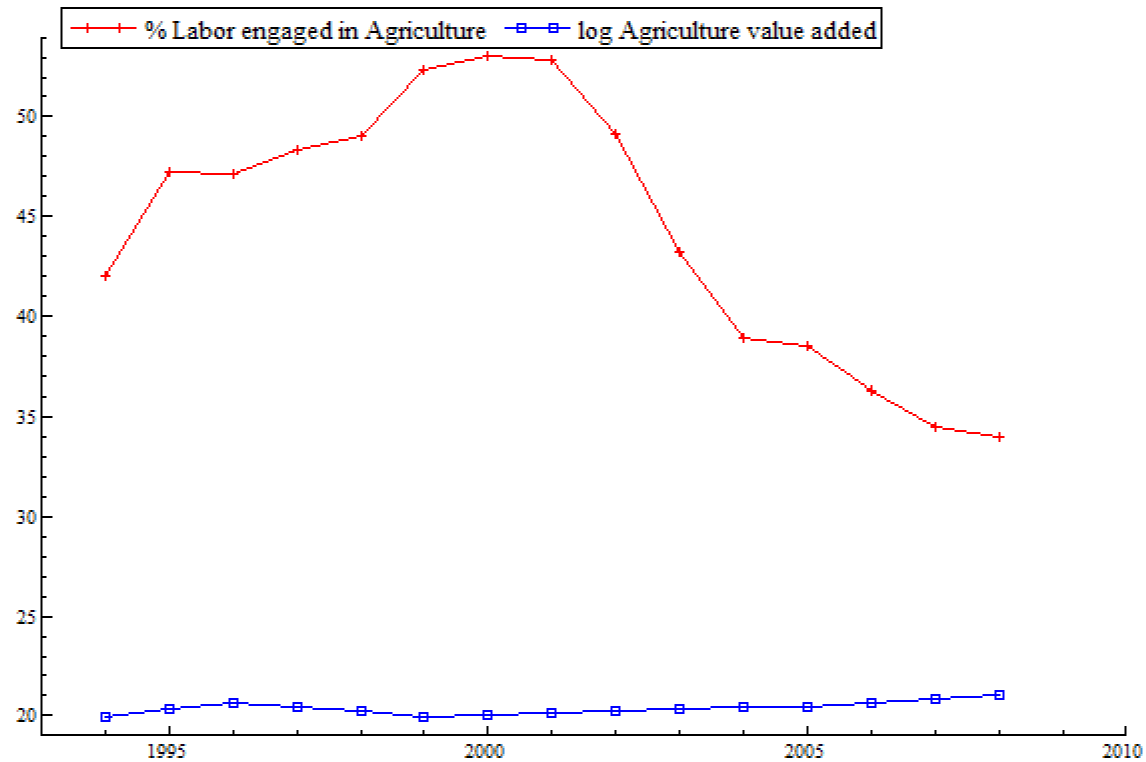
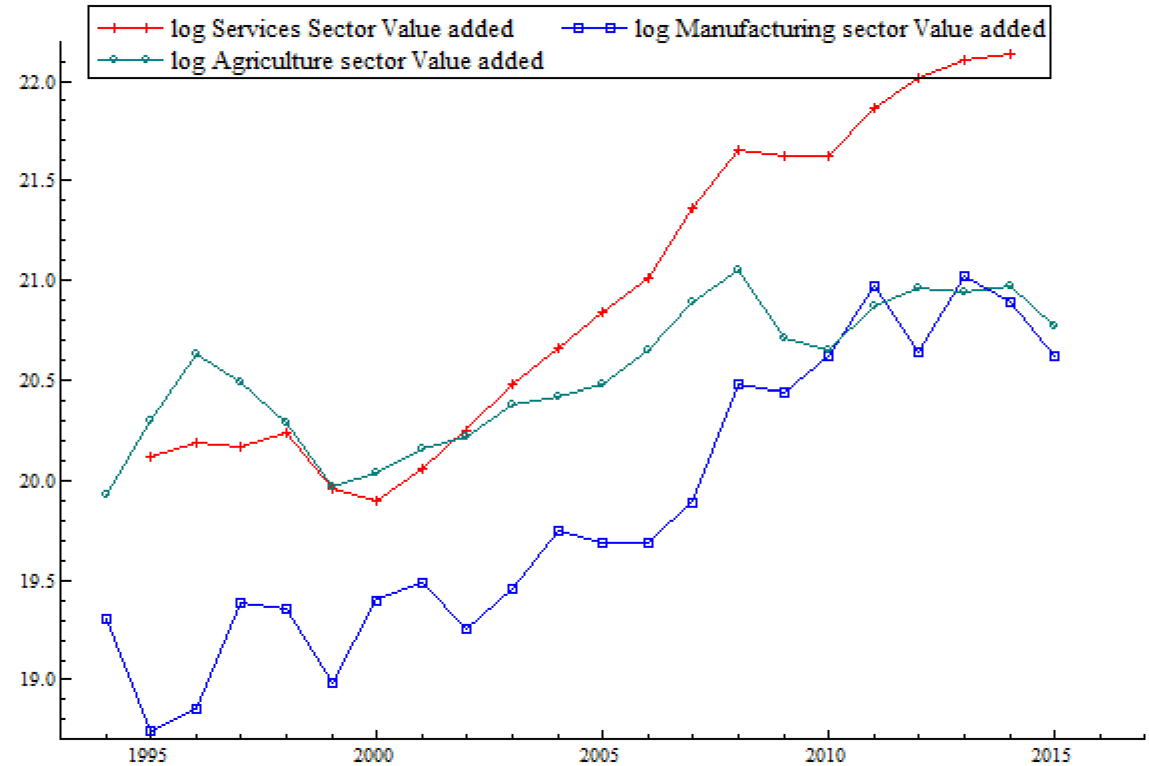


Figure 9.2 below shows the continuous increasing pattern in all three sectors value added. Services sector value addition remained the highest in general while manufacturing sectors value addition remained the lowest.

Figure 9.2: Value Addition by Sector in Kyrgyzstan



9.1.2. Aggregate Demand Block

Aggregate demand can be decomposed into consumption and investment sub-sectors, and the consumption sub-sector can further be disaggregated into private consumption and government consumption. Due to data unavailability, only two macro-econometric models, for government consumption and private investment, are presented here.

9.1.2.1. Government Consumption

Government consumption heavily depends on total government revenues as reflected in the long run relation equation (9.2). Government revenue exerts a positive influence on government consumption. The *ADF* statistic for testing the stationarity of the long run residuals is equal to -3.132, indicating a long-run relationship during the period under estimation. Hence, an ECM is estimated to derive a short run relation, presented in Eq (9.3).

Table 9.2: Government Consumption Long Run Estimates

$$c_t^g = 19.000 + 0.076 r_t^g \quad (9.2)$$

(SE) (0.266) (0.013)

t:	1994 – 2014		
Sigma:	0.049	**RSS:**	0.0450
Adj. R²:	0.623	**F (1,19):**	34.060 [0.000]**
		Log-likelihood:	34.739

Table 9.3: ADF Test of Residuals from Long Run Government Consumption Function

ADF Statistics:	-3.132	
Lags:	**0**	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The results reported in Table 9.4 reveal that lagged government consumption affects the current government consumption in the short-run. A negative, significant ECT validates the long run relation. The model passes all the diagnostic tests except for normality which is significant at the 1 percent significance level.

Table 9.4: Short Run Estimates of Long Run Government Consumption Function

	$\Delta c_t^g = 0.252\Delta c_{t-1}^g - 0.504ECT_{t-1}$			(9.3)
(SE) (0.092) (0.159)				
t:	1995 – 2014			
Sigma:	0.034	RSS	0.020	
Log Likelihood	40.465			
AR 1-2 Test:	F (2, 16) = 1.470 [0.259]			
ARCH 1-1 Test:	F (1, 18) = 0.027 [0.872]			
Normality Test:	Chi^2 (2) = 7.443 [0.024]*			
Hetero Test:	F (4, 15) = 1.660 [0.211]			
Hetero-X Test:	F (5, 14) = 1.366 [0.295]			
RESET23 Test:	F (2, 16) = 4.892 [0.022]*			

9.1.2.2. Private Investment

The long-run estimates of the real private investment ($i_t^p = LI_t^p =$ log of private investment) are given by Eq (**9.4**). It is evident from the results that real private investment is significantly determined by government investment. The government investment has substantial positive effect on private investment. It is often suggested that government investment complements private investment instead of crowding-out in developing countries (Hossain and Razzaque, 2003); as can be seen in case of the Kyrgyz Republic.

The corresponding value of the *ADF* statistic for the long run residuals stationarity is -3.617 (Table 9.6), indicating the presence of cointegration among real private investment and its determinants.

Table 9.5: Private Investment Long Run Estimates

$i_t^p = 0.826 + 0.963 i_t^g$ (9.4)				
(SE) (1.490) (0.073)				
t:	1990 – 2014			
Sigma:	0.166	**RSS:**	0.633	
Adj. R²:	0.880	**F (1, 23):**	176.500 [0.000]**	
		Log-likelihood:	10.478	

Table 9.6: ADF Test of Residuals from Long Run Private Investment Function

ADF Statistics:	-3.617	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Based on the long-run estimates a short-run ECM model has been estimated as reported in Eq (9.5). The short-run estimates suggest that government investment is an important determinant of private investment with positive and significant coefficients. The private sector credit remains insignificant in the short-run also. First lag of change in private investment is also significant; econometrically this signifies the presence of possible one common factor. The lagged error-correction term is significant with theoretical expected sign. Diagnostic tests associated with the short-run ECM model do not detect any serious specification problem.

Table 9.7: Short Run Estimates of Long Run Private Investment Function

$\Delta i_t^p = 0.499\Delta i_{t-1}^p + 0.859\Delta i_t^g - 0.882ECT_{t-1}$ (9.5)			
(SE) (0.117) (0.140) (0.206)			
t:	1992 – 2014		
Sigma:	0.151	RSS	0.455
Log Likelihood	12.478		
AR 1-2 Test:	F (2, 18) = 0.256 [0.777]		
ARCH 1-1 Test:	F (1, 21) = 0.008 [0.931]		
Normality Test:	Chi^2 (2) = 4.750 [0.093]		
Hetero Test:	F (6, 16) = 7.071 [0.001]**		
Hetero-X Test:	F (9, 13) = 6.909 [0.001]**		
RESET23 Test:	F (2, 18) = 0.213 [0.810]		

9.1.3. Fiscal Block

In the case of the Kyrgyz Republic, data unavailability restricts us from estimating econometric models for the entire fiscal block and a model is estimated for government expenditure only.

9.1.3.1. Government Expenditure

On account of limited number of observations (1994 – 2014), estimations should be considered cautiously. Eq (9.6) reports the long run estimation result for government expenditure ($ex_t^g = LEX_t^g =$ log of Government Expenditure). The result reveals that nominal income (ny) and inflation contribute positively to government expenditure. Just as in the case of Kazakhstan and Azerbaijan, the effect of inflation remains very nominal at almost zero percent. This result supports the theoretical view that government expenditure is positively correlated with nominal income. The estimated long-run income elasticity of government expenditure is 1.190.

Table 9.8: Government Expenditures Long Run Estimates

$ex_t^g - 3.900 + 1.190ny_t + 0.003INF_t$				(9.6)
(SE) (0.560) (0.026)(0.000)				
t:	1994 – 2014			
Sigma:	0.070	**RSS:**	0.081	
Adj. R^2:	0.992	**F (2, 18):**	1,173 [0.000]**	
		Log-likelihood:	28.611	

The *ADF* test for the stationarity of the residuals is -3.880 (Table 9.9), which is significant, indicating significant long-run co-movements among the variables.

Table 9.9: ADF Test of Residuals from Long Run Government Expenditure

ADF Statistics:	-3.880	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The results of the ECM model presented in Eq (9.7) suggest that the growth of nominal income exerts significant influences on the growth of government expenditure in the short-run. The error-correction term is correctly signed and statistically significant, showing that it takes almost one year for short-run deviations to converge to the long-run steady-state path. The correct sign and the significance of the error-correction term is an indication of the existence of a valid long-run relationship. The overall fit of the model is good as indicated by various diagnostic tests.

Table 9.10: Short Run Estimates of Long Run Government Expenditure Function

	$\Delta ex_t^g = 0.964\Delta ny_t - 0.689ECT_{t-1}$		(9.7)
(SE) (0.123) (0.333)			
t:	1994 – 2014		
Sigma:	0.094	**RSS:**	0.159
Log Likelihood:	20.018		
AR 1-2 Test:	$F(2, 16) = 0.748$ [0.489]		
ARCH 1-1 Test:	$F(1,18) = 0.252$ [0.622]		
Normality Test:	$Chi^2(2) = 3.744$ [0.154]		
Hetero Test:	$F(4,15) = 0.924$ [0.476]		
Hetero-X Test:	$F(5,14) = 0.716$ [0.622]		
RESET23 Test:	$F(2,16) = 2.691$ [0.098]		

9.1.4. Foreign Trade Block

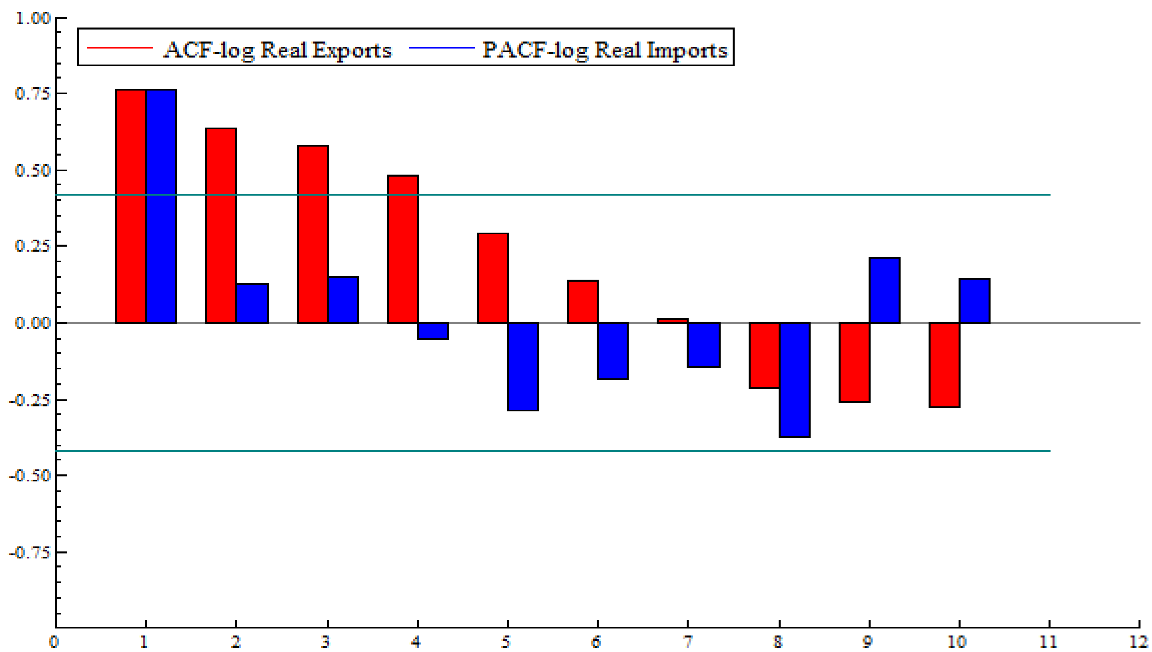
Below a brief discussion on the trend of Exports and Imports of Kyrgyz Republic economy is presented. Contemporary simulation techniques are employed and projected trends for Exports and Imports are estimated.

To ascertain the structure of macro variable we analyze ACF and PACF of the variables. From ACF and PACF plots we can get some idea for Autoregressive and Moving average structure of the series that helps in employing appropriate simulation technique.

9.1.4.1. Exports

Theoretically exports of goods and services are determined by world income, the real effective exchange rate and relative price of exports. Based on the functional form specified in Section 2.4.4.1, the data required for relevant macro variables to estimate a macro-econometric model for exports of the Kyrgyz Republic economy is not available. We continue with discussion on trends and present projected trends of exports. Figure 9.3 below presents ACF and PACF for log exports. The figure clearly indicates ARMA process which fades out after few lags.

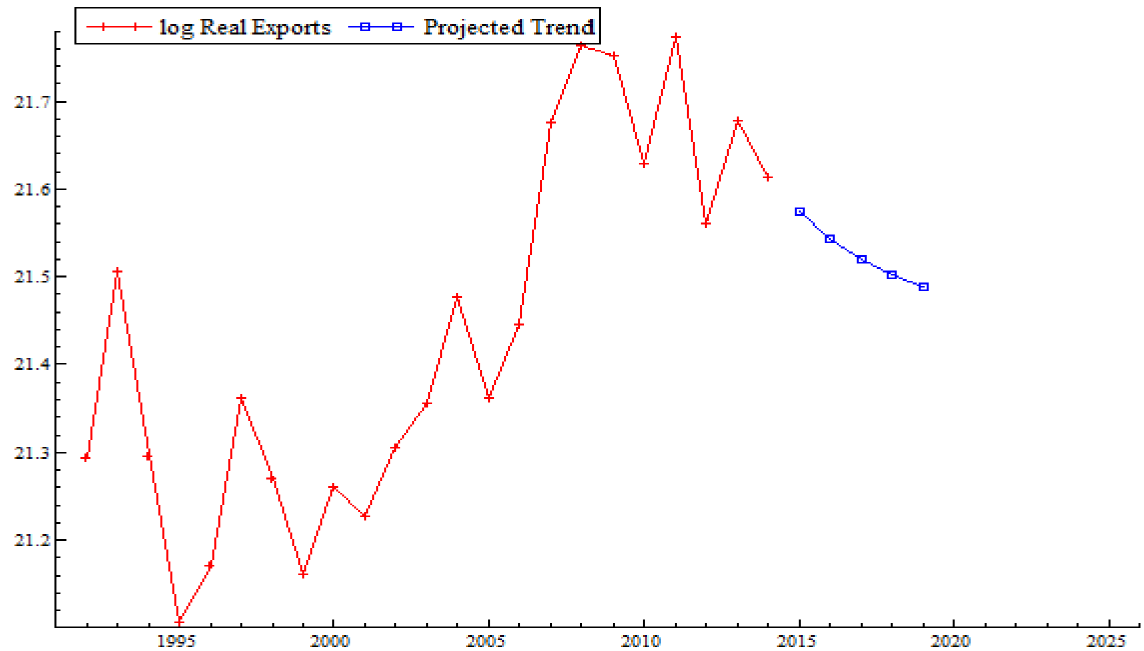
Figure 9.3: ACF and PACF Plots for Log of Real Exports



With this short data span, use of an ARFIMA (1,0,0) process is appropriate to get projected trend for real exports (log-likelihood: 14.395, T = 1992 – 2014). Figure 9.4

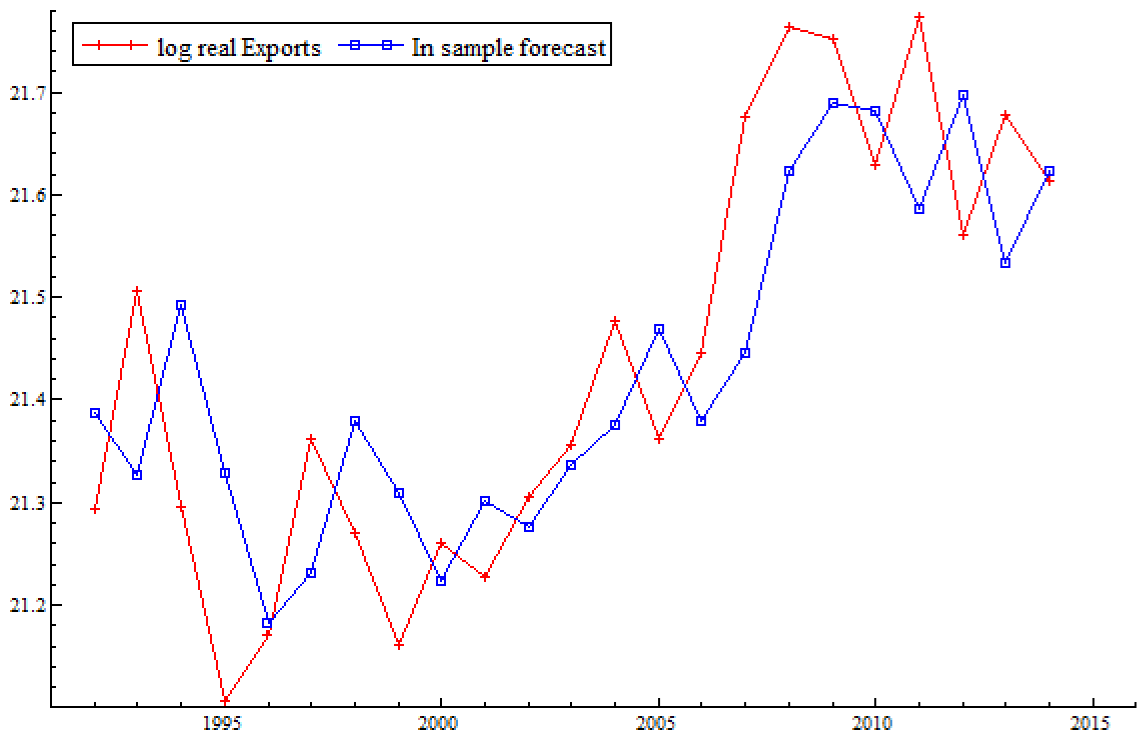
presents projected trend for log real exports from 2015 to 2019. A decrease in exports is projected through 2015-2019.

Figure 9.4: Projected and Real Trends for Log of Real Exports - 2015 to 2019



In-sample forecasts for both actual and predicted series are presented in Figure 9.5. The graph indicates how closely our model predicts the actual series. After a sharp decline in 1995 a continuous increasing trend of exports can be seen in sample 1992-2014.

Figure 9.5: In Sample Forecasts and Real Trends in Log of Exports - 1992 to 2014

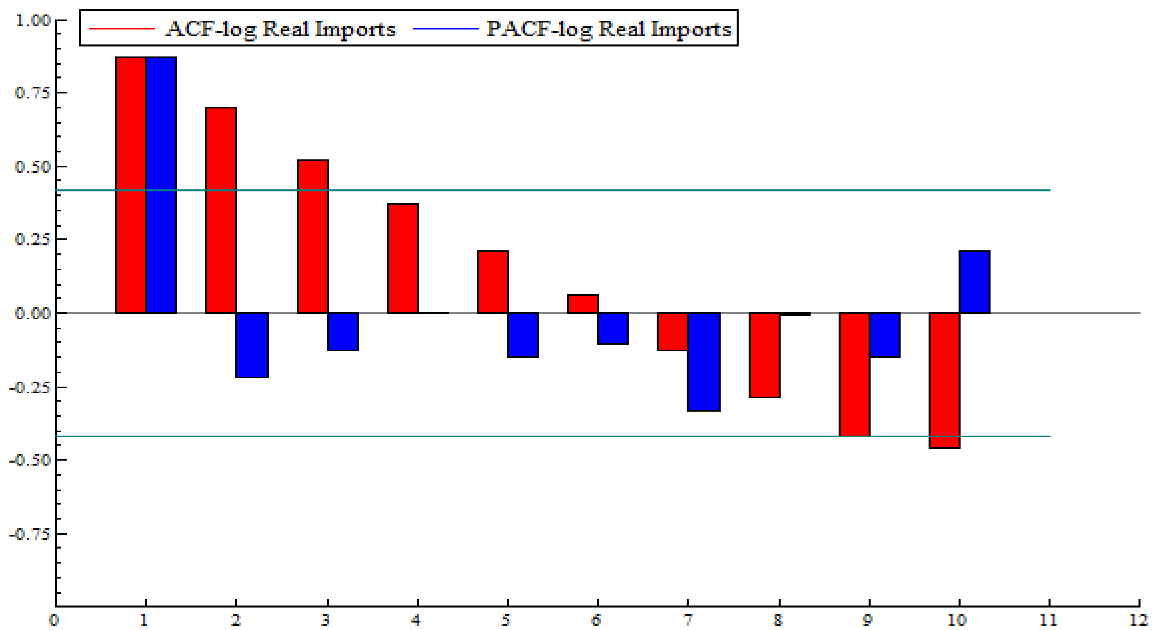


9.1.4.2. Imports

The import of goods and services is specified as a function of real domestic income, real effective exchange rate, relative price of imports and foreign capital inflows.

We lack data for the relevant macro variables to be able to estimate a macro-econometric model for imports of the Kyrgyz Republic economy. We continue with discussion on trends and present projected trends of imports. Figure 9.6 below presents ACF and PACF for log imports. The figure clearly indicates an ARMA process which fades out after few lags.

Figure 9.6: ACF and PACF plots for Log of Real Imports



With a short data span, an ARFIMA (1,0,0) process is used to get projected trend for real imports (log-likelihood: 10.538, T = 1992 – 2014). Figure 9.7 presents projected trend for log real imports from 2015 to 2019. A decrease in imports is projected through 2015-2019.

Figure 9.7: Actual and Projected Trends for Log of Real Imports - 2015 to 2019

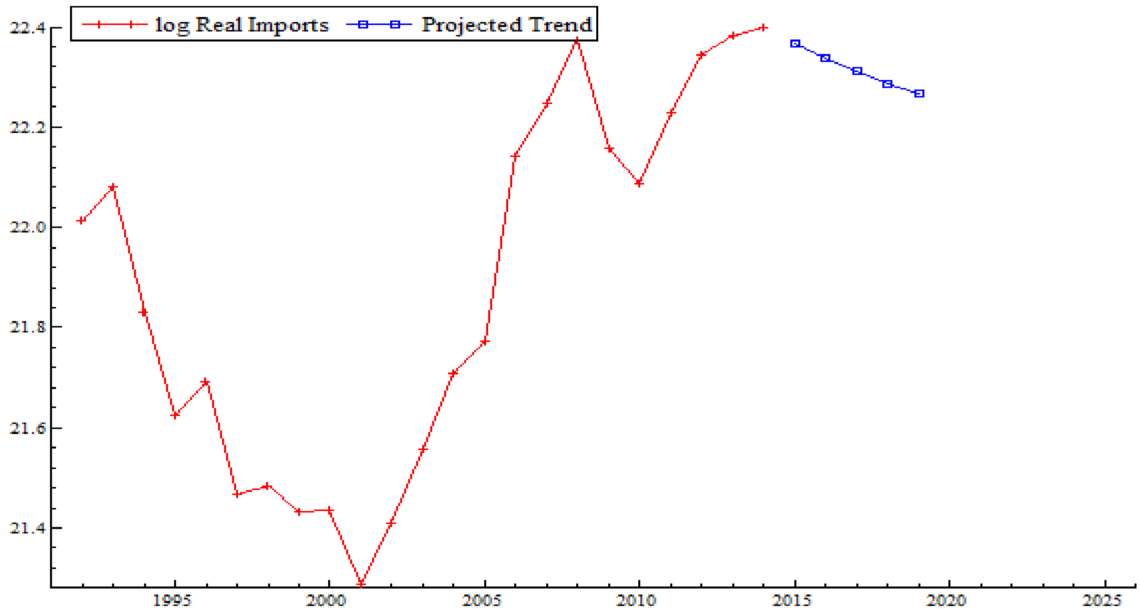
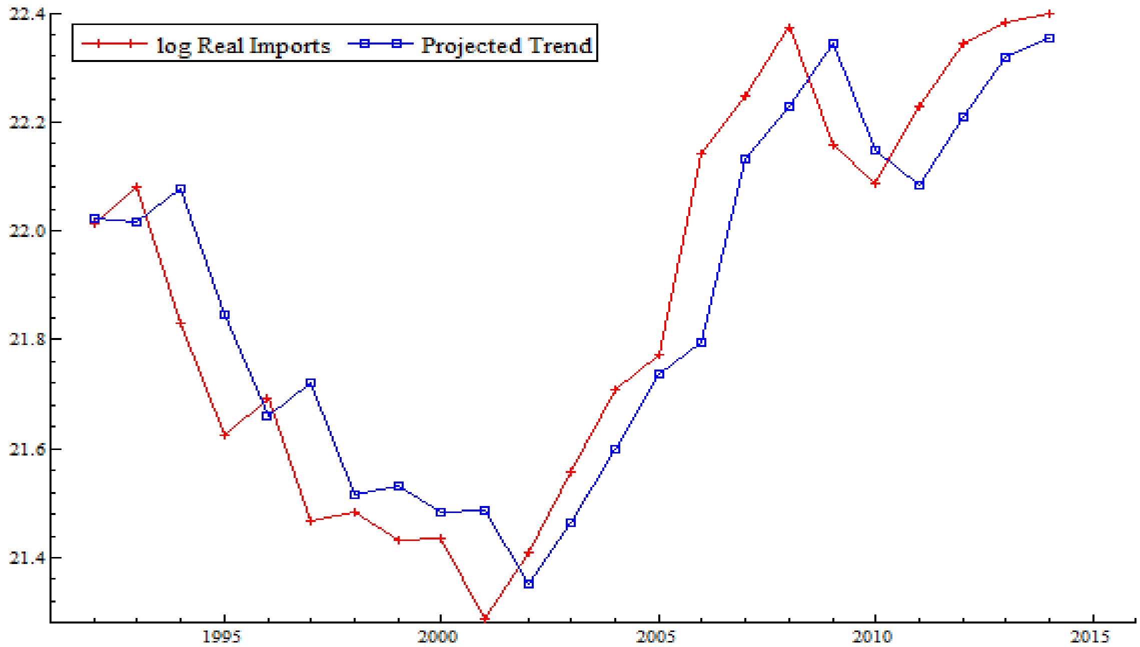


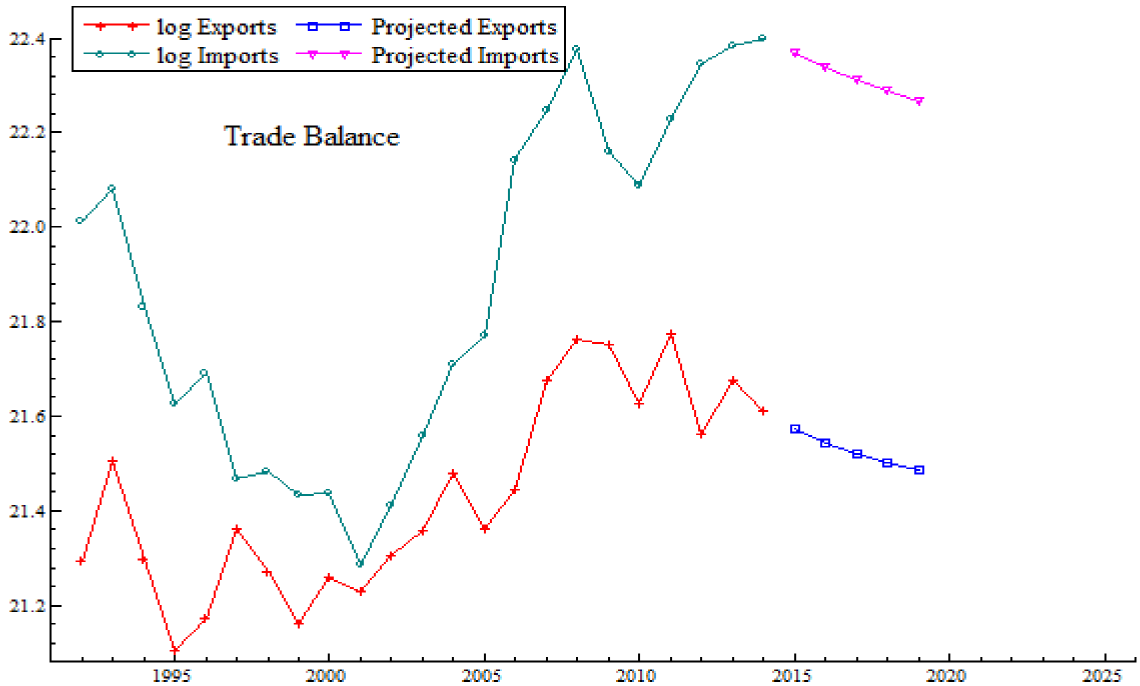
Figure 9.8 presents in-sample forecasts for both actual and predicted series. The graph indicates how closely our model predicts the actual series. An increasing trend of imports can be seen in sample 1992-2014 after 2001.

Figure 9.8: In Sample Actual and Forecast Trends for Log of Imports - 1992 to 2014



In Figure 9.9 below it is observed that real imports remained higher than exports throughout the sample span and also in projected trends indicating a persistent trade deficit for the Kyrgyz economy.

Figure 9.9: Actual and Projected Trends for Balance of Trade



9.1.5. Monetary and Price Block

The monetary block of the present macro-econometric model explains the behavior of money demand, short-term interest rate and the domestic price level. Due to data limitations a macro-econometric model for the money demand function is estimated, while for the price component of the monetary and price block an ARDL equation is estimated.

9.1.5.1. Money Demand

The demand for broad money M/P,or in logarithms $(m - p)$, is supposed to be influenced by real income (Y) as scale variable and the nominal interest rate (i). Since data on real GDP is not available for the Kyrgyz Republic nominal GDP (NY) is used as proxy for real GDP. With a small data size, results should be interpreted cautiously. Eq (**9.8**) reports the estimated long-run results, and interest rate (i) is observed to be insignificant.

Table 9.11: Money Demand Function Long Run Estimates

$(m-p)_t = 10.200 + 0.553ny_t$			(9.8)
(SE) (2.400) (0.092)			
t:	2004 – 2015		
Sigma:	0.163	**RSS:**	0.267
Adj. R^2:	0.762	**F (1, 10):**	36.130 [0.000]**
		Log-likelihood:	5.800

It is evident from the estimates that nominal income (y) possesses expected sign and statistically significant in the long-run. The income elasticity of money demand is 0.553. This result is in the line with earlier findings of Khan and Sajjid (2005) and Qayyum (2005) among others. The insignificant interest rate may imply that the domestic financial market is not yet well developed, and interest rates are not set at market rates. The *ADF* test for the non-stationarity of the residuals is -2.410 (Table 9.12), which is significant at the 5 percent level, indicating a significant long-run co-movement among the variables.

Table 9.12: ADF Test of Residuals from Long Run Money Demand

ADF Statistics:	-2.410	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The results of the ECM model presented in Eq (9.9) suggest that the growth of nominal income positively and significantly impacts real money balances in the short-run. The error-correction term (Table 9.13) is correctly signed and statistically significant, showing that it takes less than one and half years for short-run deviations to converge to the long-run steady-state path. The correct sign and the significance of the error-correction term is an indication of the existence of a valid long-run relationship. The overall fit of the model is good as indicated by various diagnostic tests.

Table 9.13: Short Run Estimates of Money Demand Function

$$\Delta(m-p)_t = 0.695\Delta ny_t - 0.785ECT_{t-1} \quad (9.9)$$

(SE) (0.320) (0.351)

t:	2005 – 2015		
Sigma:	0.145	RSS	0.190
Log Likelihood	6.703		
AR 1-2 Test:	F (1, 18) = 0.013 [0.912]		
ARCH 1-1 Test:	F (1, 19) = 0.485 [0.504]		
Normality Test:	Chi^2 (2) = 1.508 [0.470]		
Hetero Test:	F (4, 6) = 0.142 [0.960]		
Hetero-X Test:	Not enough observations		
RESET23 Test:	F (2, 7) = 1.689 [0.252]		

9.1.5.2. Price

The domestic price level, proxied by consumer price index (CPI), is significantly determined by nominal income (real income is not available) and its lagged value. Eq (9.10) reports the final ARDL estimates for the domestic price P (where $P = CPI$). The ARDL modelling is appropriate for mix of distinct order of integrated variables just as in this case.

The result reveals that nominal income (ny) contributes positively to domestic price but its lag exerts a negative effect on price.

For modelling the long run effect, the ARDL equation is solved and shows that income is the main factor contributing to inflationary pressure in the Kyrgyz economy. On the whole, the model fits well as indicated by a battery of diagnostic tests.

Table 9.14: ARDL Estimation of Price Equation

$P_t = 0.916P_{t-1} + 0.434ny_t - 0.364ny_{t-1}$ (9.10)			
(SE) (0.071) (0.653)(0.062)(0.057)			
t:	1996 – 2014		
Sigma:	0.023	RSS:	0.008
Log Likelihood:	46.809	F (3, 15):	1,371 [0.000]**
Adj. R^2:	0.996		
AR 1-2 Test:	F (2, 13) = 0.816 [0.464]		
ARCH 1-1 Test:	F (1, 17) = 0.004 [0.949]		
Normality Test:	Chi^2 (2) = 0.132 [0.936]		
Hetero Test:	F (6, 12) = 1.473 [0.267]		
Hetero-X Test:	F (9, 9) = 1.704 [0.220]		
RESET23 Test:	F (2, 13) = 2.967 [0.087]		

9.2. Forecasts

The Kyrgyz Republic is a land-locked country of 6 million people with rich endowments in agriculture, hydropower, and tourism. It is not only one of the poorest countries in Central Asia, it is also at the bottom in the ECO region with a share of only 0.3 percent in the region's GDP. Although its economy and society are the most liberal in Central Asia, the country has experienced significant political and social instability since independence in 1991. The economy depends heavily on gold exports and remittances_ mostly from Russia.

In terms of growth, real GDP declined from 10.5 percent in 2013 to 3.8 percent in 2016 respectively. This was the result of weak external demand (prolonged economic slowdown in Russia) and lower production levels at Kumtor Gold mine. The medium-term forecasts for some major macroeconomic variables in Kyrgyz Republic are reported in Table 9.15.

The Kyrgyz economy is projected to recover from the external shocks of 2014 and 2015 as growth is expected to accelerate to 8.7 percent in 2017 in nominal terms from 6.4 percent in 2016 (Table 9.15). In real terms, growth will accelerate gradually and on average the economy is projected to grow by 3.1 percent. On the supply side, manufacturing sector is projected to take the lead as it is expected to grow by more than 5 percent in real terms[85]. Real GDP growth is projected to increase to 4.7 percent in 2019, however, it will decelerate slightly to 2.2 percent in 2020, as manufacturing value added growth moderates and services sector also slows down. In terms of GDP, decline in the share of agriculture from 14.9 percent of GDP in 2016 to 13.1 percent of GDP in 2020 is compensated by increase in the share of services from 55.9 percent of GDP in 2016 to 57.2 percent of GDP in 2020.

[85] Manufacturing value added would be supported by non-gold sector (World Bank, 2018a).

Table 9.15: Growth Forecasts - Kyrgyzstan

(%)

	2016	2017	2018	2019	2020
GDP	3.8	1.9	3.8	4.7	2.2
Nominal GDP	6.4	8.7	8.3	8.0	7.7
Agriculture Value Added	3.0	0.8	1.6	1.9	1.9
Manufacturing Value Added	5.9	6.4	5.2	4.9	4.7
Services Value Added	3.7	4.7	2.1	0.7	1.9
Private Consumption	1.8	-0.01	0.4	-0.04	-0.02
Public Consumption	2.7	2.6	2.3	1.9	1.3
Gross Fixed Capital Formation	3.7	18.6	19.9	21.2	22.6
Imports	-4.0	0.8	0.8	0.8	0.7
Exports	2.2	1.6	0.9	0.9	0.9
Trade Balance (percent of GDP)	-11.4	-11.1	-10.7	-10.3	-10.1
Inflation	0.42	4.2	4.1	3.9	3.7
Total Expenditures	12.6	7.1	9.2	12.4	15.1
Total Revenue	1.4	8.4	16.8	20.4	17.1
Fiscal Balance (percent of GDP)	-6.7	-6.3	-4.5	-2.6	-2.2

Note: For 2016 is actual data; while projections from 2017 to 2020 based on past trends (from 1990 to 2016). Total revenue does not include grants.

On the demand side, growth is projected to be supported by public investment and net exports and to some extent private consumption fueled by remittances inflows. The trade deficit in terms of GDP is also projected to narrow down by 2020 as exports are projected to rise slightly faster than imports by 2020. Better export performance is expected to come from non-gold exports_ benefitting from the recovery in regional demand as well as improved compliance by Kyrgyz producers with Eurasian Economic Union quality standards. Imports are projected to rise slowly despite expected improvement in remittances and high levels of public investment World Bank (2018b).

During the last decade the highest fiscal deficit was recorded in 2012 (6.5 percent of GDP), which narrowed down till 2015 (-1.5 percent of GDP) reflecting improvement in total revenues[86] as well as delays in implementing public investment projects that limited expenditure growth. However, expansionary fiscal policy led to a rise in deficit to -4.6 percent of GDP in 2016[87]. Excluding grants, fiscal balance was about -6.7 percent of GDP in 2016. The fiscal deficit is projected to decline to 2.2 percent of GDP by 2020. This would be achieved through measures to increase tax revenues, which are projected to grow from about 20.5 percent of GDP in 2016 to 30.2 percent of GDP by 2020[88].

On the monetary side, devaluation of its currency accelerated inflation in 2014 (7.5 percent); while in 2015, average annual inflation (6.5 percent) eased slightly as food prices fell. In 2016, stabilization of the exchange rate, following appreciation early in the year, and low international food prices kept inflation at negligible level (0.42 percent). Inflation is projected to rise slightly in 2017, reaching 4.2 percent. As per our medium-term forecasts, inflation is projected to remain around 4 percent, in line with the target of National Bank of Kyrgyz Republic (i.e., 5 percent), assuming there would be no significant global food price increases and exchange rate will remain stable relatively.

The economic outlook of Kyrgyz Republic depends to a large extent on the overall development in the region, in particular, Russia and Kazakhstan, benefiting the Kyrgyz economy via the traditional remittance and trade channels. An additional boost is expected

[86] It is mainly because of the sale of mining licenses.

[87] With capital spending increasing significantly in line with the planned investment scale-up. Given a parallel decline in revenues, reflecting the overall weakness of the economy (decline in gold output and weak performance of the non-gold sector, in particular industry and services) as well as a drop in non-tax income.

[88] As government is taking measures to expand the tax base by encouraging businesses to formalize; to improve the administration of taxes; to reduce tax exemptions; and to increase some tax rates. By 2020, government expenditures are also expected to decline as government is making efforts to streamline non-priority purchases of goods and services, to reduce wage bill and to strengthen public procurement.

to come from its agreement to the Eurasian Economic Union, which will have a positive influence on trade and economic development in Kyrgyz Republic in the future (World Bank, 2018b).

9.3. Conclusion

This chapter has provided estimations for the macro-econometric model of Kyrgyz economy focusing in particular on services sector which accounts for more than 50 percent of GDP, private investment, and public expenditure, money demand and the price level. The estimated model highlights important macro-economic relationships that dictate the performance of the Kyrgyz economy. In addition, simulation techniques have been employed to study the time series behavior of fiscal and foreign trade variables and provide overall projections for the macro economy. The performance of the Kyrgyz economy significantly depends on its trade relations with Russia and remittances from its migrant labor working in Russia. Weak economic growth in Russia have led to sluggish economic growth in the Kyrgyz Republic. On the other hand, while currency depreciation added to the inflationary pressure initially, inflation has subsided in recent years due mainly to low international prices of food. The medium-term outlook for the economy is moderate growth with a stable macroeconomic environment.

Chapter 10 - Pakistan: Modelling Exercise and Forecasts

The specified model for Pakistan has been estimated using the Engle-Granger two step methodology. The results are reported below for each building block of the model.

10.1. Modelling

10.1.1. Production Block

As in previous modelling exercises, it is assumed that the production block is comprised of three sub-blocks: (1) agriculture, (2) manufacturing, and (3) services. The selection of the sectors is primarily based on the structure of the economy. However, data availability constraints have also played a role in the selection of sectors for disaggregation of production. In this block there is a mixture of stationary and non-stationary variables; in situation like this ARDL modelling is a better option. In the following subsections the distinct subsectors of the Production Block are described emphasizing appropriate macro channels, while in Section 5.2 a limited set of model equations are discussed.

10.1.1.1. Agriculture Sector

The long-run and short-run results of the production function for agriculture sector are reported in Equations (10.1) and (10.2) respectively. The results reported by Eq (10.1) suggest that infrastructure, credit disbursed to agriculture sector and water availability play a major role in the long- run productivity of the agriculture sector, with the impact of water availability and infrastructure being greater relative to credit disbursement.

Table 10.1: Agriculture Production Long Run Estimates

$y_{ta} = -9.990 + 1.350IFRS_t + 0.688w_t + 0.577CD_{ta}$ (10.1)			
(SE) (2.570) (0.253) (0.208) (0.061)			
t:	1972-2014		
Sigma:	0.299	**RSS:**	3.496
Adj. R^2:	0.969	**F (1,42):**	0.000 [0.000]**
		Log-likelihood:	0.000

The ADF statistic used to test the stationarity of the residuals is equal to -3.916 (Table 10.2), which is higher than the critical values, confirming the long-run relationship between the variables.

Table 10.2: ADF Test of Residuals from Agriculture Production Function

ADF Statistics:	-3.916	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The short-run estimates of agriculture value added are reported in Eq (10.2). It can be observed that in the short-run agriculture sector value added lagged by one year, and credit disbursed to agriculture sector influence agriculture value added positively. The coefficient of the ECT is -0.134, which indicates that the ECM is very slow. Finally, the estimated short -run model fits very well as indicated by the diagnostic statistics.

Table 10.3: Short Run Estimates of Long Run Agriculture Production Function

$\Delta y_{ta} = 0.562\Delta y_{t-1a} + 0.241\Delta CD_{ta} - 0.134ECT_{t-1}$ (10.2)			
(SE) (0.115) (0.089) (0.057)			
t:	1974 – 2014		
Sigma:	0.091	RSS:	0.315
Log Likelihood:	41.625		
AR 1-2 Test:	F (2, 36) = 4.641 [0.016]*		
ARCH 1-1 Test:	F (1, 39) = 0.104 [0.748]		
Normality Test:	Chi² (2) = 2.503 [0.286]		
Hetero Test:	F (6, 34) = 0.238 [0.961]		
Hetero-X Test:	F (9, 31) = 0.754 [0.658]		
RESET23 Test:	F (2, 36) = 3.609 [0.037]*		

10.1.1.2. Manufacturing Sector

The value added in manufacturing sector is significantly explained by infrastructure, import of machinery and raw material provided by agriculture sector to industries in the long-run. Capital stock turns out to be insignificant in the determination of output of the manufacturing sector. The long-run elasticities for infrastructure, import of machinery, and raw material are respectively 0.436, 0.166, and 0.774.

Table 10.4: Manufacturing Production Function Long Run Estimates

$y_{tm} = -4.300 + 0.436IFRS_t + 0.166IMM_t + 0.744DRM_t$ (10.3)			
(SE) (0.759) (0.083) (0.034) (0.030)			
t:	1972-2015		
Sigma:	0.072	**RSS:**	0.204
Adj. R²:	0.998	**F (1,42):**	0000 [0.000]**
Adj.R²:	0.000	**Log-likelihood:**	54.037

The ADF statistic of residual of long run equation is -3.081 (Table 10.5) which is significant and confirms a valid long-run relationship between manufacturing value added and its determinants.

Table 10.5: ADF Test of Residuals from Manufacturing Production Function

ADF Statistics:	-3.081	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The magnitude of the error-correction term is -0.480 (Table 10.6) suggesting that it takes more than 2 years to correct all the deviations to achieve long-run equilibrium. The diagnostic tests do not indicate any misspecification problem. Overall, the result for the manufacturing sector is quite satisfactory. The short-run ECM model corresponding to the long-run manufacturing value added relationship is given by Eq (10.4). In the short-run the manufacturing value added lagged by one year, agriculture value-added and imports of machinery are found to be influencing manufacturing value-added positively and significantly.

Table 10.6: Short Run Estimates of Long Run Manufacturing Production Function

$$\Delta y_{mt} = 0.385\Delta y_{mt-1} + 0.415\Delta dr_{mt} + 0.149\Delta im_{mt} - 0.480ECT_{t-1} \quad (10.4)$$

(SE) (0.112) (0.104) (0.050) (0.137)

t:	1973 – 2015		
Sigma:	0.057	RSS:	0.121
Log Likelihood:	61.248		
AR 1-2 Test:	F (2, 35) = 0.242 [0.787]		
ARCH 1-1 Test:	F (1, 39) = 0.026 [0.873]		
Normality Test:	Chi^2 (2) = 1.794 [0.408]		
Hetero Test:	F (8, 32) = 0.503 [0.845]		
Hetero-X Test:	F (14, 26) = 0.946 [0.528]		
RESET23 Test:	F (2, 35) = 4.198 [0.023]*		

10.1.1.3. Services Sector

The estimation of the services sector value added suggests that services contribution to the total production is significantly determined by real aggregate demand in the long-run. The contribution of real aggregate demand in the services value added is 2.860 in the long -run.

Table 10.7: Direct Tax Revenues Long Run Estimates

$$y_{st} = -17.800 + 2.860rad_t \quad (10.5)$$

(SE) (1.550) (0.142)

t:	1972-2014		
Sigma:	0.580	**RSS:**	13.786
Adj. R^2:	2.091	**F (1,42):**	0000 [0.000]**
Adj.R^2:	0.000	**Log-likelihood:**	-36.556

The ADF statistic of residuals of long run relation is found to be -0.550, which is insignificant indicating no long-run relationship between services value added and real aggregated demand.

Table 10.8: ADF Test of Residuals from Long Run Direct Tax Revenue Function

ADF Statistics:	-0.550	
Lags:	1	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

On changes in services value added and real aggregate demand, we employ an ARDL (1) model with assumption of at most one common factor. Following general to specific modelling technique of Davidson *et al.* (1978) we came up to specific relation presented by Eq (10.6). The results suggest that in short run change in services sector value added depends on change in real aggregate demand positively. Despite a low value of R^2, the short-run model does not have any problem of serial correlation, functional form, non-normality of residuals and heteroscedasticity.

Table 10.9: Short Run Estimates of Long Run Direct Tax Revenue Function

	$\Delta y_{st} = 0.139 + 0.404 \Delta rad_t$		**(10.6)**
(SE) (0.011) (0.137)			
t:	1974 – 2014		
Sigma:	0.064	RSS	0.159
Log Likelihood	55.675		
AR 1-2 Test:	$F(2, 37) = 0.651$ [0.528]		
ARCH 1-1 Test:	$F(1, 39) = 0.030$ [0.864]		
Normality Test:	$Chi^2(2) = 27.865$ [0.000]**		
Hetero Test:	$F(2, 38) = 1.228$ [0.304]		
Hetero-X Test:	$F(2, 38) = 0.000$ [0.000]		
RESET23 Test:	$F(2, 37) = 3.557$ [0.039]*		

10.1.2. Aggregate Demand Block

10.1.2.1. Private Consumption

Eq (10.7) reports the long-run estimates of private consumption. It can be seen from the results that in the long-run real disposable income and money supply exert positive and significant impact on real private consumption. The marginal propensity to consume (mpc) is equal to 0.36, which implies that individuals spend only 36 percent of their income on consumption in the long run. This means that marginal propensity to save out of real disposable income is moderate $(1 - 0.36 = 0.64)$.

Table 10.10: Private Consumption Long Run Estimates

	$c_{pt} = 0.357 y_{dt} + 0.742 rm_t$			(10.7)
(SE) (0.028) (0.023)				
t:	1972-2014			
Sigma:	0.141	**RSS:**	0.816	
Log-likelihood:	24.220	**F (1,42):**	0000 [0.000]**	

The ADF statistic for testing the non-stationarity of the residuals is -1.910 (Table 10.11), higher than that of critical value at the 10 percent level of significance which supports the existence of a long-run relationship between real private consumption, real disposable income and real money balances. Therefore, the short-run dynamics are estimated in the form of an ECM model represented by Eq (10.8).

Table 10.11: ADF Test of Residuals from Long Run Private Consumption Function

ADF Statistics:	-1.910	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

In the short run, changes in consumption in the previous period have a substantial effect on consumption in the present period. Also change in previous year income has significant effect on current consumption. Based on model diagnostics, the real interest rate was dropped from both long run and short run estimates. This may reflect the fact that interest rates were not set at market rates. The error-correction term is negative and significant which confirms that the error-correction mechanism is working correctly, and the deviations are corrected at the rate of 30 percent per year to achieve the long-run equilibrium path. The diagnostic tests indicate no misspecification of the estimated model.

Table 10.12: Short Run Estimates of Long Run Direct Tax Revenue Function

$\Delta c_{pt} = 0.692\Delta c_{pt-1} + 0.596\Delta y_{pt-1} - 0.302ECT_{t-1}$			(10.8)
(SE) (0.101) (0.220) (0.098)			
t:	1974 – 2014		
Sigma:	0.090	RSS	0.293
Log Likelihood	52.298		
AR 1-2 Test:	F (2, 36) = 1.472 [0.000]		
ARCH 1-1 Test:	F (1, 36) = 1.608 [0.213]		
Normality Test:	Chi^2 (2) = 0.683 [0.711]		
Hetero Test:	F (6, 31) = 2.077 [0.085]		
Hetero-X Test:	F (9, 28) = 2.183 [0.055]		
RESET23 Test:	F (1, 37) = 1.182 [0.284]		

10.1.2.2. Government Consumption

Government consumption significantly depends on total government revenue and development expenditure relative to GDP. The relationship estimated in Eq (**10.9**) and results reported in Table 10.13 suggest that in the long-run development expenditure exerts a negative effect on government consumption, although the effect is as low as 27 percent, but it is statistically significant. Government revenue is expected to exert a substantial positive influence on government consumption.

Table 10.13: Government Consumption Long Run Estimates

$c_{gt} = 1.150 - 0.267exdev_t + 0.817r_{gt}$			(10.9)
(SE) (0.238) (0.115) (0.033)			
t:	1976-2014		
Sigma:	0.180	**RSS:**	1.162
Log-likelihood:	13.167	**F (1,42):**	0000 [0.000]**

The ADF statistic for testing the non-stationarity of the long run residuals is -2.057 (Table 10.14), indicating presence of a long-run relationship. Both the ratio of development expenditures to GDP and government revenues influence government consumption levels during the period under consideration.

Table 10.14: ADF Test of Residuals from Long Run Government Consumption

ADF Statistics:	-2.057	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Based on the result of the residuals test, an ECM is estimated to derive the short run relation, represented by Eq (10.10). The results reported by this equation reveal that government consumption lagged by one year and government revenue are significant determinants of government consumption in the short-run. However, government consumption lagged by one year is only significant at the 15 percent level of significance. The model passes all the diagnostic tests.

Table 10.15: Short Run Estimates of Long Run Government Consumption Function

$\Delta c_{gt} = 0.252\Delta c_{gt-1} + 0.500\Delta r_{gt} - 0.192ECT_{t-1}$				(10.10)
(SE) (0.172) (0.154) (0.098)				
t:	1973 – 2015			
Sigma:	0.101	RSS	0.355	
Log Likelihood	34.893			
AR 1-2 Test:	$F(2, 33) = 1.000$ [0.379]			
ARCH 1-1 Test:	$F(1, 33) = 1.148$ [0.292]			
Normality Test:	$Chi^2(2) = 14.032$ [0.001]**			
Hetero Test:	$F(6, 28) = 0.488$ [0.812]			
Hetero-X Test:	$F(9, 25) = 0.483$ [0.872]			
RESET23 Test:	$F(1, 34) = 4.551$ [0.040]*			

10.1.2.3. Private Investment

The long-run estimates of the real private investment are given by Eq (**10.11**). It is evident from the results that real private investment is significantly determined by real income, the ratio of private sector credit to GDP, and government investment. Real income is highly significant with a positive impact on real private investment. These results partially confirm the earlier findings by Guru-Gharana (2000) in the case of Pakistan. The positive and significant coefficient of real income verifies the existence of accelerator principle in the case of Pakistan.

Government investment has a crowding-out effect on real private investment. This finding of the crowding-out effect from government investment is against the majority of empirical studies, inter alia, Sakr (1993); Looney (1997); Looney and Frederiken (1997); Hyder and Qayyum (2001); Naqvi (2002); Atukeren (2005); and Rashid and Ahmad (2005). The crowding-out effect of government investment on real private investment implies the lead role played by private sector in economic activities. The real interest rate exerts no significant effect on private investment in the long-run. The absence of interest rate in the investment function indicates the absence of a channel through which monetary policy shocks can be transmitted to the real sector (Ra and Rhee, 2005).

Table 10.16: Private Investment Long Run Estimates

$i_{pt} = -42.000 + 3.560y_t - 0.390crpy_t - 0.128i_{gt}$ (10.11)			
(SE) (1.460) (0.140) (0.160) (0.070)			
t:	1972-2015		
Sigma:	0.149	**RSS:**	0.889
Log-likelihood:	23.420	**F (1,42):**	0000 [0.000]**

The corresponding value of the ADF statistic for the long run residuals stationarity is -2.864, indicating the presence of cointegration among the real private investment and its determinants.

Table 10.17: ADF Test of Residuals from Long Run Private Investment

ADF Statistics:	-2.684	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Based on the long-run estimates we have estimated short-run ECM model and Eq (10.12) reports the results. The short-run estimates suggest that real income is an important determinant of private investment with positive and significant coefficient. The private sector credit remains insignificant in the short-run. The lagged error-correction term is significant with theoretically expected sign. Diagnostic tests associated with the short-run ECM model do not detect any specification problem.

Table 10.18: Short Run Estimates of Long Run Private Investment

	$\Delta i_{pt} = 3.140\Delta y_t - 0.256ECT_{t-1}$			(10.12)
(SE) (0.321) (0.116)				
t:	1974 – 2015			
Sigma:	0.107	RSS:	0.454	
Log Likelihood:	35.485			
AR 1-2 Test:	F (2, 38) = 0.895 [0.417]			
ARCH 1-1 Test:	F (1, 38) = 1.080 [0.305]			
Normality Test:	Chi^2 (2) = 8.43 [0.015]*			
Hetero Test:	F (4, 35) = 0.317 [0.864]			
Hetero-X Test:	F (5, 34) = 0.285 [0.918]			
RESET23 Test:	F (1, 39) = 0.235 [0.631]			

10.1.3. Fiscal Block

10.1.3.1. Direct Tax Revenue

Eq (10.13) reports the long-run estimates for direct tax revenues ($dtxr = LNDTXR$). The result reveals that nominal income (ny) contributes positively to the collection of direct tax revenues, supporting the theoretical view that direct taxes are positively correlated with nominal income. The average tax rate remains insignificant; therefore, it has been excluded from the analysis. The estimated long-run elasticity of direct taxes with respect to nominal income is 1.224 showing that a one percent increase in nominal income translates into more than unity increase in direct taxes. This result is in line with previous findings of Mukarram (2001) and Chaudhary and Hamid (2001).

Table 10.19: Direct Tax Revenues Long Run Estimates

$$dtxr_t = -6.959 + 1.224ny_t \quad (10.13)$$

(SE) (0.423) (0.030)

t:	1972-2015		
Sigma:	0.349	**RSS:**	5.101
Adj. R²:	0.976	**F (1,42):**	1,716 [0.000]**
Adj.R²:	0.990	**Log-likelihood:**	50.411

The ADF test performed on the residuals generated by Eq (10.13) yields a statistic of -2.840 (Table 10.20), which is statistically significant, indicating a long-run relationship between direct tax revenue and nominal income.

Table 10.20: ADF Test of Residuals from Long Run Direct Tax Revenue Function

ADF Statistics:	-2.840	
Lags:	1	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Given the stationarity of the residuals, it is appropriate to estimate an ECM model as represented by Eq (10.14), and the results of this model are given in Table 10.21. The long-run direct tax elasticity with respect to nominal income(ny_t) is 1.220, whereas the corresponding short-run direct tax elasticity is 1.050. These results have very important implications for fiscal policy in Pakistan especially pertaining to the generation of revenues as a result of economic expansion. The ECT is negative and significant, implying the existence of cointegration among the variables.

Table 10.21: Short Run Estimates of Long Run Direct Tax Revenue Function

	$\Delta dtxr_t = 1.05\Delta ny_t - 0.313ECT_{t-1}$			(10.14)
(SE) (0.249) (0.111)				
t:	1973 – 2015			
Sigma:	0.250	RSS:	2.562	
Log Likelihood:	-0.377			
AR 1-2 Test:	F (2, 39) = 2.240 [0.1200]			
ARCH 1-1 Test:	F (1, 41) = 0.005 [0.944]			
Normality Test:	Chi^2 (2) = 75.130 [0.000]**			
Hetero Test:	F (4, 38) = 5.193 [0.002]**			
Hetero-X Test:	F (5, 37) = 5.444 [0.001]**			
RESET23 Test:	F (2, 39) = 9.334 [0.001]**			

10.1.3.2. Indirect Tax Revenue

As with direct tax revenue, the indirect tax revenue is assumed to depend on the nominal income. Equations (10.15) and (10.16) report the long-run and short run results respectively. Nominal income (ny_t) exerts a positive impact on indirect tax revenue in the long-run. The long-run elasticity of indirect tax revenue with respect to nominal income is 0.918, which implies that indirect tax system is neither regressive nor progressive.

Table 10.22: Indirect Tax Revenues Long Run Estimates

$$indtxr_t = -1.4 + 0.918ny_t \qquad (10.15)$$

(SE) (0.203) (0.014)

t:	1972-2015		
Sigma:	0.168	**RSS:**	1.179
Adj. R^2:	0.990	**F (1,42):**	4169 [0.000]**
		Log-likelihood:	17.187

The ADF statistic of residuals of the long run relation is -2.900 (Table 10.23), which implies the presence of an ECM among the variables.

Table 10.23: ADF Test of Residuals from Long Run Indirect Tax Revenue

ADF Statistics:	-2.900	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

In the short-run nominal income (ny_t) exerts positive impact on indirect tax revenue. The error-correction term is negative and significant implying the existence of cointegration among the variables (Table 10.24). The diagnostic tests suggest a good fit of the estimated model. Together with the direct tax revenue and indirect tax revenue, government consumption expenditure is determined by government revenue which, in turn, affects the monetary base (Musila, 2002).

Table 10.24: Short Run Indirect Tax Revenue Function

$$\Delta indtxr_t = 0.96\Delta ny_t - 0.204ECT_{t-1}$$				(10.16)
(SE) (0.078) (0.072)				
t:	1973 – 2015			
Sigma:	0.078	RSS	0.250	
Log Likelihood	49.690			
AR 1-2 Test:	F (2, 39) = 0.257 [0.775]			
ARCH 1-1 Test:	F (1, 41) = 0.092 [0.763]			
Normality Test:	Chi^2 (2) = 1.617 [0.446]			
Hetero Test:	F (4, 38) = 0.759 [0.559]			
Hetero-X Test:	F (5, 37) = 0.593 [0.706]			
RESET23 Test:	F (2, 39) = 1.389 [0.262]			

10.1.3.3. Current Expenditures

Government current expenditure is assumed to depend on nominal income which captures domestic economic activity. The long-run results are reported in Eq (10.17), and short run results are reported in Eq (10.18). The results show that nominal income (ny_t) exerts a positive impact on the current expenditure in the long-run. The long-run elasticity of current expenditure with respect to nominal income is 0.990 (Table 10.25).

Table 10.25: Current Expenditures Long Run Estimates

$$curexp_t = -1.660 + 0.990ny_t$$				(10.17)
(SE) (0.220) (0.015)				
t:	1976-2015			
Sigma:	0.151	**RSS:**	0.872	
Adj. R^2:	0.991	**F (1,38):**	4,306 [0.000]**	
		Log-likelihood:	19.762	

The ADF test statistic of residuals of long run relation is -2.050 (Table 10.26), confirming the presence of an ECM among the variables.

Table 10.26: ADF Test of Residuals from Long Current Expenditures

ADF Statistics:	-2.050	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

In the short-run nominal income (ny_t) positively impacts the current expenditure (Table 10.27). The error-correction term is negative and significant implying the existence of cointegration among the variables. The diagnostic tests suggest that the estimated model is correctly specified.

Table 10.27: Short Run Estimates of Long Run Direct Tax Revenue Function

$$\Delta curexp_t = 0.947\Delta ny_t - 0.198ECT_{t-1} \quad (10.18)$$

(SE) (0.102) (0.105)

t:	1976 – 2015
AR 1-2 Test:	F (2, 34) = 0.718 [0.491]
ARCH 1-1 Test:	F (1, 36) = 0.517 [0.477]
Normality Test:	Chi^2 (2) = 8.997 [0.011]*
Hetero Test:	F (4, 33) = 0.542 [0.706]
Hetero-X Test:	F (5, 32) = 0.421 [0.831]
RESET23 Test:	F (2, 34) = 1.678 [0.202]

10.1.4. Foreign Trade Block

10.1.4.1. Exports

Theoretically exports of goods and services are determined by world income, the real effective exchange rate and relative price of exports. Based on the functional form specified earlier, we have estimated the following long-run equation for exports.

It is evident from the results reported in Eq (10.19) that both the variables exhibit expected signs and are statistically significant at conventional level of significance in the long-run (Table 10.28). Foreign income came out to be insignificant suggesting that Pakistani exports are not much in demand in the world market, which reflects the actual trends observed. The relative price of exports is seen to influence real exports negatively.

Table 10.28: Export Function Long Run Estimates

$x_t = -18.400 + 2.050y_t - 0.722rpx_t$				(10.19)
(SE) (4.930) (0.307) (0.197)				
t:	1980-2015			
Sigma:	0.119	**RSS:**	0.466	
Log-likelihood:	27.170	**F (1,42):**	0.000 [0.000]**	

The estimated relationship between real exports of goods and services, and other variables in the model is found to be cointegrating as the ADF statistic for residuals stationarity is equal to -3.799 (Table 10.29), which is significant at the one percent level of significance.

Table 10.29: ADF Test of Residuals from Export Function

ADF Statistics:	-3.799	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Given the existence of a long-run relationship, we have estimated the ECM model represented by Eq (10.20) and Table 10.30 reports the results. In the short-run world real income and real domestic income exert positive and significant effect on real exports. The coefficient on the error-correction term has expected negative sign and is statistically significant, which implies that the deviations from the equilibrium path are corrected in the following period. Overall, the diagnostic statistics indicate that the model is well specified.

Table 10.30: Short Run Estimates of Long Run Export Function

$$\Delta x_t = 1.400\Delta y_t + 0.509\Delta y_t^f - 0.389ECT_{t-1} \tag{10.20}$$

(SE) (0.459) (0.165) (0.126)

t:	1982 – 2015		
Sigma:	0.076	RSS:	0.178
Log Likelihood:	41.036		
AR 1-2 Test:	$F(2, 29) = 2.864$ [0.073]		
ARCH 1-1 Test:	$F(1, 32) = 0.362$ [0.552]		
Normality Test:	$Chi^2(2) = 2.574$ [0.276]		
Hetero Test:	$F(6, 27) = 0.620$ [0.712]		
Hetero-X Test:	$F(9, 24) = 1.075$ [0.415]		
RESET23 Test:	$F(2, 29) = 1.962$ [0.159]		

10.1.4.2. Imports

The import of goods and services is estimated as a function of real domestic income, real effective exchange rate, relative price of imports and foreign capital inflows. The long-run and short-run estimates are reported in Equations (10.21) and (10.22) respectively. It can be seen from the results presented in Eq (10.21) and Table 10.31 that domestic real income and real effective exchange rate positively influence real imports of goods and services in the long-run.

Table 10.31: Import Function Long Run Estimates

$IM_t = -48.200 + 3.570 y_t + 1.240 REER_t$				(10.21)
(SE) (2.170) (0.094) (0.162)				
t:	1980 – 2015			
Sigma:	0.133	**RSS:**	0.586	
		Log-likelihood:	23.038	

The ADF test for stationarity of the residuals yields a statistic of -4.106 (Table 10.32), which is significant at the one percent level, confirming the presence of a long-run relationship among the variables.

The short-run model for import of goods and services is represented by Eq (10.22) and the results are in Table 10.33. The results suggest that only real domestic income produces a positive and significant impact on real imports in the short-run. The error-correction term is negative and significant confirming the existence of cointegration among the variables entered in the model. The overall fit of the model is good as indicated by the diagnostic statistics.

Table 10.32: ADF Test of Residuals from Long Run Imports

ADF Statistics:	-4.106	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Table 10.33: Short Run Estimates of Long Run Imports

$$\Delta IM_t = 2.530\Delta y_t - 0.340ECT_{t-1} \quad (10.22)$$

(SE) (0.348) (0.150)

t:	1980 – 2015		
Sigma:	0.102	RSS:	0.346
Log Likelihood:	31.136		
AR 1-2 Test:	F (2, 31) = 0.432 [0.653]		
ARCH 1-1 Test:	F (1, 33) = 0.118 [0.734]		
Normality Test:	Chi^2 (2) = 0.423 [0.809]		
Hetero Test:	F (4, 30) = 0.965 [0.441]		
Hetero-X Test:	F (5, 29) = 0.766 [0.582]		
RESET23 Test:	F (2, 31) = 3.650 [0.038]*		

10.1.5. Monetary and Price Block

10.1.5.1. Money Demand

The demand for broad money M/P or in logarithmic form $(m-p)$ is assumed to be influenced by real income (Y) as a scale variable and the nominal interest rate (i). It is evident from the estimates presented in Eq (10.23) above that real income (y) and nominal interest rate (i) display expected signs and are statistically significant in the long-run. The income elasticity of money demand is 1.320. This result is in line with earlier findings of Qayyum (2005) and Khan and Sajjid (2005) among others. The semi-interest elasticity of money demand of -0.015 is quite low. This implies that domestic financial market is not yet well developed, and the interest rates were not set at market rates before 1993.

Table 10.34: Money Demand Function Long Run Estimates

$$m - p = 9.930 + 1.320Y_t - 0.015i_t \quad (10.23)$$

(SE) (0.302) (0.020) (0.005)

t:	1972-2015		
Sigma:	0.080	**RSS:**	0.261
R^2:	0.991	**F (2,41):**	2205 [0.000]**
Adj.R^2:	0.990	**Log-likelihood:**	50.411

The *ADF* test for the non-stationarity of the residuals is -4.326, which is significant at the 5 percent level of significance, indicating significant long-run co-movements among the variables.

Table 10.35: ADF Test of Residuals from the Long Run Money Demand

ADF Statistics:	-4.326	
Lags:	1	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The results of the ECM model presented in Table 10.36 and represented by Eq (10.24) suggest that lagged real money balances, growth of real income and changes in short-term interest rate exert significant effects on the real money balances in the short-run. The error-correction term is correctly signed and statistically significant which shows that it takes on average 2 years for short-run deviations to converge to the long-run steady-state path. The correct sign and the significance of the error-correction term is an indication of the existence of a valid long-run relationship. The overall fit of the model is good as indicated by the various diagnostic tests.

Table 10.36: Short Run Estimates of Money Demand

$$\Delta(m-p)_t = 0.351\Delta(m-p)_t + 0.793\Delta y_t - 0.011\Delta i_t - 0.391ECT_{t-1} \quad (10.24)$$

(SE) (0.12) (0.198) (0.004) (0.103)

t:	1974 – 2015		
Sigma:	0.047	RSS:	0.083
Log Likelihood:	71.044		
AR 1-2 Test:	$F(2, 36) = 2.444$ [0.101]		
ARCH 1-1 Test:	$F(1, 40) = 3.613$ [0.065]		
Normality Test:	$Chi^2(2) = 0.018$ [0.991]		
Hetero Test:	$F(8, 33) = 2.210$ [0.052]		
Hetero-X Test:	$F(14, 27) = 1.305$ [0.267]		
RESET23 Test:	$F(2, 36) = 0.204$ [0.817]		

10.2. Simulations and Policy Forecasts

The purpose of this section is to provide analytically informed overview of the economy of Pakistan, with primary emphasis on the expected future performance of the economy.

10.2.1. In-Sample Forecasts

Well-specified individual behavioral equations are a prerequisite for a good macro-econometric model. From a statistical perspective, individual equation estimation should exhibit high goodness of fit, and the coefficient estimates should be statistically significant. However, good statistical properties in individual equations do not necessarily imply a good performance of the model as a whole. Rather, good forecasting performance of the model depends on how well the relations between behavioral equations are linked and if the coefficient estimates are economically reasonable. Tests need to be carried out to determine whether the predicted values from the system trace the actual history of the variables reasonably well to evaluate the forecasting performance of the model.

The model estimated for Pakistan in Chapter 4 is evaluated for in-sample predictive performance. The evaluation of in-sample performance is mainly done via conventional statistics such as MAPE and the Theil's inequality coefficient (U). Theil's inequality coefficient compares the forecast with the random walk and always lies between zero (perfect fit) and one (i.e., forecast is not better than that of random walk). The MAPE is not normalized but it should be as small as possible. If MAPE is zero, it means no error in forecasting. Table 10.37 summarizes the forecast evaluation for key endogenous variables.

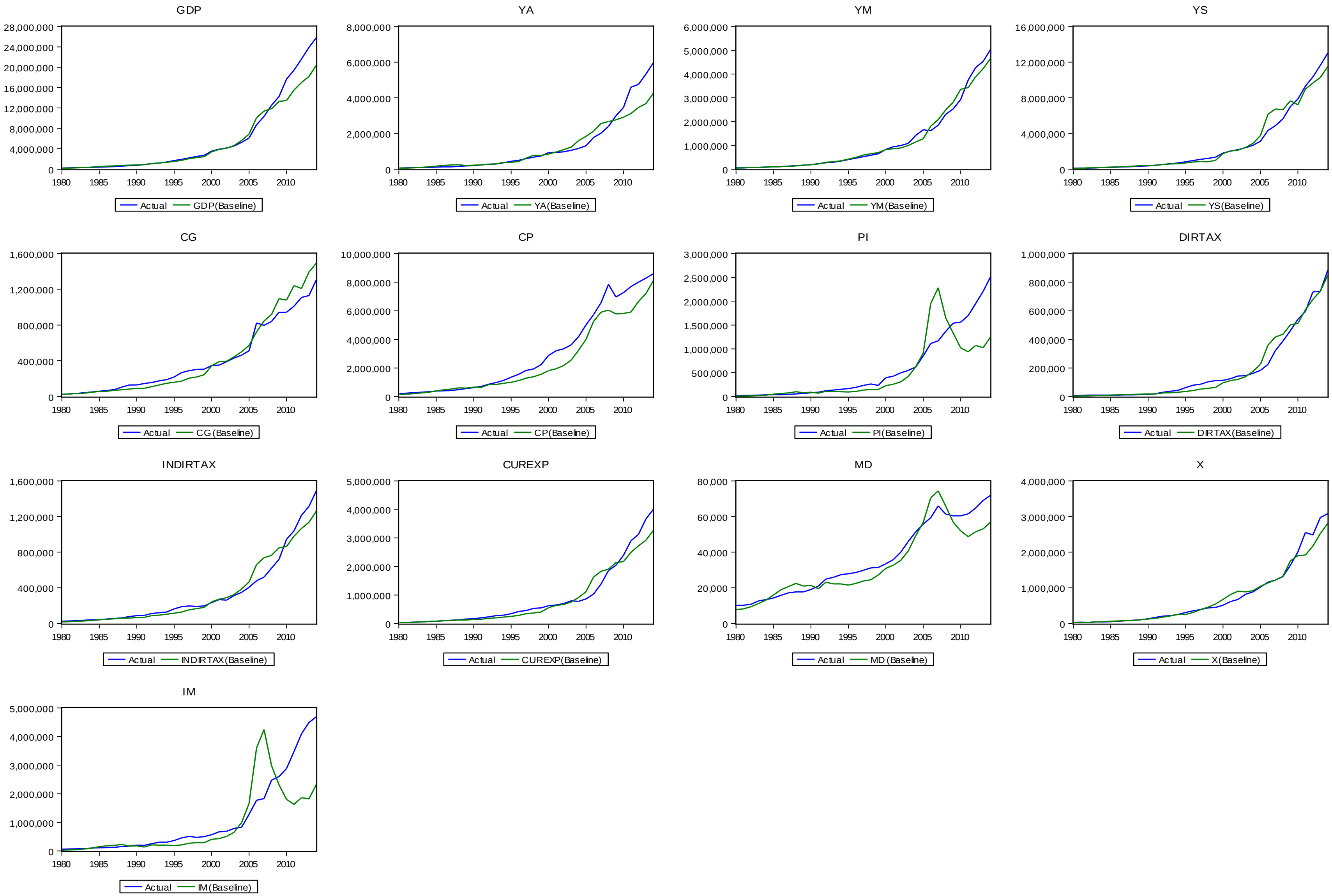
Table 10.37: Model Validation Statistics - Pakistan

	MAPE	Theil's Inequality (U)
Agriculture Value Added	1.68	0.01
Manufacturing Value Added	0.52	0.003
Services Value Added	0.84	0.01
Real Private Consumption	0.75	0.005
Real Government Consumption	1.24	0.007
Real Private Investment	2.76	0.01
Money Demand	1.1	0.01
Direct tax Revenues	2.68	0.02
Indirect tax revenues	1.33	0.007
Current Expenditures	1.02	0.006
Export Demand	0.82	0.005
Import Demand	2.37	0.01

The results in Table 10.37 show that the model is able to track the historical development of the economy reasonably well. The MAPE is reasonable and lies within the range of 0.52 to 2.76 percent for all endogenous variables. Similarly, the Theil's inequality coefficient (U) is less than unity and close to zero for all the endogenous variables. In other words, the overall forecasting ability of estimated equations is satisfactory.

Next, the model for the period 1980 to 2014 is solved to assess the in-sample forecasting ability of the model and compare the actual values for all the endogenous variables (estimated) with the in-sample simulated values. Figure 10.1 illustrates the paths of the ex-post simulation along with the actual values of the endogenous variables. The simulated values of each variable track the actual trajectories quite reasonably for almost all the estimated variables.

Figure 10.1: In-Sample Forecast for Pakistan Model - 1980 to 2014



10.2.2. Out-of-Sample Forecasts

The primary purpose of developing the macro-econometric model is to provide guidelines for macroeconomic planning and management by forecasting the future path of the economy. However, forecasting performance usually declines with the length of the forecasting horizon. In the case of Pakistan, considering the rapidly changing economic structure with the commencement of China Pakistan Economic Corridor (CPEC), it is more likely to be so. Taking these into consideration, the forecasting horizon is set at 5 years. But still results need to be interpreted with caution[89].

It follows that a set of assumptions are needed on the future values of exogenous variables including government policy variables. In particular, since policy variables have great influence on the course of the economy, it is important to set the future values of policy variables in a consistent way. No doubt, policy variables can be affected by the socioeconomic environment and political change, but in this case, it is not possible to go into these details due to limited information in certain cases. The projection of world output (foreign income) is taken from Global Economic Outlook; while for rest of the exogenous variables (including policy variables) we have employed ARIMA models to project the future values of a series based entirely on its own inertia. Based on this information we have solved the model for 2016 to 2020. Table 10.38 reports the out-of-sample forecasts for various relevant variables, while Figure 10.2 illustrates the projected

[89] Additionally, elections are due in 2018; possibility of change in political regime cannot be overruled. In case of change it may have an impact on the overall macroeconomic performance of the country.

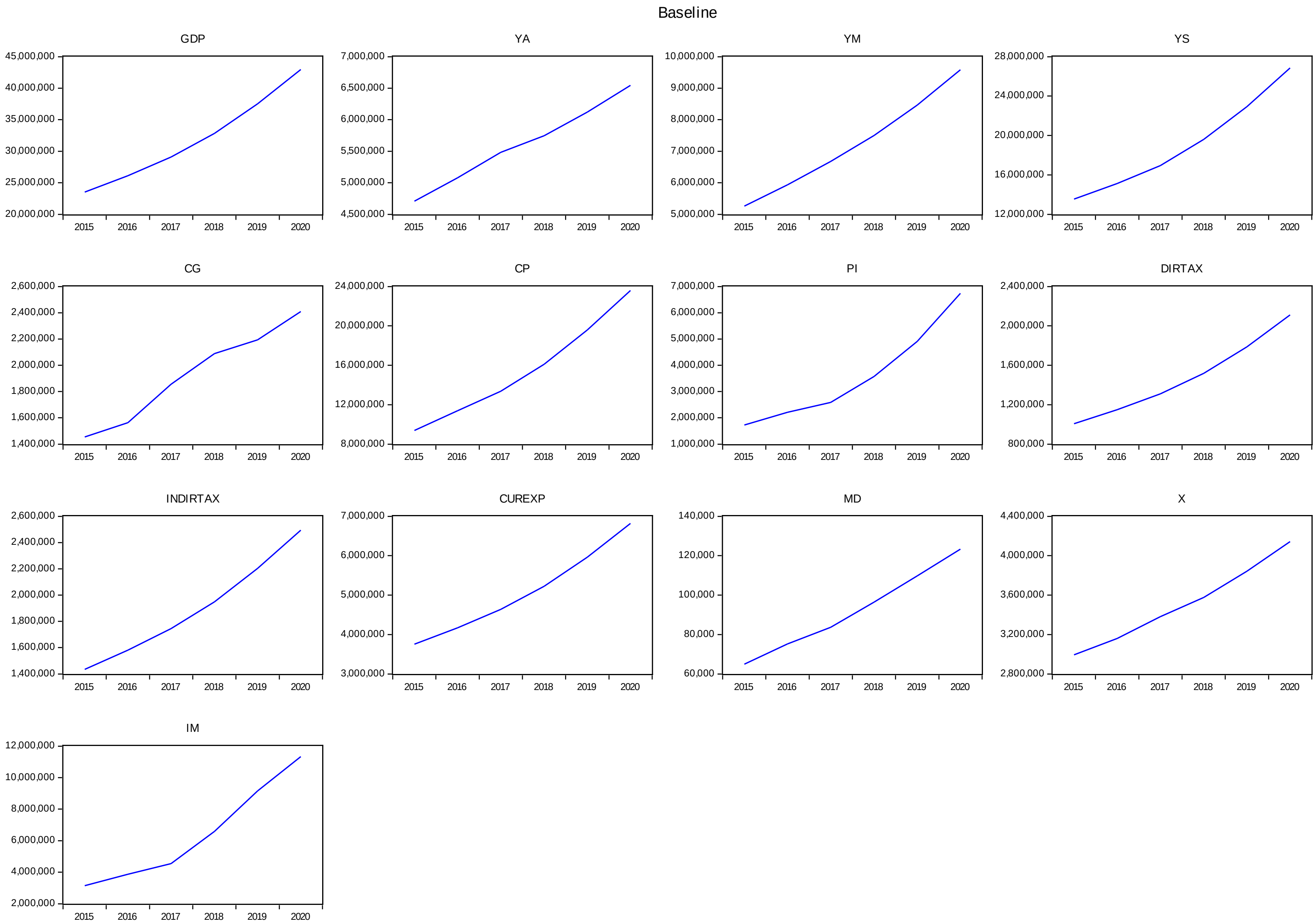
values of selected macroeconomic variables (2015 is actual data while 2016 to 2020 are projected values).

Table 10.38: Out-of-Sample Forecasts - Pakistan

	2016	2017	2018	2019	2020
Real GDP	5.4	7.4	6.6	8.6	9.3
Inflation	6.7	8.4	6.3	9.0	9.7
Real Value Added in Agriculture	1.1	-0.4	-1.4	-2.2	-2.4
Real Value Added in Manufacturing	5.6	3.9	5.7	3.6	3.2
Real Value Added in Services	4.7	3.4	8.9	7.4	6.8
Exports	5.5	7.1	5.7	7.4	7.8
Imports	23.3	17.5	44.9	38.9	23.7
Direct Taxes	14.0	14.1	15.9	17.7	18.1
Indirect Taxes	10.2	10.4	11.7	13.0	13.3
Current Expenditures	11.1	11.2	12.7	14.1	14.4
Private Investment	8.2	2.8	17.4	12.6	12.7
Fiscal Deficit in terms of GDP	5.7	3.8	4.5	4.2	5.5
External Deficit in terms of GDP	2.7	4.0	9.2	15.4	18.5

Real GDP is expected to grow by almost 8 percent from 2016 to 2020, supported mainly by manufacturing and services at constant prices of 2010 on the supply side. Assuming infrastructure growth (by almost 3 percent) and rising imports of machinery (by almost 5 percent) accompanied with strong domestic support would help manufacturing to grow by almost 4 percent at constant prices of 2010 (from 2016 to 2020). Similarly, services sector will grow by 6.6 at constant prices of 2010 (from 2016 to 2020). Value added in agriculture will grow by almost 7 per cent in nominal terms but in real terms it will grow negatively. On the supply side, services are expected to contribute about 63

Figure 10.2: Out-of-Sample Forecasts for Pakistan - 2015 to 2020



percent to GDP by 2020. With improvement in ease of doing business accompanied with increased supply of energy would help in raising the contribution of manufacturing to about 22 percent of GDP[90]. The contribution of agriculture to GDP will decline to about 15 percent of GDP by 2020[91].

In the case of Pakistan, credit to the private sector (in terms of GDP) has witnessed a noticeable decline since 2008 plunging from 29 percent in 2008 to merely 14 percent in 2014. But since 2015, to support economic growth, State Bank of Pakistan is maintaining a low policy rate (expansionary monetary policy) allowing domestic credit to expand.

Assuming the same policy, credit to private sector is expected to reach almost 24 percent of GDP by 2020; helping private investment to grow by about 11 percent. While private investment is expected to reach about 29 percent of GDP., the contribution of private household consumption as well as government consumption to GDP would remain almost the same. On the expenditure side, final consumption expenditure will continue to be the largest expenditure item in Pakistan accounting for about 93 percent of GDP in 2020.

The impetus to economic activity is expected to come mainly from an accommodative monetary policy and the consequent increase in private sector credit, especially for investment. Further, a steady increase in development spending and

[90] The expansion of the digital economy, the convergence of fixed, mobile and broadcast networks, the increasing connectivity of devices and objects, and the changes in social interactions and personal relationships that these developments bring about, is reshaping the manufacturing and services sectors in emerging Asian economies, including Pakistan.

[91] These estimates may slightly differ from actual data, given data limitations in the estimation of model. However, major trends are more or less similar.

continuing work on infrastructure and energy projects under CPEC, and persistent growth in private consumption would also play an important role in the overall growth prospects of the economy.

On the fiscal side, the policy of fiscal consolidation is expected to continue, with slight improvement in the pace of revenue collection. The projections of direct and indirect taxes reveal increasing trend. In terms of GDP, direct taxes will improve their share by almost one percentage point as a consequence of comprehensive reform program (currently underway)[92]; while the share of indirect taxes would remain the same. Similarly, current expenditure in terms of GDP is expected to decline to 15 percent by 2020 as a result of fiscal consolidation efforts by the government but without compromising the development projects. The adjustment will come initially on the back of scaling down in investment spending both at the federal and provincial level. With an exogenous growth of about 12.7 percent (generated using an ARIMA model) for development expenditures (about 3.9 percent of GDP); fiscal deficit will remain about 4 percent of GDP (from 2016 to 2020).

In Pakistan, net exports as a percentage of GDP (reflecting widening of trade deficit) has decreased over the years (from 2010 to 2016) despite the fall in commodity and fuel prices (major import item) since 2015. Pakistan's export earnings are declining since 2014. While the recent decline in exports has been attributed to global developments; as the price impact of global economic conditions is negative for many of the Pakistan's textile export

[92] Broadening of tax base and other administrative measures.

items[93]. Both exports of goods and services and imports of goods and services are projected to rise from 2016 to 2020 only in nominal terms[94]. However, imports are expected to increase much faster than exports. Under CPEC, import of machinery plus duty exemptions on other imported item for CPEC related projects is expected to continue. Additionally, crude oil prices (major item in Pakistan's import basket) are expected to rise, thus increasing the value of our imports. Consequently, trade deficit will rise significantly by 2020.

Prices are estimated exogenously due to data limitation using ARIMA. Inflation in Pakistan will rise again from 3 percent in 2015 to almost 10 percent in 2020; rising oil prices and prices of other commodities[95] in the international market along with stronger domestic demand will have a positive impact on inflation in future. Additionally, the increase in prices will also be driven by exchange rate pass through to domestic prices.

Overall, the economy is expected to benefit from higher development spending by the Government, accommodative monetary policy and progress on CPEC-related projects. Additionally, an added impetus to growth would come from the consolidation in global economic recovery. While the real sector of the economy presents an encouraging picture for the medium term, the external account will remain a cause of concern from the

[93] In 2016, Pakistan witnessed a further fall in exports despite government's support package to boost exports because of the decline in textile exports. For details see State Bank Annual Report, 2016.

[94] In real terms exports will grow negatively from 2016 to 2020 (-0.5 percent); while imports will grow by about 21 percent.

[95] As per the World Bank's commodity forecast, energy and non-energy commodity prices will continue to rise by 2030. (available at: http://pubdocs.worldbank.org/en/678421508960789762/CMO-October-2017-Forecasts.pdf). International fuel prices as well as other commodity prices have a crucial role behind inflation rates in Pakistan.

perspective of macroeconomic stability. Despite the recovery in exports, Pakistan's balance of payments will continue to remain under pressure on account of surging imports. The balance of payments position is particularly vulnerable for Pakistan at the current level of reserves.

For Pakistan, foreign direct investment (FDI), multilateral, bilateral, and private debt-creating flows are expected to be the main financing sources in the medium-term. To meet external financing needs, the government will continue to access international markets. Remittances will play an important role to finance the current account deficit. However, slower growth in Gulf Cooperation Council (GCC) countries will affect migrants' employment options and growth in remittances[96].

10.3. Conclusion

This chapter has presented a comprehensive macro-econometric model of Pakistan's economy covering all the major building blocks including production, aggregate demand, fiscal and monetary framework, and foreign trade and capital inflows. The production block has estimated the supply side of the economy focusing on all the major commodity producing sectors including manufacturing, agriculture and services. The model has been used to generate forecasts of key macroeconomic variables in the medium term. The results show that while the economy will remain vulnerable on account of rising external imbalances, the manufacturing and services sector are likely to post robust growth

[96] World Bank. 2018. South Asia Economic Focus, Spring 2018: Jobless Growth? Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/29650 License: CC BY 3.0 IGO.

in the medium term. Also, prudent macro-economic management is expected to help reduce fiscal deficit through increase in direct and indirect revenues and targeted expenditure towards productivity-enhancing spending. Pakistan needs to urgently tackle its ballooning current account deficit that is threatening macroeconomic stability and may pose a significant risk to economic growth in the short to medium term.

Chapter 11 - Tajikistan: Modelling Exercise and Forecasts

The modelling exercise for Tajikistan has focused on key macroeconomic variables for which time series data of adequate duration was available. The model specifications have also been dictated by data availability and consequently there may be some missing variable bias.

11.1. Modelling Exercise

11.1.1. Production Block

To model the production activities, we have disaggregated the production into three major sub-sectors: (1) agriculture, (2) manufacturing, and (3) services. The selection of the sectors is primarily based on the structure of the economy. However, data unavailability constraints have also played a role in the selection of sectors for disaggregation of production. Because of short data span the actual effect of regressor on regressand may not be observed properly and we might find unusual relation between dependent and independent variables; the results should thus be interpreted cautiously. Unavailability of some relevant regressor may cause omitted variable bias that may appear in residual analysis.

In the production block only one model has been estimated due to data constraints; i.e. for services sector value added. Analysis of the remaining sectors has been presented in terms of the time series properties.

11.1.1. Services Sector

The estimation of the services sector value added model in Table 11.1 suggests that services contribution to the total production is significantly determined by aggregate demand in the long-run as represented by Eq (11.1). The contribution of aggregate demand in the services value added is 2.890 in the long -run.

Table 11.1: Services Sector Long Run Estimates

$y_t^s = 43.900 + 2.890ad_t$				(11.1)
(SE) (17.000) (0.764)				
t:	1993 – 2013			
Sigma:	0.835	**RSS:**	13.260	
Log-likelihood:	24.971	**F (1, 19)**	14.31 [0.001]**	

The *ADF* statistic for test of stationarity of residuals of the long run relation is -2.7677 (Table 11.2), which is significant, indicating a long-run relationship between services value added and aggregate demand in the Tajikistan economy.

Table 11.2: ADF Test of Residuals from Long Run Services Sector Function

ADF Statistics:	-2.768	
Lags:	**1**	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The short-run ECM model corresponding to the long-run services value added relationship is given by Eq (11.2). The results suggest that in the short run change in services sector value added depends on lag of change in aggregate demand positively (Table 11.3). The short-run model should be interpreted with caution as the ECT confirming the long run relation is negative and only marginally significant.

Table 11.3: Short Run Estimates of Long Run Services Sector Function

$\Delta y_t^s = 0.179\Delta y_t^d + 1.390\Delta ad_{t-1} - 0.226ECT_{t-1}$ (11.2)			
(SE) (0.068) (0.438)(0.123)			
t:	1995 – 2013		
Sigma:	0.290	RSS:	1.346
Log Likelihood:	30.626	F (2, 16)	5.516 [0.015]*
Adj. R^2:	-1.814		
AR 1-2 Test:	F (2, 14) = 0.824 [0.459]		
ARCH 1-1 Test:	F (1, 17) = 1.734 [0.205]		
Normality Test:	Chi^2 (2) = 3.027 [0.220]		
Hetero Test:	F (4, 14) = 2.807 [0.067]		
Hetero-X Test:	F (5, 13) = 2.602 [0.077]		
RESET23 Test:	F (2, 14) = 4.506 [0.031]*		

11.1.2. Aggregate Demand Block

11.1.2.1. Private Investment

As a result of the limited number of observations (1992-2013; t = 21), estimations for the private investment model represented by Eq (11.4) should be considered cautiously. Table 11.4 reports the final ARDL estimates for private investment ($i_t^p = LI_t^p =$ log of private investment); automatic model selection technique is employed to derive the final model. ARDL modelling is appropriate for a mix of distinct order of integrated variables just as in this case. The result reveals that government investment contributes positively to private investment. It is often suggested that government investment complements private investment instead of crowding-out in developing countries (Hossain and Razzaque, 2003). The long run elasticity is calculated by solving ARDL equation. The estimated long-run government investment elasticity of private investment is 0.689 in Tajikistan economy.

Table 11.4: ARDL Estimates of Long Run Private Investment Function

	$i_t^p = 0.323 i_{t-1}^p + 0.689 i_t^g$			(11.3)
(SE) (0.083) (0.085)				
t:	1961 – 2014			
Sigma:	0.132	RSS:	0.333	
Log Likelihood:	13.716			
AR 1-2 Test:	F (2, 17) = 1.860 [0.186]			
ARCH 1-1 Test:	F (1, 19) = 0.136 [0.716]			
Normality Test:	Chi^2 (2) = 0.001 [1.000]			
Hetero Test:	F (4, 16) = 0.232 [0.916]			
Hetero-X Test:	F (5, 15) = 0.677 [0.648]			
RESET23 Test:	F (2, 17) = 2.767 [0.091]			

11.1.3. Fiscal Block

Due to data constraints, the econometric model for the fiscal block is restricted to the estimation of government expenditure which plays a key role in the fiscal policy.

11.1.3.1. Government Expenditure

Again, on account of the limited number of observations (1992-2013) in the Fiscal Block, estimations should be considered cautiously. Table 11.5 reports the final ARDL estimates for government expenditure $\left(ex_t^g = LEX_t^g = \log of\ Government\ Expenditure\right)$ based on the model given in Eq (11.4). ARDL modelling is appropriate for mix of distinct order of integrated variables as in this case. The result reveals that nominal income (ny) contributes positively to government expenditure.

Table 11.5: ARDL Estimates for Government Expenditure Estimates

$$ex_t^g = 2.220 + 0.769ex_{t-1}^g + 0.138ny_t \quad (11.4)$$

(SE) (1.090) (0.058)(0.023)

t:	1992 – 2013		
N:	22	Parameters:	3
Sigma:	0.080	RSS:	0.122
R2:	0.961	F (2, 19):	236.100 [0.000]**
Adj. R2:	0.957	Log Likelihood:	25.917
AR 1-2 Test:	F (2, 17) = 2.709 [0.095]		
ARCH 1-1 Test:	F (1, 20) = 0.060 [0.809]		
Normality Test:	Chi^2 (2) = 6.622 [0.037]*		
Hetero Test:	F (4, 17) = 0.797 [0.544]		
Hetero-X Test:	F (5, 16) = 0.866 [0.525]		
RESET23 Test:	F (2, 17) = 0.526 [0.601]		
Portmanteau (3):	Chi^2(2) = 5.735 [0.057]		
D-W statistic:	DW = 1.624		

The coefficient for inflation turned out to be insignificant, while in case of Kazakhstan and Azerbaijan the effect of inflation remained very nominal at almost zero percent. This result is in line with the theoretical view that government expenditure is positively correlated with nominal income. Long run elasticity for nominal GDP has been estimated by solving the ARDL equation. The estimated long-run income elasticity of government expenditure income is 0.597, indicating that a one percent increase in nominal income translates into approximately 60 percent increase in government expenditure.

11.1.4. Foreign Trade Block

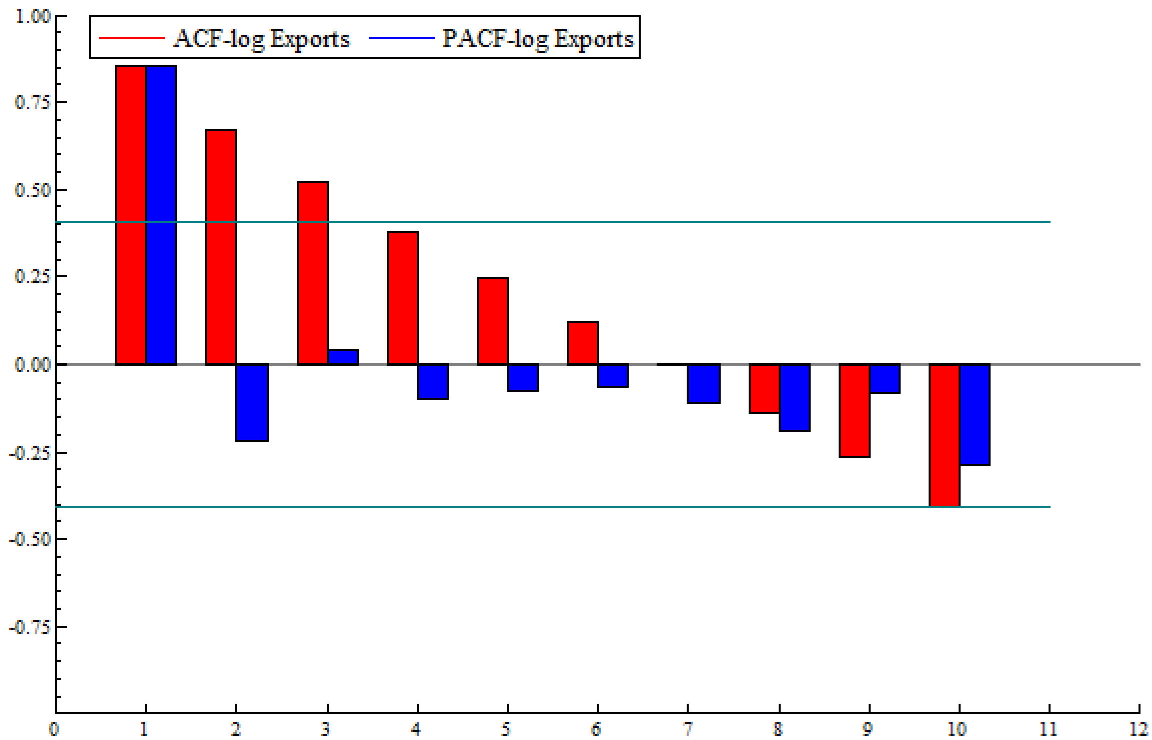
A brief discussion on the trend of exports and imports of Tajikistan economy is presented here. Contemporary simulation techniques are employed and projected trends for exports and imports are also estimated.

Analysis of ACF and PACF of the variables yields insights on the structure of the macroeconomic variables. From ACF and PACF plots we can get an idea for Autoregressive and Moving average structure of the series that helps in employing appropriate simulation technique.

11.1.4.1. Exports

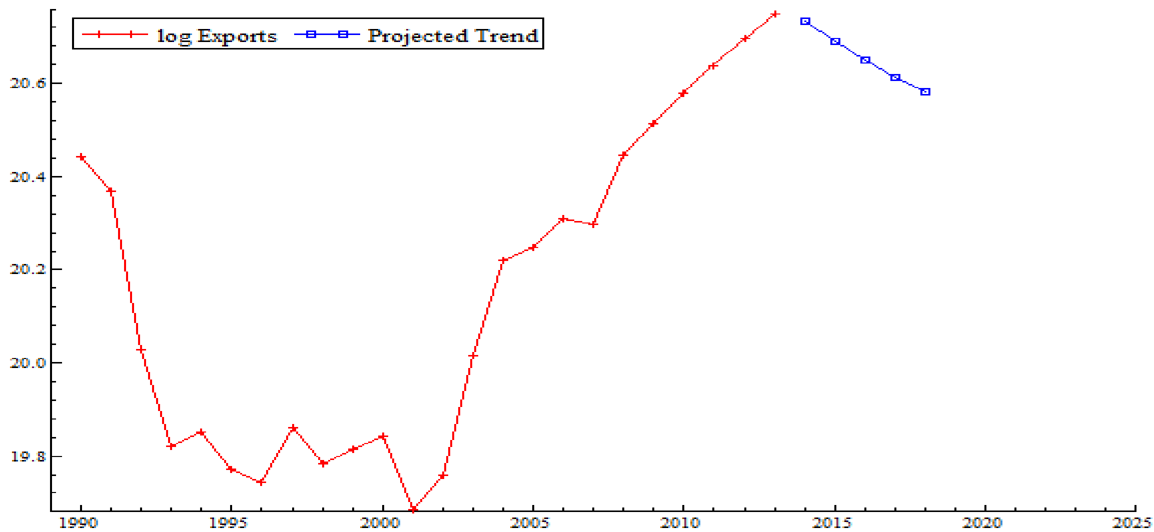
Theoretically, exports of goods and services are determined by world income, the real effective exchange rate and relative price of exports. Based on the functional form specified earlier, we lack adequate number of observations for the relevant macro variables required to estimate a robust macro-econometric model for Exports in the Tajikistan economy. Therefore, a discussion on present and projected trends of exports is presented here. Figure 11.1 presents ACF and PACF for log exports. The figure clearly indicates an ARMA process which fades out after few lags.

Figure 11.1: ACF and PACF Plots for Log of Real Exports



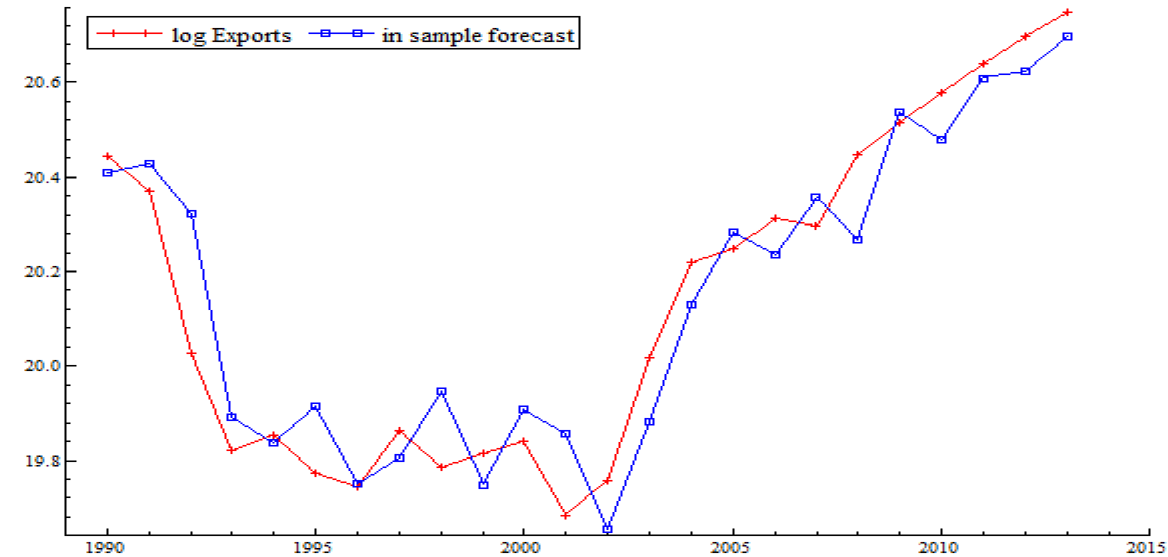
With this short data span, an ARFIMA (1,0,1) process is employed to estimate projected trend for real exports (log-likelihood: 17.750, T = 1990 – 2013). Figure 11.2 presents projected trend for log real exports from 2014 to 2018. A decrease in exports is projected through 2014-2018.

Figure 11.2: Projected and Actual Trends for Log of Real Exports - 2014 to 2018



Trends of in-sample forecasts, for both actual and predicted series indicate how closely the estimated model predicts the actual series (Figure 11.3). After a sharp decline in 2001 a continuous increasing trend of exports can be seen in sample 1990-2013.

Figure 11.3: In-sample Actual and Forecast Trends for Log of Exports - 1990 to 2013

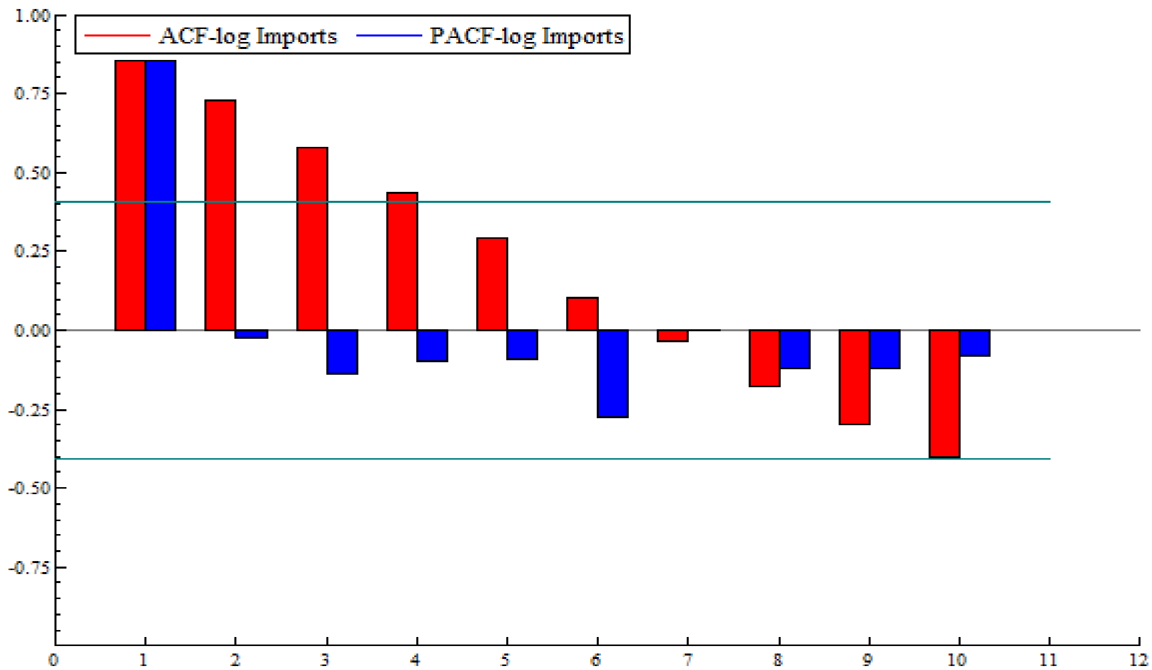


11.1.4.2. Imports

The import of goods and services is estimated as function of real domestic income, real effective exchange rate, relative price of imports and foreign capital inflows.

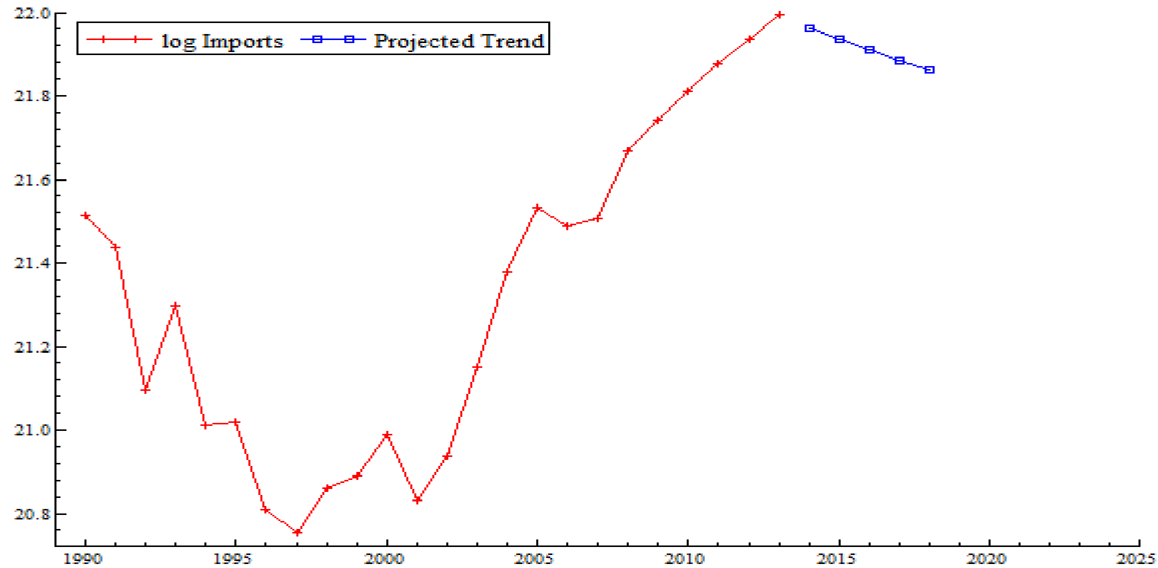
We lack data for relevant macro variables to estimate a macro-econometric model for imports into the Tajikistan economy. We continue with discussion on trends and present projected trends of imports. Figure 11.4 below presents ACF and PACF for log imports. The graph clearly indicates an ARMA process which fades out after few lags.

Figure 11.4: ACF and PACF Plots for Log of Real Imports



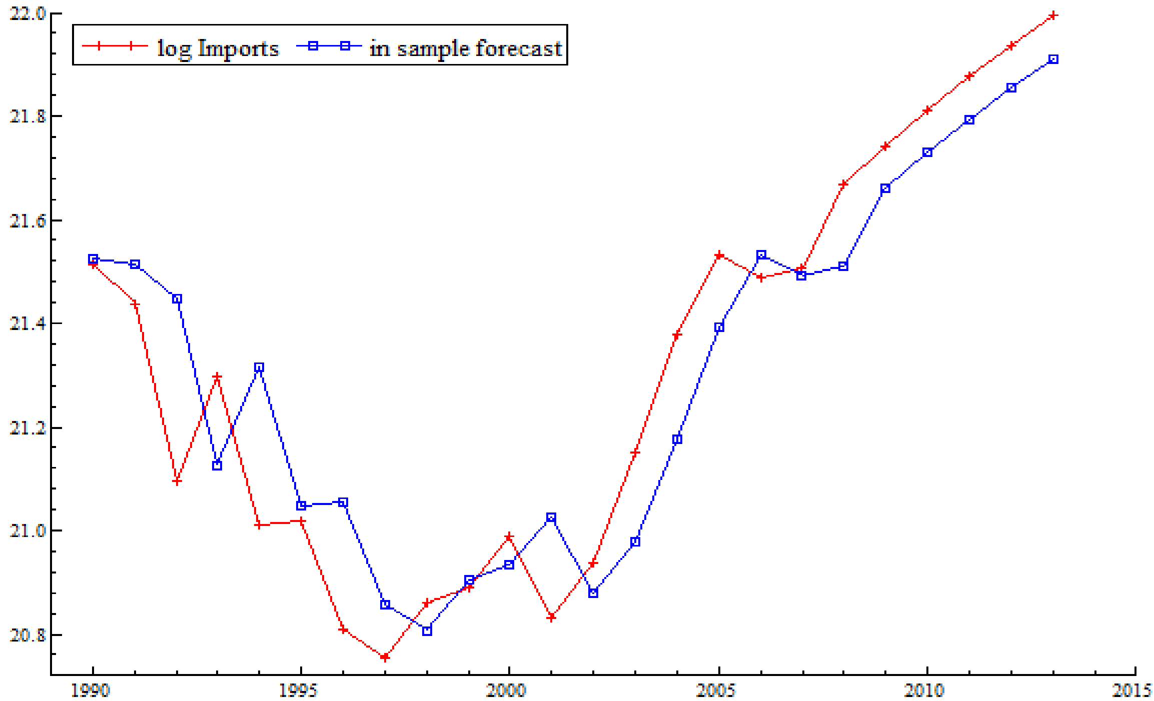
With a short data span, an ARFIMA (1,0,0) process is applied to generate the projected trend for real imports (log-likelihood: 10.844, T = 1990 – 2013). Figure 11.5 presents projected trend for log real imports from 2014 to 2018. A decrease in imports is projected through 2014-2018.

Figure 11.5: Actual and Projected Trends for Log of Real Imports - 2014 to 2018



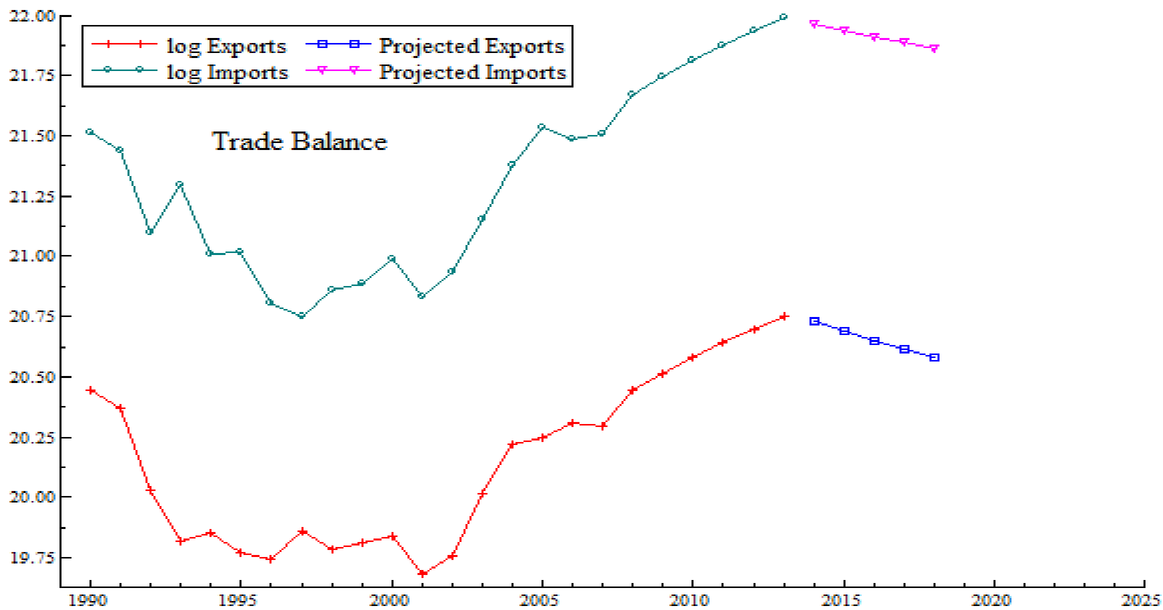
In-sample forecasts, for both actual and the predicted series of imports can be seen in Figure 11.6. The figure indicates how closely our model predicts the actual series. A continuous increasing trend of imports can be seen in sample 1990-2013.

Figure 11.6: In Sample Actual and Forecast Trends for Log of Imports - 1990 to 2013



From trends in the balance of trade (Figure 11.7), it is observed that real imports remained higher than exports throughout the sample span as well as in projected trends.

Figure 11.7: Balance of Trade - 1990 to 2018



11.1.5. Monetary and Price Block

Due to unavailability of data on macro variables for Tajikistan economy, a macro-econometric model for the monetary and price block of the economy cannot be presented. However simulated projections of some macro variables are presented followed by brief explanations.

To explore the structure of macro variable we analyze ACF and PACF of the macro variable. The ACF and PACF plots reveal the Autoregressive and Moving average structure of the series that helps in employing appropriate simulation technique.

11.1.5.1. Real Income Per Capita

Figure 11.8 presents ACF and PACF of log real GDP per capita. The graph clearly indicates ARMA process which fades out quickly. With a short data span, we employ ARFIMA (1, 0.456, 0) process to get projected trend for real GDP per capita (log-likelihood: 25.283 , T = 1990 – 2015).

Figure 11.8: ACF and PACF Plots for Log of Real GDP Per Capita

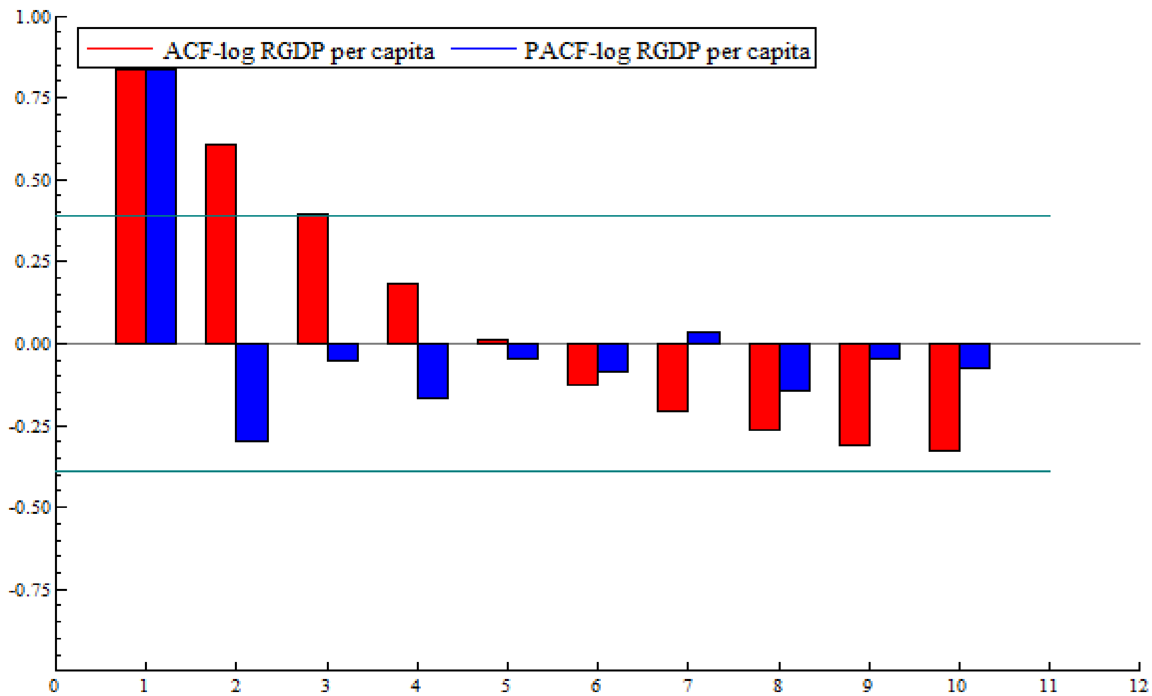


Figure 11.9 presents projected trend for log real income per capita from 2016 to 2020. A clear increasing trend can be seen throughout the projected period 2016 – 2020., showing positive economic outlook for Tajikistan's economy.

Figure 11.9: Actual and Projected Trends for Log Real GDP Per Capita - 2016 to 2020

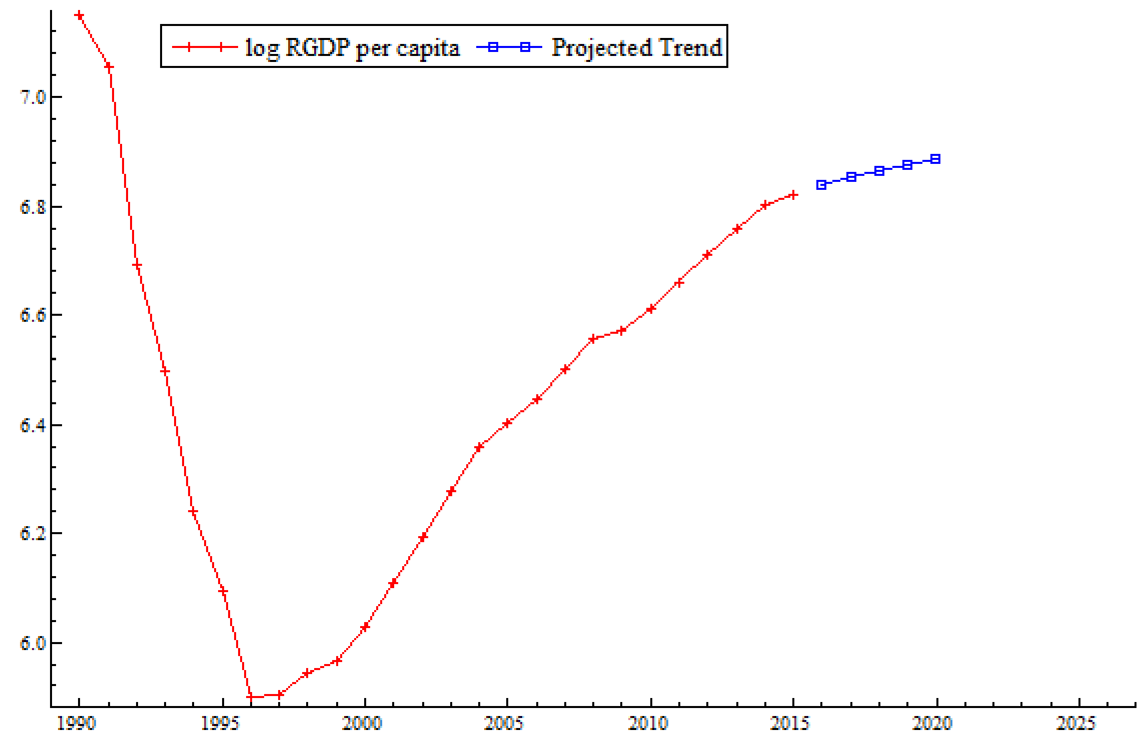
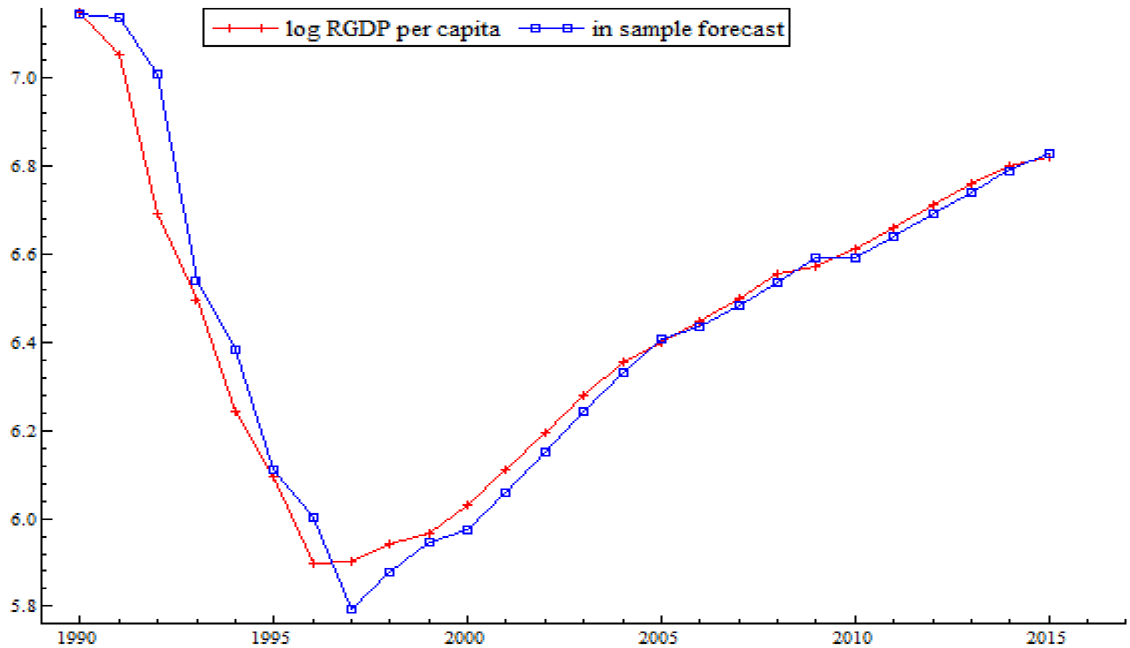


Figure 11.10 presents in-sample forecasts for both actual and predicted series and the graph indicates how closely the model predicts the actual series. After a sharp decline in 1997, a continuous increasing trend of real income per capita can be seen clearly which indicates the growth prospects of Tajikistan's economy.

Figure 11.10: In Sample Actual and Forecast Trends - Log Real GDP Per Capita: 1990 to 2015



11.1.5.2. Money Demand

Figure 11.11 presents ACF and PACF for log money supply. The figure clearly indicates ARMA process which fades out quickly. We employ ARFIMA (1, 0.47, 0) process to get projected trend for log money supply (log-likelihood 4.975, T = 2001 – 2015).

Figure 11.11: ACF and PACF Plots for Log of Money Supply M2

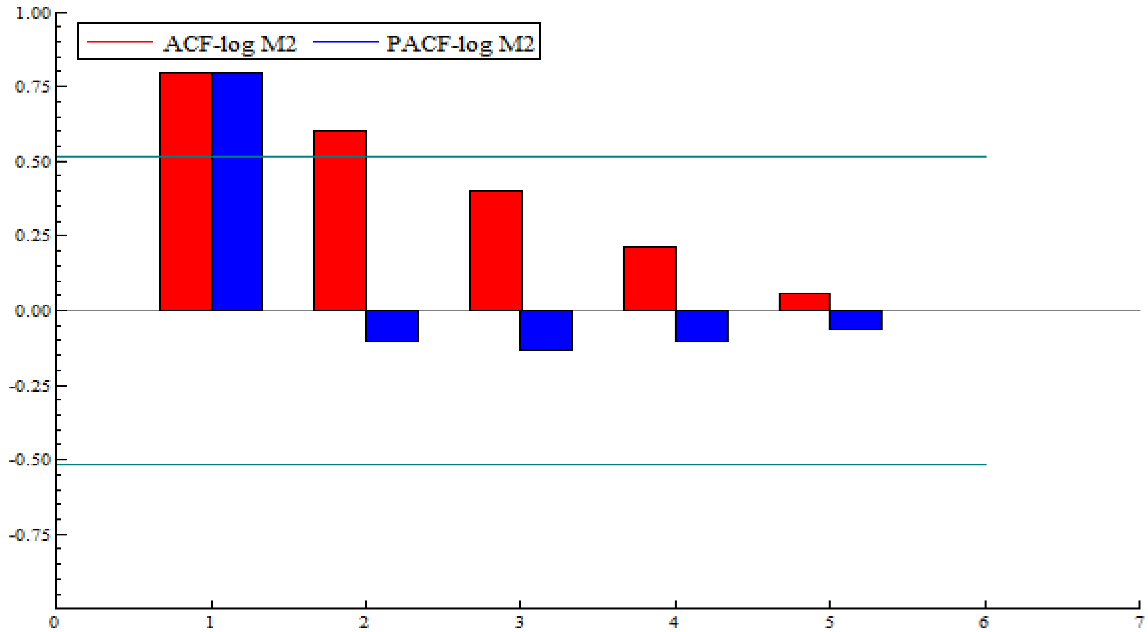


Figure 11.12 presents projected trend for log money supply from 2016 to 2020. An increasing trend can be seen in demand for money which is consistent with projected increase in the level of income.

Figure 11.12: Actual and Projected Trends for Log of Money Supply M2 - 2016 to 2020

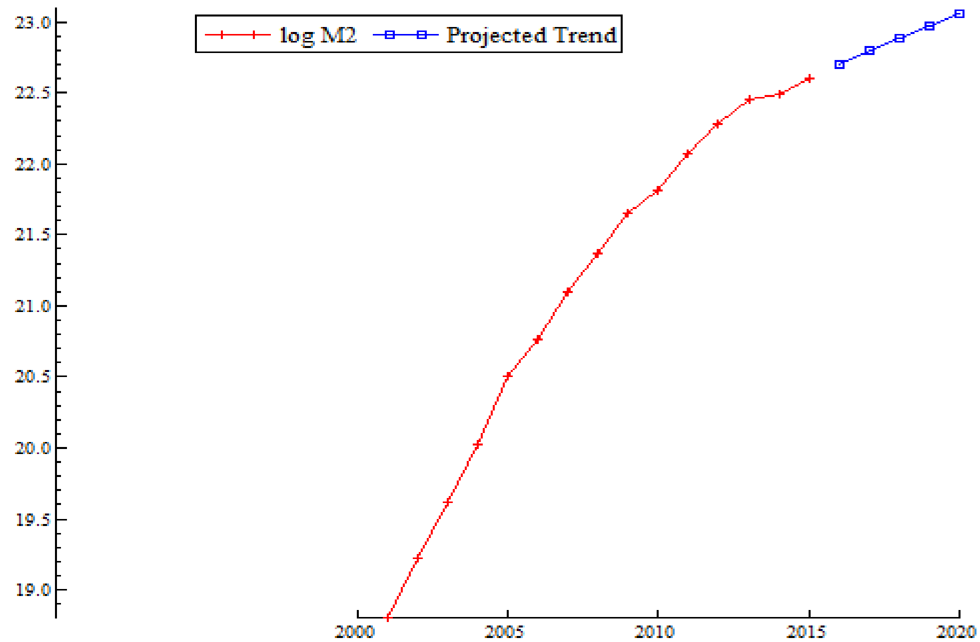
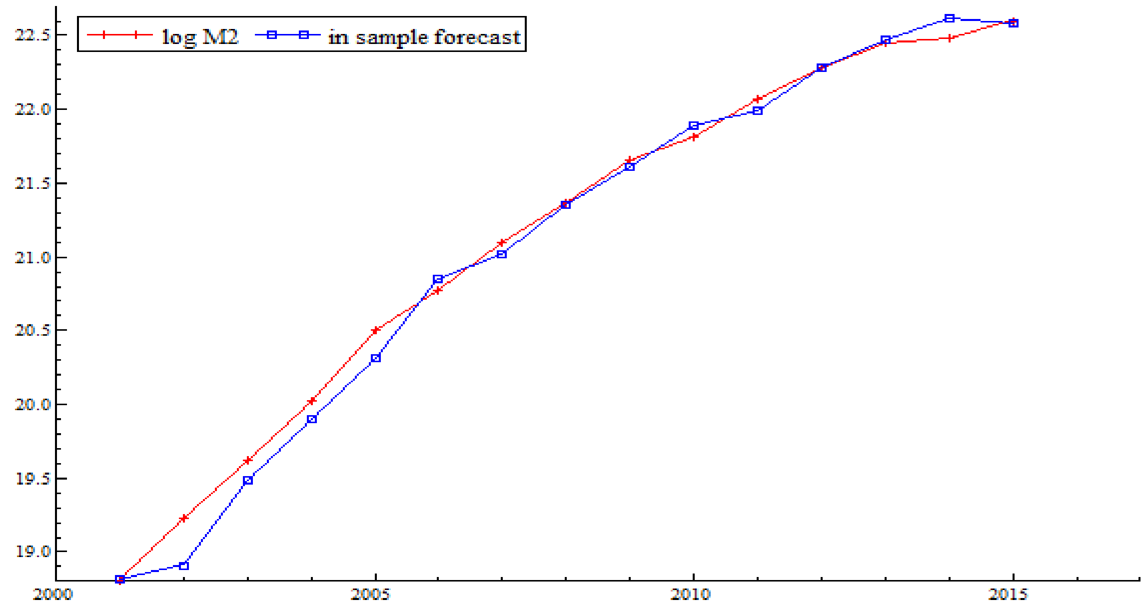


Figure 11.13 presents in-sample forecasts for both actual and predicted series of demand for money and the graph indicates how closely the model predicts the actual series. Since 2000, a continuous increasing trend for demand of money can be seen clearly without any decline.

Figure 11.13: In Sample Actual and Forecast Trends for Log of M2 - 2001 to 2015



11.2. Simulations and Forecasts

As discussed in Chapter 3, Tajikistan has experienced high economic growth since 1997. Real gross domestic product grew at an average rate of about 7 per cent during the period 1997 to 2015, driven mainly by agriculture and services on the supply side. On the demand side the economy was largely fueled by private consumption supported by significant increases in remittance inflows and a favorable external environment. Additionally, macroeconomic stabilization and rising international prices of aluminum and cotton, Tajikistan's two major exports also played a significant role.

In 2015, decline in remittances (due to slowdown in Russia) and weak global demand for cotton and aluminum slowed down Tajikistan's GDP growth. However, in 2016, growth picked up again (6.9 percent) led by improvement in net exports and the rising private consumption supported by recovering remittances. On the supply side, growth was driven by industry, particularly non-energy extractives and services.

Table 5.9. Growth Forecasts - Tajikistan

(%)

	2016	2017	2018	2019	2020
Real GDP	6.9	7.1	5.0	4.9	3.1
Nominal GDP	12.5	13.6	11.7	11.6	9.7
Real Agriculture Value Added	6.8	6.9	6.9	6.9	6.9
Real Manufacturing Value Added	1.9	2.9	-3.5	-4.1	-7.6
Real Services Value Added	4.8	7.2	8.8	7.6	7.9
Private Consumption	7.8	-2.8	7.1	3.5	3.3
Public Consumption	8.5	12.9	9.7	9.4	9.5
Gross Fixed Capital Formation	27.5	19.7	20.1	17.3	15.2
Trade Balance (Share of GDP)	-22.8	-24.9	-24.9	-22.5	-19.5
Inflation	5.3	6.0	6.3	6.4	6.4
Total Expenditures	13.2	16.9	12.2	13.3	11.0
Total Revenue	5.4	11.4	10.8	10.2	9.7
Fiscal Balance (Share of GDP)	-10.4	-11.2	-12.4	-12.9	-12.3

Note: For GDP 2016, 2017 is actual data; while projections from 2018 to 2020. For the rest of the variables 2017 to 2020 are projections based on past trends (from 1990 to 2016).

Inflation is based on GDP deflator.

As per our medium-term forecasts, Tajikistan's performance is expected to remain moderate. From 2016 to 2020, average growth is projected to be about 5 per cent; fueled by increased remittances and improved external environment. Growth of 6.9 per cent in 2016 and 7.1 percent in 2017 can be explained by the improved external environment, including high prices of its major export commodities, and better relationship with its neighbors, particularly Uzbekistan[97]. Slowdown in growth after 2017 is possible if the current weaknesses in the banking sector continued. In addition, monetary policy efforts to contain inflation may lead to economic slowdown.

[97] World Bank Tajikistan Country Economic Update; Spring 2017; available at: http://pubdocs.worldbank.org/en/543471500543123667/ECA2017-TJK-003.pdf and World Bank Country Overview – Tajikistan; available at: http://www.worldbank.org/en/country/tajikistan/overview#3

By 2020, on the supply side, economic growth is projected to be supported by both agriculture and services in real terms. Agriculture valued added and services value added (in real terms) are projected to grow by about 6.9 percent and 7.2 percent respectively by 2020. In terms of GDP, services sector is expected to increase its contribution from 44.6 percent in 2016 to 49.6 percent in 2020. As remittances are expected to rise[98]; higher remittances are likely to boost output of services. The share of agriculture in GDP will increase from 25 percent in 2016 to 26.8 percent in 2020. On the demand side, growth is expected to be supported by public consumption and total investment, which are projected to grow by 10 percent and 18 percent respectively by 2020.

On the back of recovering remittances and external environment, the external position of Tajikistan is likely to improve by 2020. With relatively faster growth in exports, net exports (i.e., trade balance) in terms of GDP are projected to improve from -22.8 percent in 2016 to -19.5 percent in 2020.

Inflation is forecast to remain in single digits assuming major role by the central bank to target inflationary pressures. On the fiscal side, as per our medium-term forecasts, fiscal deficit will increase from -10.4 percent of GDP in 2016 to -12.3 percent of GDP by 2020. Public expenditure is expected to go up with additional recapitalization of troubled banks, clearing of arrears at state-owned enterprises, and faster currency depreciation. In addition, the

[98] Asian Development Outlook: How Technology Affects Jobs, April 2018, as reported by https://news.tj/en/news/tajikistan/economic/20180411/tajikistans-economic-growth-is-forecast-to-moderate-to-60-in-2018-says-adb-report

euro bond placements to finance large infrastructure projects would also add up to rising expenditures[99]. These trends demand for prudent fiscal measures, in line with the deficit ceiling set by the Government's medium-term fiscal strategy.

Tajikistan needs to explore more productive business and investment opportunities to sustain high economic growth in the medium to long term. Its industry is relying on low skilled and low value production, which needs to be developed. Tajikistan has to diversify its export basket (that is beyond aluminum, cotton and ores group) and improve the quality of its existing exports to increase its revenues. The country needs to improve the business environment and tackle financial sector weaknesses to bolster private investment and promote economic growth.

11.3. Conclusion

This chapter has estimated a macro-econometric model for Tajikistan's economy that focuses on services sector on the supply side, and private investment and public consumption on the demand side. These estimations have highlighted important macroeconomic relationships that shape the performance of Tajikistan's economy. In addition, dynamic simulations have been carried out to model the time series behavior of key fiscal, monetary and foreign trade variables and their projections. The results show that aggregate demand plays an important role in the expansion of services sector which accounts for more than 40 percent of GDP. Whereas public investment helps attract private

[99] Asian Development Outlook: How Technology Affects Jobs, April 2018, as reported by https://news.tj/en/news/tajikistan/economic/20180411/tajikistans-economic-growth-is-forecast-to-moderate-to-60-in-2018-says-adb-report

investment in the economy, public consumption responds to the level of domestic economic activity to cater to the growing demand for public goods and services. The medium-term economic outlook is moderate for Tajikistan though high fiscal deficit may pose a risk to macroeconomic stability. There is thus a need for the government to rationalize public spending and generate more revenues to reduce fiscal deficit to a more sustainable level.

Chapter 12 - Turkey: Modelling Exercise and Forecasts

12.1. Modelling Exercise

12.1.1. Production Block

The production block consists of estimations of production functions for all the key productive sectors of the economy including agriculture, manufacturing and services. The regressors in each production function have been chosen based on data availability. With a short data span, the actual effect of the regressor on the regressand cannot be observed accurately and a spurious relation might be observed between the dependent and independent variables; the results should thus be interpreted with caution. Unavailability of some relevant regressor may cause omitted variable bias that may reflect in residual analysis.

12.1.1.1. Agriculture Sector

As in some other economies in the ECO region, , a decline in labor force engaged in agriculture sector is also observed in Turkey; a possible reason for this trend might be rapid urbanization and use of less labor intensive, innovative agricultural tools and techniques. A negative relationship is observed in scatter plot of agricultural value added and labor force engaged in agriculture sector; this relationship is rather unusual.

The functional form for the agriculture sector production function developed in Section 2.4.1.1. earlier takes the following form:

$$Y_t^a = f(L_t^a, CD_t^a, W_t^a, IFRS_t^a) \qquad (12.1)$$

Where:

Y_t^a	=	Agriculture value added (Available)
L_t^a	=	Labor force engaged in agriculture (Constructed)
CD_t^a	=	Credit disbursement to agriculture sector (Not available)
W_t^a	=	Water availability (area irrigated by tube wells) (Not available)
$IFRS_t^a$	=	Infrastructure proxied by road length (Not available)

It is hypothesized that all the right-hand side variables exert a positive impact on agriculture sector value added.

The results reported by Eq (12.2) suggest that in the absence of important variables like infrastructure, credit disbursed to agriculture sector and water availability the impact of labor involved in agriculture has negative significant effect. While this result seems quite unusual, it may be indicative of more intensive use of labor-saving technology in the agriculture sector

The ADF test statistic used to test the stationarity of the residuals is equal to -1.205 (Table 12.2), which is insignificant, indicating there is no long-run relationship between agricultural value added and labor involved in agriculture sector.

Table 12.1: Agriculture Production Long Run Estimates

$$y_t^a = 31.600 - 0.547 l_t^a \quad (12.2)$$

(SE) (1.330) (0.084)

t:	1990 – 2015		
Sigma:	0.081	**RSS:**	0.156
Adj. R^2:	0.623	**F (1,24):**	42.250 [0.000]**
		Log-likelihood:	29.602

Table 12.2: ADF Test of Residuals from Long Run Agriculture Production Function

ADF Statistics:	-1.205	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

For short run analysis we employ ARDL (1) model with assumption of at most one common factor. Following general to specific modelling technique of Davidson *et al.*, (1978) we came up to specific relation presented by Eq (12.3). The results suggest that in short run change in agricultural value added depends positively on change in labor force engaged in agriculture sector lagged one. The short-run model does not have any problem of serial correlation, functional form, non-normality of residuals and heteroscedasticity. In the short-run labor force (l_t) exerts a positive influence on agricultural value added. The short-run estimates of agriculture value added are reported in Eq (12.3). It can be observed that in the short-run, one year lagged agriculture sector value added influences current agriculture value added negatively.

Table 12.3: Short Run Estimates of Long Run Agriculture Production Function

$$\Delta y_t^a = -0.512\Delta y_{t-1}^a + 0.031 + 0.279\Delta l_{t-1}^a \quad (12.3)$$

(SE) (0.152) (0.007) (0.093)

t:	1992 – 2015		
Sigma:	0.032	RSS:	0.022
Adjusted R^2:	0.518	F (2,21):	13.340 [0.000]**
Log Likelihood:	49.864		
Normality Test:	Chi^2 (2) = 0.302 [0.860]		
Hetero Test:	F (4, 19) = 0.408 [0.801]		
Hetero-X Test:	F (5, 18) = 0.378 [0.857]		
RESET23 Test:	F (2, 19) = 0.716 [0.502]		

12.1.1.2. Manufacturing Sector

The value added in manufacturing sector is significantly explained by labor engaged in manufacturing sector, import of machinery and raw material provided by agriculture sector to industries in the long-run. Capital stock plays a significant role in the determination of output of the manufacturing sector in Turkey.

The long-run elasticities of labor force, raw material, capital inflows and import of machinery, are respectively 0.697, 0.532, 0.018 and 0.086 in Eq (12.4).

Table 12.4: Manufacturing Sector Long Run Estimates

$$y_t^m = 0.697 l_t^m + 0.532 drm_t^m + 0.018 k_t^m + 0.086 im_t^m \quad (12.4)$$

(SE) (0.157) (0.103) (0.008) (0.042)

t:	1990-2015		
Sigma:	0.043	**RSS:**	0.040
		Log-likelihood:	47.293

The *ADF* statistic of residual of long run equation is -5.969 (Table 12.5) which is significant and confirms that valid long-run relationship exists between manufacturing value added and its determinants.

Table 12.5: ADF Test of Residuals from Long Run Manufacturing Sector Function

ADF Statistics:	-5.969	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The short-run ECM model corresponding to the long-run manufacturing value added relationship is given by Eq (12.5). In the short-run the labor engaged in manufacturing, import of machinery lagged by one year and capital inflows are found to be influencing the manufacturing value added positively and significantly. The magnitude of the error-correction term is -0.474 suggesting that it takes more than 2 years to correct all the deviations to achieve long-run equilibrium. The diagnostic tests do not indicate any misspecification problem. Overall, the result of the manufacturing sector is quite satisfactory.

Table 12.6: Short Run Estimates of Long Run Direct Tax Revenue Function

$$\Delta y_t^m = 0.460\Delta l_t^m + 0.228\Delta im_t^m + 0.021\Delta k_t^m - 0.228ECT_{t-1} \quad (12.5)$$

(SE) (0.130) (0.035) (0.007) (0.167)

t:	1992 – 2015		
Sigma:	0.022	RSS:	0.010
Log Likelihood:	59.427		
AR 1-2 Test:	F (2, 18) = 0.206 [0.816]		
ARCH 1-1 Test:	F (1, 22) = 0.244 [0.626]		
Normality Test:	Chi^2 (2) = 0.519 [0.771]		
Hetero Test:	F (8, 15) = 0.653 [0.723]		
Hetero-X Test:	F (14, 9) = 1.016 [0.507]		
RESET23 Test:	F (2, 18) = 0.427 [0.659]		

12.1.1.3. Services Sector

The estimation of the services sector value added model in Eq (12.6) suggests that services contribution to the total production is significantly determined by labor involved in services sector in the long-run. The contribution of labor in the services value added is 1.230 in the long -run (Table 12.7).

Table 12.7: Services Sector Long Run Estimates

$$y_t^s = 4.680 + 1.230l_t^s \quad (12.6)$$

(SE) (0.547) (0.034)

t:	1990-2015		
Sigma:	0.049	**RSS:**	0.058
Adj. R^2:	0.981	**F (1,24):**	1,313 [0.000]**
		Log-likelihood:	42.545

The ADF test statistic of the residuals of the long run relation is found to be -2.955 (Table 12.8), which is significant, indicating a long-run relationship exists between services value added and labor engaged in the services sector.

Table 12.8: ADF Test of Residuals from Long Run Services Sector Function

ADF Statistics:	-2.955	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The short-run ECM model corresponding to the long-run services value added relationship is given by Eq (12.7). The results suggest that in the short run a change in services sector value added depends positively on change in the labor force (Table 12.9). The short-run model does not have any problem of serial correlation, functional form, non-normality of residuals and heteroscedasticity. Negative and significant ECT confirms the existence of the long run relation.

Table 12.9: Short Run Estimates of Long Run Services Sector Function

$$\Delta y_t^s = 0.450\Delta y_{t-1}^s + 0.644\Delta l_t^s - 0.667ECT_{t-1} \quad (12.7)$$			
(SE) (0.166) (0.214) (0.174)			
t:	1992 – 2015		
Sigma:	0.038	RSS:	0.031
Log Likelihood:	45.933		
AR 1-2 Test:	F (2, 19) = 0.597 [0.560]		
ARCH 1-1 Test:	F (1, 22) = 0.093 [0.764]		
Normality Test:	Chi^2 (2) = 2.787 [0.248]		
Hetero Test:	F (6, 17) = 0.602 [0.725]		
Hetero-X Test:	F (9, 14) = 0.683 [0.713]		
RESET23 Test:	F (2, 19) = 0.078 [0.925]		

12.1.2. Aggregate Demand Block

12.1.2.1. Private Consumption

Table 12.10 reports the long-run estimates of the private consumption model given by Eq (12.8). It can be seen from the results that in the long-run money supply exerts a positive and significant impact on real private consumption.

Table 12.10: Private Consumption Long Run Estimates

$$c_t^p = 12.400 + 0.562rm_t \quad (12.8)$$			
(SE) (0.509) (0.023)			
t:	1987-2015		
Sigma:	0.072	**RSS:**	0.141
Adj. R²:	0.954	**F (1,27):**	584.5 [0.000]*
		Log-likelihood:	36.080

The ADF statistic for testing the stationarity of the residuals of the long run model is -3.582, higher than that of the critical value at any conventional level of significance. This supports the existence of a long-run relationship between real private consumption, and real money balances. Therefore, we estimate short-run dynamics in the form of ECM model by Eq (12.9).

Table 12.11: ADF Test of Residuals from Long Run Private Consumption

ADF Statistics:	-3.582	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993)		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

In the short-run, a change in previous consumption affects change in present consumption. Also, a change in lagged real money balances has a significant effect on current consumption decision. The real interest rate becomes insignificant in both long run and short run estimates. The error-correction term is negative and significant, which confirms that the error-correction mechanism is working correctly, and the deviations are corrected at the rate of 34 percent per year to achieve the long-run equilibrium path (Table 12.12). The diagnostic tests indicate no misspecification of the estimated model.

Table 12.12: Short Run Estimates of Long Run Private Consumption Function

$\Delta c_t^p = 0.517\Delta c_{t-1}^p + 0.186\Delta rm_{t-1} - 0.340ECT_{t-1}$			(12.9)
(SE) (0.202) (0.094) (0.172)			
t:	1989 – 2015		
Sigma:	0.050	RSS	0.060
Log Likelihood	44.207		
AR 1-2 Test:	F (2, 22) = 0.055 [0.946]		
ARCH 1-1 Test:	F (1, 25) = 0.173 [0.681]		
Normality Test:	Chi² (2) = 0.506 [0.776]		
Hetero Test:	F (6, 20) = 1.626 [0.192]		
Hetero-X Test:	F (9, 17) = 1.030 [0.456]		
RESET23 Test:	F (2, 22) = 2.436 [0.111]		

12.1.2.2. Government Consumption

Government consumption depends on the total government revenues as reflected in the long run relation in Eq (12.10). Government revenue exerts a significant positive influence on government consumption, and although inflation turned out to be insignificant, it is retained in the long run equation as the Exclusion Restriction Test does not allow us to drop it.

Table 12.13: Government Consumption Long Run Estimates

$c_t^g = 0.536 + 0.002INF_t + 0.913r_t^g$			(12.10)
(SE) (0.136) (0.002) (0.001)			
t:	1972-1997		
Sigma:	0.143	**RSS:**	0.469
Adj. R²:	0.998	**F (2,23):**	7,659 [0.000]**
		Log-likelihood:	15.303

The ADF statistic for testing the stationarity of the long run residuals is –2.333 (Table 12.14), indicating long-run relationship exists during the period under estimation. Hence, we estimate an ECM to determine the short run relation, presented in Table 12.15 and represented by Eq (12.11).

Table 12.14: ADF Test of Residuals from Long Run Government Consumption

ADF Statistics:	-2.333	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993):		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The results of the ECM reveal that government consumption in the previous period affects government consumption in the current period. Also, government revenue is a significant determinant of government consumption in the short-run. A negative and significant ECT validates the long run relation. The model passes all the diagnostic tests except for the normality test, which is significant at the 1 percent level of significance (Table 12.15).

Table 12.15: Short Run Estimates of Long Run Government Consumption

$\Delta c_t^g = 0.497\Delta c_{t-1}^g + 0.486\Delta r_t^g - 0.302ECT_{t-1}$			(12.11)
(SE) (0.122) (0.108) (0.122)			
t:	1973 – 1997		
Sigma:	0.083	RSS:	0.151
Log Likelihood:	28.360		
AR 1-2 Test:	F (2, 20) = 0.238 [0.790]		
ARCH 1-1 Test:	F (1, 23) = 0.052 [0.822]		
Normality Test:	Chi^2 (2) = 8.998 [0.011]*		
Hetero Test:	F (6, 18) = 0.470 [0.822]		
Hetero-X Test:	F (9, 15) = 0.718 [0.686]		
RESET23 Test:	F (2, 20) = 2.244 [0.132]		

12.1.2.3. Private Investment

The long-run estimates of the real private investment are given by Eq (12.12). It is evident from the results that real private investment is significantly determined by real income. The coefficient for real income is highly significant with positive impact on real private investment. These results partially confirm the earlier findings by Guru-Gharana (2000) as well as the earlier estimations for Pakistan. The positive and significant coefficient of real income verifies the accelerator principle from standard economic theory.

Table 12.16: Private Investment Long Run Estimates

$i_t^p = -7.250 + 1.230y_t$			(12.12)
(SE) (1.360) (0.054)			
t:	1987-2015		
Sigma:	0.096	**RSS:**	0.247
Adj. R^2:	0.948	**F (1,27):**	510.6 [0.000]**
		Log-likelihood:	27.930

The corresponding value of the ADF statistic for testing the long run residuals stationarity of the long run equation is -2.973 (Table 12.17), in the presence of cointegration among the real private investment and its determinants.

Table 12.17: ADF Test of Residuals from Long Run Private Investment

ADF Statistics:	-2.973	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values,(Davidson and MacKinnon, 1993):		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Based on the long-run estimates we have estimated short-run ECM model given in Eq (12.13) and Table 12.18 reports the results. The short-run estimates suggest that real income is an important determinant of private investment with positive and significant coefficients. Private sector credit remains insignificant in the short-run also, while second lags of change in private investment and change in real income are significant; econometrically this signifies the presence of two possible common factors. The lagged error-correction term is significant with theoretical expected sign (Table 12.18). Diagnostic tests associated with the short-run ECM model do not detect any serious specification problem.

Table 12.18: Short Run Estimates of Long Run Private Investment

$\Delta i_t^p = 0.554\Delta i_{t-2}^p + 2.670\Delta y_t - 1.920\Delta y_{t-2} - 0.246ECT_{t-1}$ (12.13)			
(SE) (0.149) (0.208) (0.421) (0.116)			
t:	1990 – 2015		
Sigma:	0.050	RSS:	0.055
Log Likelihood	43.102		
AR 1-2 Test:	$F(2, 20) = 1.981$ [0.164]		
ARCH 1-1 Test:	$F(1, 24) = 0.058$ [0.813]		
Normality Test:	$Chi^2(2) = 9.070$ [0.011]*		
Hetero Test:	$F(8, 17) = 1.851$ [0.136]		
Hetero-X Test:	$F(14, 11) = 7.078$ [0.001]**		
RESET23 Test:	$F(2, 20) = 0.830$ [0.450]		

12.1.3. Fiscal Block

12.1.3.1. Direct Tax Revenue

Eq (12.14) reports the long-run estimates for direct tax revenues ($dtxr = LNDTXR$). The results (Table 12.19) reveal that nominal income (ny) contributes positively to the collection of direct tax revenues. Inflation is insignificant, but it cannot be dropped from the model because the Exclusion Restriction test allows keeping inflation in the long run equation even though it is insignificant. This result supports the theoretical view that direct taxes are positively correlated with nominal income. The estimated long-run elasticity of direct taxes with respect to nominal income is 0.986 indicating that a one percent increase in nominal income translates into almost a unit increase in direct taxes. This result is in line with previous findings of Mukarram (2001) and Chaudhary and Hamid (2001).

Table 12.19: Direct Tax Revenues Long Run Estimates

$$dtxr_t = -2.310 + 0.968ny_t + 0.003INF_t \quad (12.14)$$

(SE) (0.209) (0.016) (0.002)

t:	1972-1997		
Sigma:	0.178	**RSS:**	0.726
Adj. R^2:	0.997	**F (2,23):**	4,781 [0.000]**
		Log-likelihood:	9.630

The ADF test performed on the residuals generated by Eq (12.14) is equal to -2.528 which is significant, indicating long-run relationship between direct tax revenues and nominal income (Table 12.20).

Table 12.20: ADF Test of Residuals from Long Run Direct Tax Revenue

ADF Statistics:	-2.528	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values,(Davidson and MacKinnon, 1993):		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

Stationarity of the residuals suggests an ECM model be estimated, given by Eq (12.15). Long-run direct tax elasticity with respect to nominal income (ny) is 0.986 (Table 12.21), whereas short-run elasticity is 0.634. These results have important implications for macroeconomic management policies that aim to boost tax revenues. The ECM is negative and significant implying the existence of cointegration among the variables.

Table 12.21: Short Run Estimates of Long Run Direct Tax Revenue

$$\Delta dtxr_t = 0.406\Delta dtxr_t + 0.634\Delta ny_t - 0.284ECT_{t-1} \qquad (12.15)$$

(SE) (0.152) (0.149) (0.131)			
t:	1974 – 1997		
Sigma:	0.098	RSS:	0.201
Log Likelihood:	23.362		
AR 1-2 Test:	F (2, 19) = 0.209 [0.813]		
ARCH 1-1 Test:	F (1, 22) = 2.175 [0.155]		
Normality Test:	Chi^2 (2) = 2.613 [0.271]		
Hetero Test:	F (6, 17) = 1.789 [0.161]		
Hetero-X Test:	F (9, 14) = 1.248 [0.343]		
RESET23 Test:	F (2, 19) = 0.060 [0.942]		

12.1.3.2. Indirect Tax Revenue

Similar to direct tax revenue, indirect tax revenue is assumed to depend on the nominal income. The long-run results are reported by Eq (12.16), and short run results are reported by Eq (12.17). It is found that nominal income (ny_t) exerts a positive impact on indirect tax revenues in the long-run. The long-run elasticity of indirect tax revenue with respect to nominal income is 1.040, which implies that indirect tax system is neither regressive nor progressive.

Table 12.22: Indirect Tax Revenues Long Run Estimates

$$indtxr_t = -3.820 + 1.040ny_t \qquad (12.16)$$

(SE) (0.235) (0.0132)			
t:	1972-1997		
Sigma:	0.232	**RSS:**	1.293
Adj. R^2:	0.996	**F (1, 24):**	6,269 [0.000]**
		Log-likelihood:	2.123

The *ADF* statistic of residuals of long run relation is -1.212, which is insignificant indicating no long-run relationship between indirect tax revenue and nominal income.

Table 12.23: ADF Test of Residuals from Long Run Indirect Tax Revenue Function

ADF Statistics:	-1.212	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993):		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

For short run analysis, an ARDL (1) model has been used with an assumption of at most one common factor. Following (Davidson *et al.*, 1978)'s general to specific modelling technique, we obtain the specific relation presented by Eq (12.17). The results suggest that in the short run, a change in indirect tax revenue depends on change in nominal income lagged one. The short-run model is not susceptible to the adverse effects of serial correlation, functional form, non-normality of residuals and heteroscedasticity (Table 12.24). In the short-run nominal income (ny_t) is observed to exert a positive impact on indirect tax revenues.

Table 12.24: Short Run Estimates of Long Run Indirect Tax Revenue Function

	$\Delta indtxr_t = 1.120 \Delta ny_{t-1}$			(12.17)
(SE) (0.049)				
t:	1974 – 1997			
Sigma:	0.113	RSS:	0.295	
Log Likelihood:	18.733			
AR 1-2 Test:	$F(2, 21) = 0.209$ [0.813]			
ARCH 1-1 Test:	$F(1, 22) = 0.100$ [0.754]			
Normality Test:	$Chi^2(2) = 2.228$ [0.328]			
Hetero Test:	$F(2, 21) = 0.432$ [0.655]			
Hetero-X Test:	$F(2, 21) = 0.432$ [0.655]			
RESET23 Test:	$F(2, 21) = 1.295$ [0.295]			

12.1.4. Foreign Trade Block

12.1.4.1. Exports

As discussed in chapter 4, exports of goods and services are determined by world income, the real effective exchange rate and relative price of exports. Based on the functional form specified earlier, the long-run equation for exports given in Eq (12.18) has been estimated. It is evident from the results reported in Table 12.25 that both the income variables have the expected sign and are statistically significant at conventional level of significance in the long-run. The significance of foreign income suggests that Turkey's exports have been very much in demand during the period. The relative price of exports influences real exports negatively.

Table 12.25: Export Function Long Run Estimates

$$x_t = -67.100 + 2.950y_t + 0.874y_t^f - 1.030rp_t^x \tag{12.18}$$

(SE) (7.540) (0.540) (0.397) (0.042)

t:	1980-2015			
Sigma:	0.262	**RSS:**	2.201	
Adj. R²:	0.997	**F (3,32):**	3862 [0.000]**	
		Log-likelihood:	-0.777	

The estimated relationship between real exports of goods and services, and other variables in the model is found to be cointegrating as the ADF statistic for residuals stationarity is equal to -5.463, which is significant at the one percent level of significance. Based on the fact that there exists a long-run relationship, an ECM model, as specified in Eq (12.19) and Table 12.27, reports the short run results.

Table 12.26: ADF Test of Residuals from Long Run Export Function

ADF Statistics:	-5.463	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993):		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

In the short-run, world real income and real domestic income exert no significant effect on real exports, while real effective exchange rate is found to have conventional negative effect on exports in the short run. The coefficient of the error-correction term has expected negative sign and is statistically significant, which implies that the deviations from the equilibrium path are corrected in the following period. Overall, the diagnostic statistics indicate that the model is well specified.

Table 12.27: Short Run Estimates of Long Run Export Function

$$\Delta x_t = 1.240 + 0.299\Delta x_{t-1} - 1.220REER_t - 0.505ECT_{t-1} \quad (12.19)$$

(SE) (0.205) (0.097) (0.228) (0.102)

t:	1981 – 2015		
Sigma:	0.142	RSS:	0.623
Log Likelihood:	20.845	F (3, 31):	33.370 [0.000]**
Adj R^2:	0.741		
AR 1-2 Test:	F (2, 29) = 0.137 [0.872]		
ARCH 1-1 Test:	F (1, 33) = 1.039 [0.315]		
Normality Test:	Chi^2 (2) = 4.022 [0.134]		
Hetero Test:	F (6, 28) = 0.877 [0.524]		
Hetero-X Test:	F (9, 25) = 0.689 [0.712]		
RESET23 Test:	F (2, 29) = 0.476 [0.626]		

12.1.4.2. Imports

The import of goods and services is estimated as a function of real domestic income, real effective exchange rate, relative price of imports and foreign capital inflows. The long-run and short-run estimates are reported in Eq (12.20) and Eq (12.21) respectively. It can be seen from the results presented in Table 12.28 that domestic real income and real effective exchange rate exert positive impact on real imports of goods and services, while relative price of imports has a negative impact in the long-run.

Table 12.28: Import Function Long Run Estimates

$im_t = -66.000 + 3.610y_t + 0.057k_t^f - 0.964rp_t^{im} + 0.744REER_t$				(12.20)
(SE) (8.330) (0.372) (0.053) (0.060) (0.265)				
t:	1980-2015			
Sigma:	0.173	**RSS:**	0.927	
Adj. R²:	0.999	**F (4, 31):**	6,473 [0.000]**	
		Log-likelihood:	14.785	

The ADF test for checking stationarity of the residuals yields a statistic equal to -3.146 (Table 12.29), which is significant at the one percent level, confirming the long-run relationship among the variables.

Table 12.29: ADF Test of Residuals from Long Run Import Function

ADF Statistics:	-3.146	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993):		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The results of short-run model, represented by Eq (12.21), for import of goods and services are given in Table 12.30. The results suggest that real domestic income and capital inflow produce positive and significant impact on real imports in the short -run. The error-correction term is negative and significant confirming the existence of cointegration among the variables entered in the model. The overall fit of the model is good as indicated by the diagnostic statistics.

Table 12.30: Short Run Estimates of Long Run Import Function

$\Delta im_t = 0.617\Delta im_{t-1} + 1.520\Delta y_t + 0.079\Delta k_t^f - 0.229\Delta rp_{t-1}^{im} - 0.390ECT_{t-1}$ (12.21)			
(SE) (0.081) (0.372) (0.034) (0.081) (0.135)			
t:	1982 – 2015		
Sigma:	0.103	RSS:	0.305
Log Likelihood:	31.861		
AR 1-2 Test:	$F(2, 27) = 0.089$ [0.915]		
ARCH 1-1 Test:	$F(1, 32) = 2.159$ [0.152]		
Normality Test:	$Chi^2(2) = 0.112$ [0.946]		
Hetero Test:	$F(10,23) = 1.153$ [0.369]		
Hetero-X Test:	$F(20, 13) = 1.463$ [0.243]		
RESET23 Test:	$F(2, 27) = 1.016$ [0.375]		

12.1.5. Monetary and Price Block

12.1.5.1. Money Demand

The demand for broad money M/P or in logarithms $(m-p)$ is influenced by real income (Y) as the scale variable and nominal interest rate (i). Eq (**12.22**) specifies the long run model and Table 12.31 reports the estimated long-run results where interest rate (i) is found to be insignificant. It is evident from the estimates presented that real income (y) has the expected sign and is statistically significant in the long-run. The income elasticity of money demand is 1.620. This result is in the line with earlier findings of researchers in this area. The insignificant interest rate may imply that the domestic financial market is not yet as well developed as those of developed countries, and the interest rates were not set at market rates.

Table 12.31: Money Demand Function Long Run Estimates

$$(m-p)_t = -18.600 + 1.620y_t \qquad (12.22)$$

(SE) (0.868) (0.035)

t:	1973-2015		
Sigma:	0.114	**RSS:**	0.535
Adj. R²:	0.981	**F (1, 41):**	2127 [0.000]**
		Log-likelihood:	33.296

The ADF test for the non-stationarity of the residuals is -4.137, which is significant at the 5 percent level of significance, indicating significant long-run co-movements among the variables.

Table 12.32: ADF Test of Residuals from Long Run Money Demand Function

ADF Statistics:	-4.173	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993):		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The results of the ECM model presented in Table 12.33 and Eq (12.23) suggest that the growth of real income and changes in short-term interest rate exert significant effects on the real money balances in the short-run. The error-correction term is correctly signed and statistically significant showing that it takes approximately 2 years for short-run deviations to converge to the long-run steady-state path. The correct sign and the significance of the error-correction term is an indication of the existence of a valid long-run relationship. The overall fit of the model is good as indicated by the various diagnostic tests.

Table 12.33: Short Run Estimates of Money Demand Function

$\Delta(m-p)_t = 1.150\Delta y_t + 0.005\Delta i_t - 0.322ECT_{t-1}$			(12.23)
(SE) (0.246) (0.001) (0.139)			
t:	1975 – 2015		
Sigma:	0.085	RSS:	0.276
Log Likelihood:	44.346		
AR 1-2 Test:	F (2, 36) = 1.044 [0.363]		
ARCH 1-1 Test:	F (1, 39) = 1.101 [0.301]		
Normality Test:	Chi^2 (2) = 2.817 [0.245]		
Hetero Test:	F (6, 34) = 2.819 [0.025]*		
Hetero-X Test:	F (9, 31) = 2.480 [0.029]*		
RESET23 Test:	F (2, 36) = 1.204 [0.312]		

12.1.5.2. Interest Rate

In modelling the impact of macroeconomic variables on the interest rate, the results for Eq (12.24) reported in Table 12.34 suggest that nominal money balances, real income and policy discount rate determine the short-term nominal interest rate. Nominal money balances exert a positive impact, while price level has no impact on the short-term nominal interest rate in the long-run. The policy discount rate influences short-term nominal interest rate positively in the long-run. The pass-through effect of discount rate is substantial (i.e. 0.820 percent) on short-term nominal interest rate in the long-run.

Table 12.34: Interest Rate Long Run Estimates

$$i_t = -357.000 + 14.012y_t + 0.824DR_t + 49.025\Delta m_t \quad (12.24)$$

(SE) (73.200) (2.930) (0.109) (10.600)

t:	1973-2015		
Sigma:	8.816	**RSS:**	3031.401
Adj. R^2:	0.886	**F (3, 39):**	109.3 [0.000]**
		Log-likelihood:	152.509

The ADF test performed on the residuals generated by Eq (12.24) is equal to -3.692 (Table 12.35), which is significant, implying cointegration among interest rate, money balances, real income and policy discount rate. The co-movement among the interest rates is very important for the successful conduct of the monetary policy through changes in policy discount rate.

Table 12.35: ADF Test of Residuals from Long Run Interest Rate Function

ADF Statistics:	-3.692	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993):		
1%	**5%**	**10%**
-2.565	-1.941	-1.617

A short run relation, presented in Eq (12.25), has been estimated based on the result of the ADF test on residuals. Surprisingly, log of prices (pt) and log nominal money balances (mt) are I(2) series in the data (Table 12.35). To apply cointegration we use first difference (which are I(1) series) of these series in long run equations and their second difference in short run relation.

It is clear from the results reported in Eq (12.25) that like the long-run, in the short-run changes in domestic price level exert no significant impact on nominal short-term interest rate. The short-run pass-through effect of policy rate on current nominal market interest rate is completed within one year. The overall fit of the equation is good as indicated by the diagnostic statistics.

Table 12.36: Short Run Estimates of Long Run Direct Tax Revenue Function

$$\Delta i_t = 0.400\Delta i_{t-1} + 0.304\Delta DR_t + 51.400\Delta\Delta m_t - 23.000\Delta\Delta m_{t-1} - 0.592ECT_{t-1} \qquad (12.25)$$

(SE) (0.124) (0.142) (7.460) (8.870) (0.112)			
t:	1975 – 2015		
Sigma:	5.923	RSS:	1262.922
Log Likelihood:	128.443		
AR 1-2 Test:	$F(2, 34) = 0.300$ [0.743]		
ARCH 1-1 Test:	$F(1, 39) = 0.379$ [0.542]		
Normality Test:	$Chi^2(2) = 0.247$ [0.884]		
Hetero Test:	$F(10, 30) = 2.230$ [0.044]*		
Hetero-X Test:	$F(20, 20) = 3.129$ [0.007]**		
RESET23 Test:	$F(2, 34) = 4.254$ [0.022]*		

12.1.5.3. Prices

The domestic price level, proxied by the consumer price index (CPI), is significantly determined by real income and nominal money balances. Equations (12.26) and (12.27) report the long-run and short-run estimates respectively.

According to the results reported in Table 12.37, money supply and real income are the main factors contributing to inflationary pressure in Turkey in the long-run. The impact of money supply is 0.979 percent on domestic price level. On the other hand, the coefficient of real output is -1.430, implying that an increase in real GDP would significantly depress inflationary pressures in the long-run. Overall, the result supports the view that monetarist and structuralist factors are responsible for inflationary pressure in Turkey in the long-run.

Table 12.37: Long Run Estimates for Prices

$p_t = 14.500 + 0.979m_t - 1.430y_t$			(12.26)
(SE) (4.390) (0.017) (0.191)			
t:	1980-2015		
Sigma:	0.114	**RSS:**	0.428
Adj. R²:	0.999	**F (1,42):**	2.229e+004 [0.000]**
		Log-likelihood:	28.684

To examine the degree of cointegration among the variables we employ ADF test on the residuals obtained from Eq (12.26). The ADF statistic is equal to -3.940 (Table 12.38), which is significant, indicating the existence of cointegration among the variables. Therefore, an ECM model is estimated to examine the short-run dynamics.

Table 12.38: ADF Test of Residuals from Long Run Estimates of Prices

ADF Statistics:	-3.940	
Lags:	0	
Intercept:	None	
Time Trend:	None	
Asymptotic critical values, (Davidson and MacKinnon, 1993):		
1%	**5%**	**10%**
-2.566	-1.941	-1.617

The results (Table 12.39) of the ECM model given by Eq (12.27) suggest that expected inflation (i.e. $\Delta p_t - 1$), significantly contributes to inflation in Turkey in the short-run just as in the case of Pakistan. The error-correction term is negative and significant, indicating that the past period's deviations are corrected in the current period at the rate of 27 percent per year. However, this speed of convergence is very low. Overall the model fits well as indicated by the battery of diagnostic tests.

Table 12.39: Short Run Estimates of Prices

$$\Delta p_t = 0.308\Delta p_{t-1} + 0.571\Delta m_t - 0.266ECT_{t-1} \quad (12.27)$$

(SE) (0.118) (0.106) (0.122)

t:	1981 – 2015		
Sigma:	0.075	RSS:	0.181
Log Likelihood:	42.514		
AR 1-2 Test:	F (2, 30) = 2.687 [0.084]		
ARCH 1-1 Test:	F (1, 33) = 0.213 [0.647]		
Normality Test:	Chi^2 (2) = 6.335 [0.042]*		
Hetero Test:	F (6, 28) = 2.478 [0.048]*		
Hetero-X Test:	F (9, 25) = 7.256 [0.000]**		
RESET23 Test:	F (2, 30) = 1.371 [0.269]		

12.2. Policy Forecasts

12.2.1. In-sample Forecasts

First of all, the model estimated for Turkey is evaluated for within-sample predictive performance. Table 5.3 summarizes the forecast evaluation for key endogenous variables for Turkey.

Table 12.40: Model Validation Statistics - Turkey

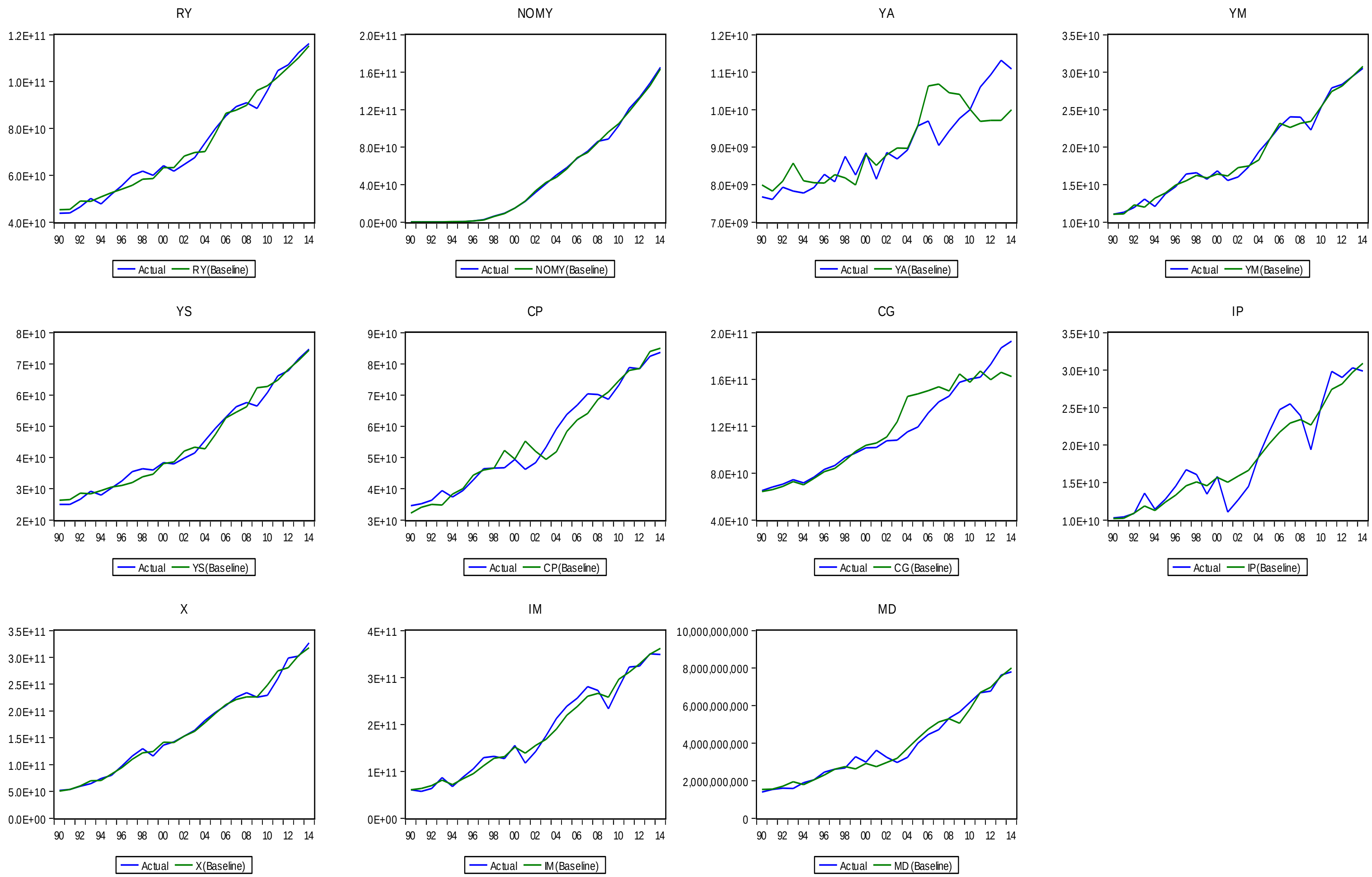
	MAPE	Theil's Inequality (U)
Agriculture Value Added	0.26	0.002
Manufacturing Value Added	0.12	0.001
Services Value Added	0.16	0.001
Real Private Consumption	0.22	0.001
Real Government Consumption	0.27	0.002
Real Private Investment	0.28	0.002
Money Demand	0.41	0.003
Consumer Price index	3.78	0.01
Direct tax Revenues	0.81	0.004
Indirect tax revenues	1.43	0.006
Export Demand	0.16	0.001
Import Demand	0.23	0.001

The MAPE is reasonable and lies within the range of 0.13 to 3.78 percent for all the endogenous variables. Similarly, the Theil's inequality coefficient (U) is less than unity and close to zero for all the endogenous variables. In other words, the overall forecasting ability of estimated equations for Turkey is satisfactory except for price equation for which it is relatively high.

Next, the model for the period 1990 to 2014 is solved to assess the in-sample forecasting ability of the model and compare the actual values for all the endogenous variables (estimated) with the in-sample simulated values[100]. Figure 5.3 illustrates the paths of the ex post simulation along with the actual values of the endogenous variables. The simulated values of each variable track the actual trajectories quite reasonably for almost all the estimated variables.

[100] Some equations are omitted from model due to data limitations as well as their inability to forecast properly.

Figure 12.1: In-sample Model (1990-2014) Forecasts – Turkey



12.2.2. Out-of-sample Forecasts

To set the future values of policy variables in a consistent way, the projection of world output (foreign income) is taken from Global Economic Outlook; while for rest of the exogenous variables (including policy variables) we have employed ARIMA models to project the future values of a series based entirely on its own inertia. Based on this information we have solved the model for Turkey for 2016 to 2020. Table 12.41 reports the out-of-sample forecasts for some of the relevant variables; while Figure 12.2 illustrates the projected values of some selected macroeconomic variables (where 2015 is actual data and 2016 to 2020 are projected values).

Table 12.41: Out-of-Sample Forecasts - Turkey

(%)

	2016	2017	2018	2019	2020
GDP	2.6	4.7	4.3	4.5	4.3
Value Added in Agriculture	1.2	1.2	1.2	1.3	1.3
Value Added in Manufacturing	2.7	5.4	3.7	4.7	4.1
Value Added in Services	4.9	4.9	4.8	4.8	4.7
Inflation	7.8	6.9	6.9	6.3	6.2
Exports	1.7	7.2	6.2	8.8	9.1
Imports	3.9	7.9	7.5	7.4	7.8
Direct Taxes	8.7	6.6	7.2	7.9	7.4
Indirect Taxes	9.5	7.4	7.9	8.8	8.1
Real Private Consumption	5.1	2.2	4.9	2.8	2.8
Real Government Consumption	-0.02	2.9	1.0	2.0	0.9
Real Private Investment	3.2	6.3	6.5	7.3	8.1
External Balance (Share of GDP)	-2.0	-1.9	-1.8	-1.5	-1.1

Turkey's growth prospects are reasonably robust, with an expected 4 to 5 percent growth from 2017 to 2020. Recovery in 2017 depends to some extent on a fiscal stimulus[101], but that is expected to be a short-term measure only. Mainly growth would be through the export market recovery. Exports are expected to grow at about 8 percent from 2017 to 2020, fueled by rising external demand and an increase in its competitiveness. While rebounding domestic demand will stimulate import growth. Overall it would be net exports, which are expected to contribute substantially to GDP growth in 2017 and onwards. The projected growth in imports of about 7 percent (less than of exports, i.e., about 8 percent) would help in reducing external trade deficit by 2020 (from 2 percent in terms of GDP in 2016 to 1.1 percent in terms of GDP in 2020).

Furthermore, credit facilitation is expected to support private consumption and private investment in the period under study. Since 2010, final consumption expenditure in terms of GDP is decreasing. This trend is expected to continue; final consumption expenditure in terms of GDP is projected to decline from about 75 percent in 2016 to about 73 percent in 2020. However, despite this decline it will remain the main expenditure item on the demand side. Private investment is likely to remain weak in 2016, however, after the recovery of business confidence, private investment will pick up from 2017 onwards. Investments (mainly FDI from Europe) have remained the main driver of growth in Turkey for the last fifteen years or so; this is expected to continue.

On the production side both manufacturing and services sectors are expected to support economic growth in the medium term. As discussed in Chapter 3, Turkey is

[101] Fiscal stimulus package was announced in 2016 after failed coup attempt in Turkey to spur growth. In 2016, growth slowed to about 2.6 percent from 6.1 percent in previous year, as the failed coup attempt depressed consumer and business confidence and tourism revenues fell.

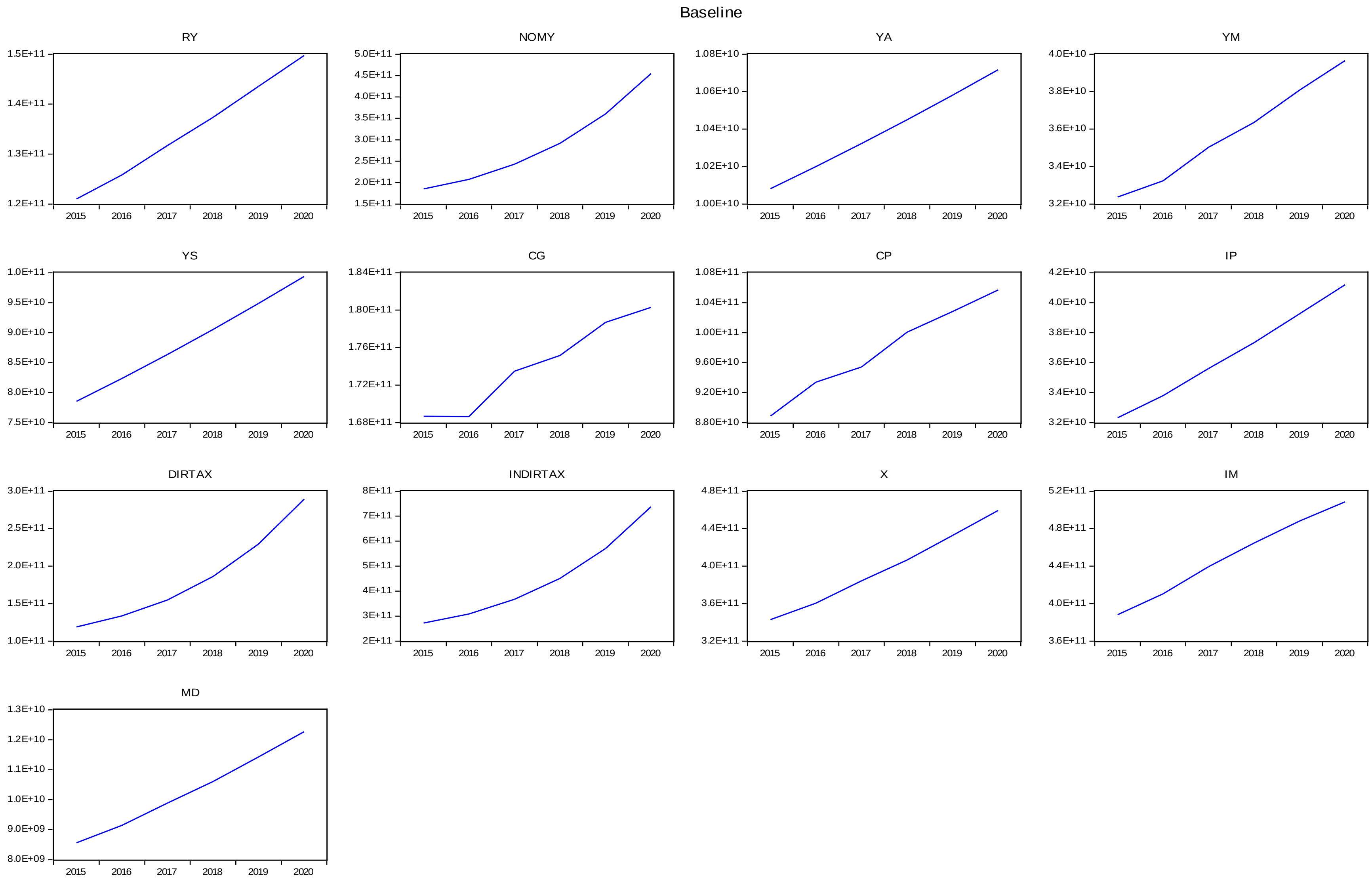
classified as an emerging market economy with strong industrial base and well-developed services sector[102]. These two sectors will continue to remain strong pillars to support economic growth on the supply side.

As per the projections on the fiscal side, both the direct and indirect taxes are expected to rise by 7 percent and 8 percent respectively from 2016 to 2020. However, in terms of GDP they are expected to decline, which may have a negative impact on the overall budgetary balance.

On the monetary side, a stable lira eased the pressure on prices of imported goods and average inflation rate declined in 2015; this decline is projected to continue by 2020. With expected volatility in exchange rate, tight monetary policy would help in maintaining inflation rates in Turkey.

[102] Turkey has high capacity utilization ratio in industry and strong appetite to invest in new areas which will keep this trend to continue.

Figure 12.2: Out-of-Sample Forecasts (2015 - 2020) - Turkey



12.3. Conclusion

This chapter has developed a detailed macro-econometric model for the Turkish economy covering all aspects of the economy including the three commodity producing sectors, major components of aggregate demand, fiscal and monetary variables and foreign trade sector. Both long run relationships and short run dynamics have been estimated which capture the key features of the macroeconomic structure of the Turkish economy as well as its evolution over time. The estimated models have been used for simulations and forecasting of important macroeconomic variables. While economic growth in the medium term is projected to remain modest, the macroeconomic environment is expected to be characterized by relatively high inflation. On the external front, both exports and imports are likely to show robust growth. Despite this, however, the Turkish economy is vulnerable to external shocks as its firms are leveraged with external debt and recent currency depreciation has worsened their balance sheets. These developments could hamper the growth momentum and raise the risk of macroeconomic destabilization. The immediate policy concern for Turkey is thus to bolster its currency and help its troubled firms to restructure their loans. The Turkish economy has demonstrated resilience in the past and given prudent macroeconomic management, it is expected to effectively deal with the emerging challenges and recharge the process of economic growth.

Chapter 13 - Turkmenistan: Modelling Exercise and Forecasts

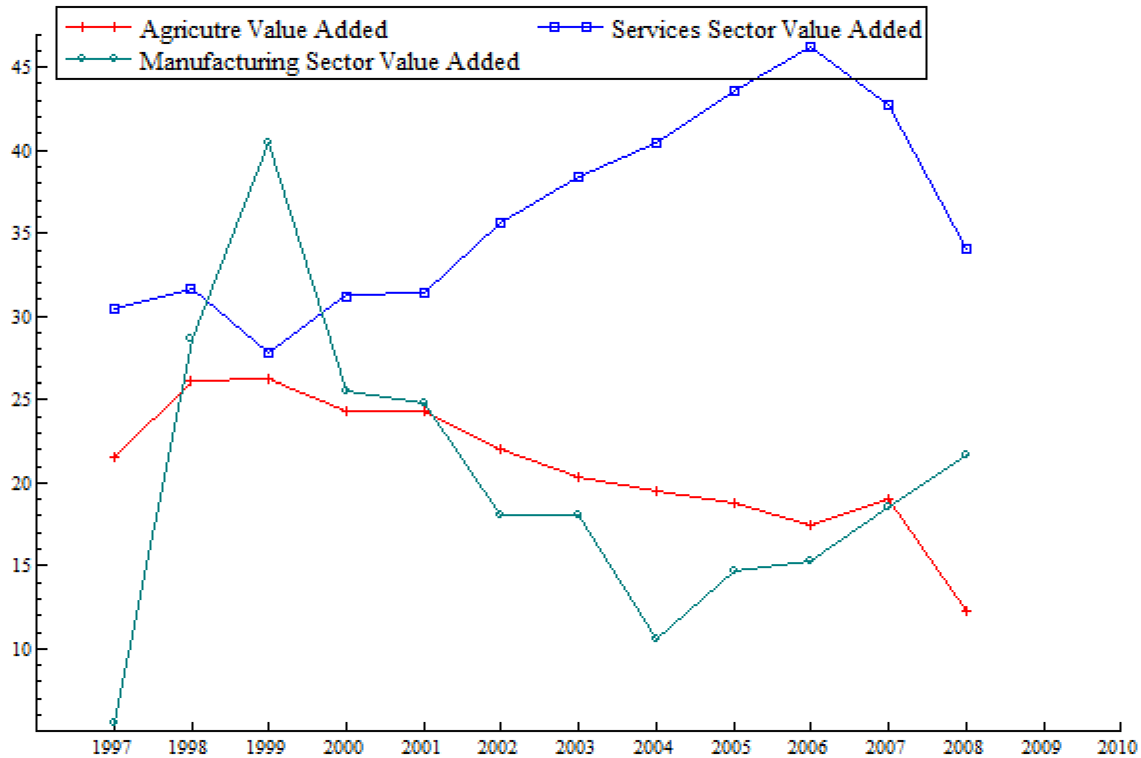
The modelling exercise for Turkmenistan has focused on key macroeconomic variables for which time series data of adequate duration was available. The model specifications and estimations have also been dictated by data availability. Due to data constraints, the macro-econometric modelling for Turkmenistan focuses on dynamic simulations and forecasting of important macroeconomic variables using time series techniques.

13.1. Modelling Exercise

13.1.1. Production Block

To model the production activities, we have disaggregated the production into three major sub-sectors: (1) agriculture, (2) manufacturing, and (3) services. The selection of the sectors is primarily based on the structure of the economy. In production block, agriculture value-added, services sector value-added and manufacturing sector value-added are given as percentage of their share in GDP. A very small synchronized data 1997-2008 are available for these three value-added sectors. Figure 13.1 below shows that services sector value addition remained the highest through the data span while manufacturing sector's value addition remained the lowest. Also, agricultural sector value addition is continuously decreasing not least because of growing urbanization trend in Turkmenistan.

Figure 13.1: Sector-wise Value Added

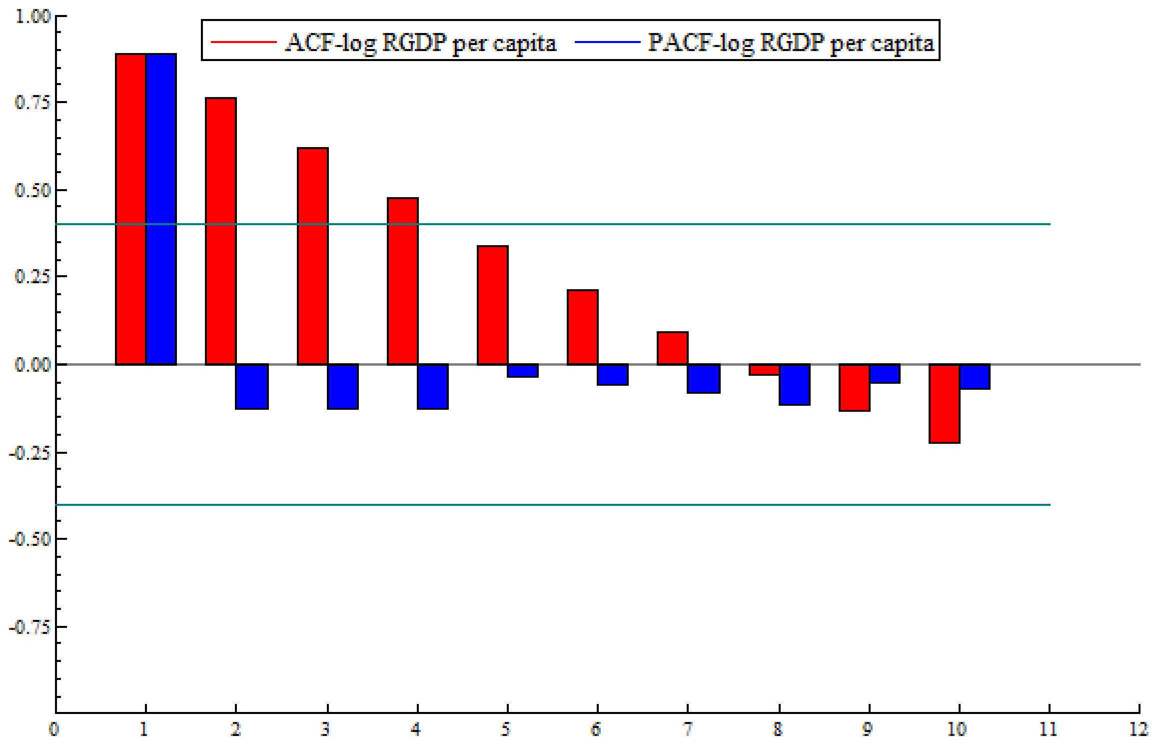


13.1.2. Monetary and Price Block

13.1.2.1. Real Income Per Capita

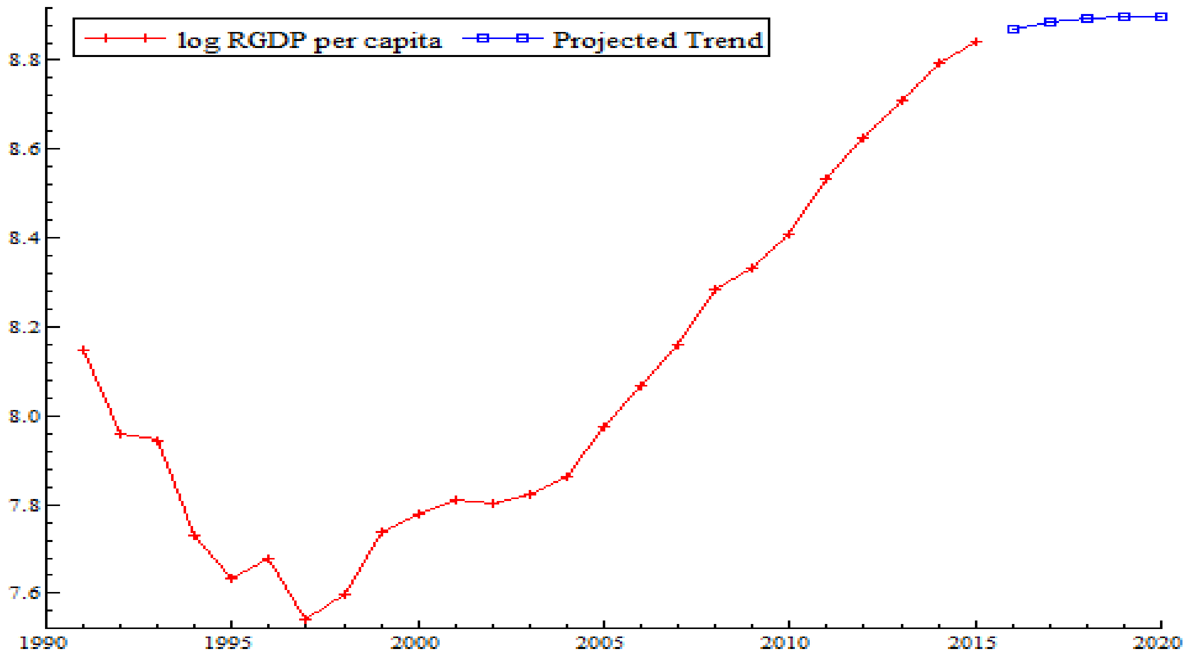
Figure 13.2 below presents ACF and PACF of log real GDP per capita. The graph clearly indicates an ARMA process which fades out after few lags. With this short data span, an ARFIMA (1, 0.367, 0) process is used to derive projected trend for real GDP per capita (log-likelihood: 24.859, T = 1991 – 2015).

Figure 13.2: ACF and PACF Plots for Log of Real GDP Per Capita



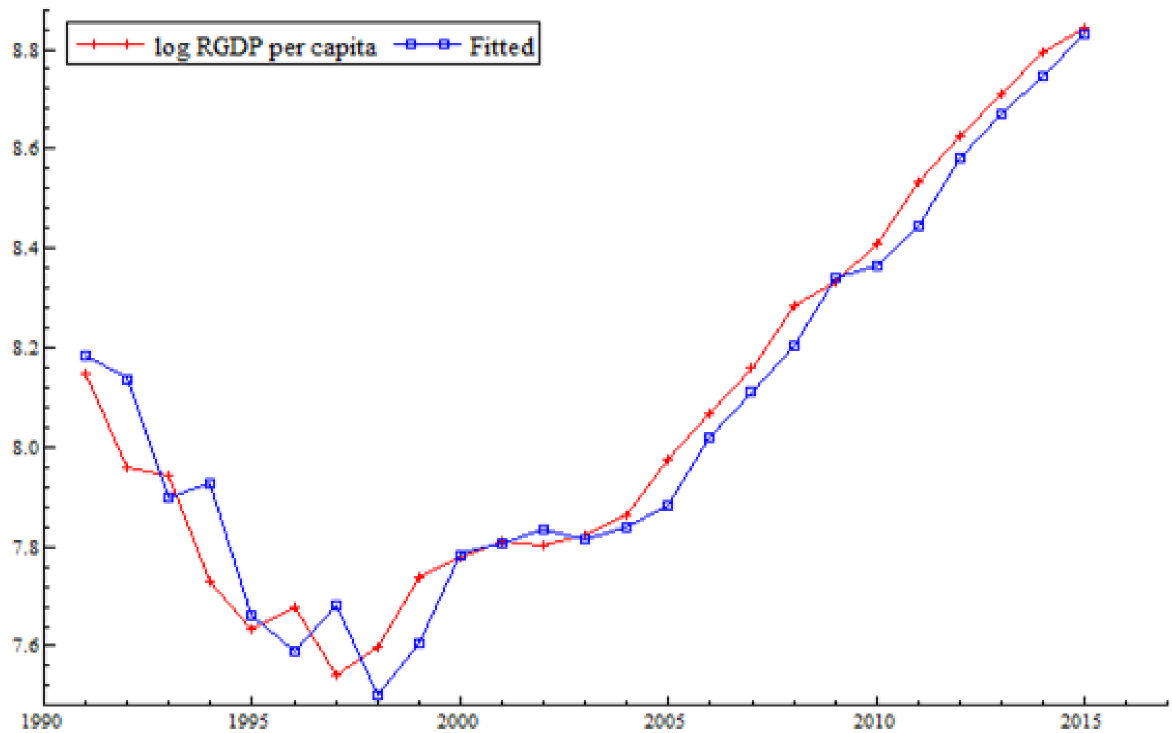
Projected and actual trends for log of real income per capita from 2016 to 2020 are given in Figure 13.3. A clear increasing trend can be seen throughout the projected period 2016 – 2020 showing positive growth prospects for Turkmenistan's economy in the medium term.

Figure 13.3: Actual and Projected Trends for Log Real GDP Per Capita - 2016 to 2020



In-sample forecasts, for both actual and predicted series of real income per capita indicate that the estimated model predicts the actual series fairly accurately. After a sharp decline in 1997 a continuous increasing trend of real income per capita can be seen clearly which indicates a positive growth outlook.

Figure 13.4: In Sample Forecasts for Actual and Fitted Trends of Log of Real GDP Per Capita - 1991 to 2015



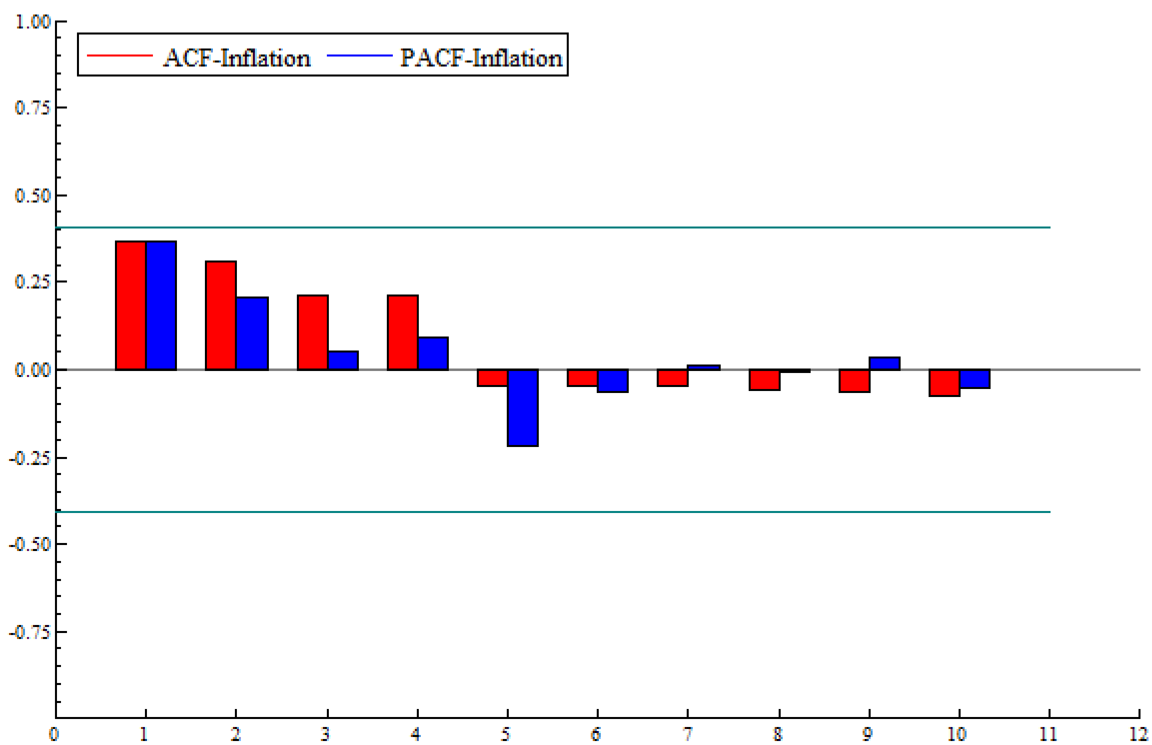
13.1.2.2. Inflation

Since the emergence of Turkmenistan as sovereign state in 1991, this important central Asian economy has experienced hyperinflation. The highest inflation rate of 3,089.15 percent was observed in 1992; within a decade the inflation decreased down to double digits before further declining to 0.6 percent in 2014. The effect of a global hike in commodity prices in 2008 can be seen in Turkmenistan economy and the inflation again rose to 60 percent, and subsequently the Turkmenistan economy has maintained decreasing pattern of inflation.

Two possible factors are responsible for the hyperinflation observed in the Turkmenistan economy. First and foremost is the lack of coordination between fiscal and monetary policies. Second, heightened inflationary expectations reduced the effectiveness of monetary policy, as agents based their contracts on their expectations of high future inflation.

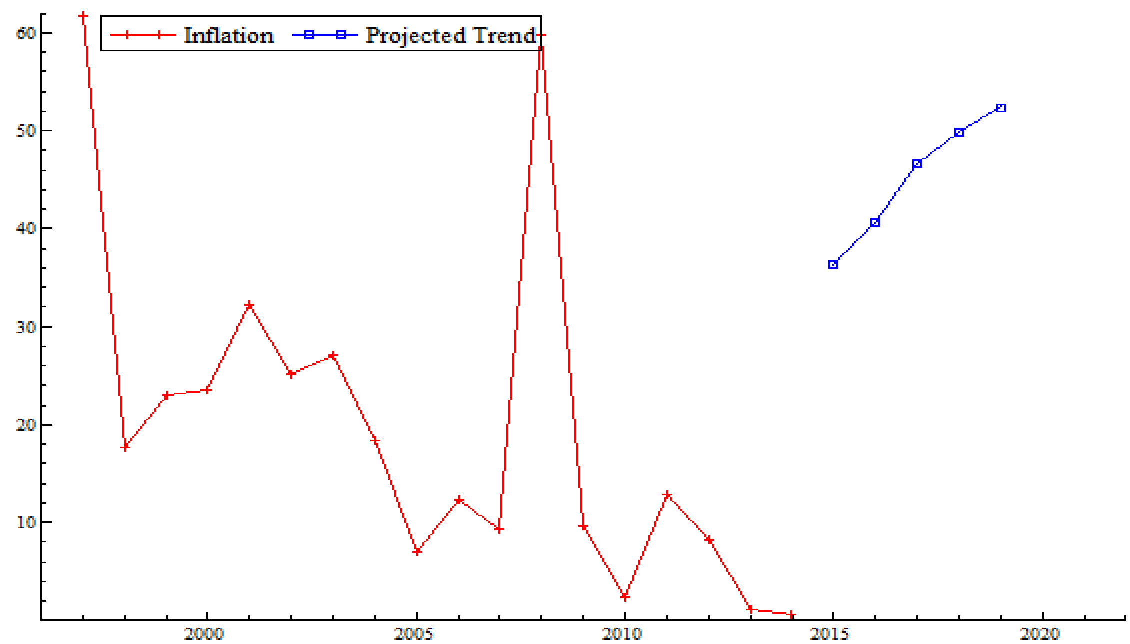
Figure 13.5 presents ACF and PACF for inflation. The figure clearly indicates an ARMA (0, 0) process at the 95 percent level of confidence. An ARFIMA (1, 0.420, 0) process is employed to estimate the projected trend for inflation (log-likelihood: -188.935, T = 1991 – 2014).

Figure 13.5: ACF and PACF Plots for Inflation



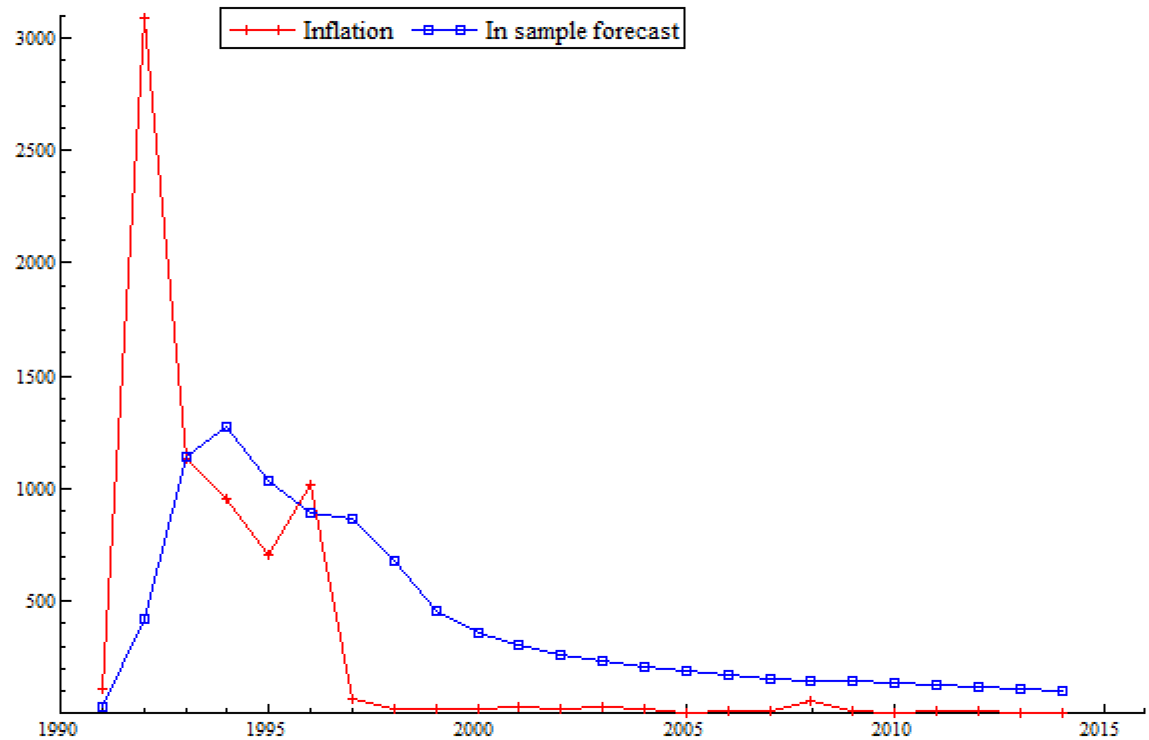
Projecting trends for inflation in Turkmenistan from 2015 to 2019 suggest inflation is likely to trend upwards throughout the projected period from 2015 to 2019.

Figure 13.6: Actual and Projected Trends for Inflation - 1997 to 2019



In-sample forecasts for both actual and predicted series of inflation indicate how closely the estimated model predicts the actual series. After 1996 the model forecasts comparatively better than the period 1991 – 1996 (Figure 13.7).

Figure 13.7: In Sample Actual and Forecast Trends for Inflation – 1991 to 2015



13.2. Simulation/Forecasts

Despite its upper-middle-income status, Turkmenistan is still at an early stage of transition. Undeniably, its abundant natural resources have delayed first generation reforms such as price and trade liberalization, privatization, and the creation of institutions for market regulation. Tight administrative controls and the public sector's large overall role in economic activity remain the key obstacles to private sector development in Turkmenistan. The public sector and state-owned monopolies continue to dominate the economy and the formal labor market.

Table 5.12. Growth Forecasts - Turkmenistan

(%)

	2016	2017	2018	2019	2020
Real GDP	6.2	7.7	7.6	8.1	9.2
Real Agriculture Value Added	6.5	-2.2	0.8	6.7	2.6
Real Manufacturing Value Added	6.0	13.8	11.0	5.9	11.1
Real Services Value Added	6.3	9.2	8.9	8.6	8.3
Real Private Consumption	-4.0	10.2	2.9	0.0	0.0
Real Public Consumption	6.7	-1.0	0.3	-3.7	5.0
Real Gross Fixed Capital formation	7.6	6.2	6.2	6.2	6.2
Inflation	-4.8	1.8	3.7	3.7	3.4
Total Expenditures	-17.8	-22.8	-31.4	-19.6	2.9
Total Revenue	-10.8	4.5	4.4	4.2	4.0
Fiscal balance (Share of GDP)	0.6	4.3	8.5	11.2	12.4

Note: For 2016 is actual data; while projections from 2017 to 2020 based on past trends (from 1990 to 2016). Inflation is based on GDP deflator.

In Turkmenistan, growth remained strong since late 1990s and continued to depend highly on hydrocarbons_ natural gas, oil, and petrochemicals (in terms of production as well as exports) and to a lesser degree on cotton, wheat and textiles. Real GDP growth in 2014 was recorded at 10.3 percent. However, lower global energy prices and sluggish economic activity in Turkmenistan's trading partners led to a fall in revenues from oil and natural gas exports, thus bringing down GDP growth to 6.2 percent in 2016. On the supply side, slower growth in hydrocarbons cut expansion in industry, compensated by expansion in services sector. While on the demand side, public and foreign direct investment supported growth.

According to our forecasts, Turkmenistan is likely to keep this growth momentum in the medium term as real GDP is projected to grow at about 8 percent by 2020, supported by strong domestic demand and export growth. On the supply side, growth would mainly be supported by manufacturing and services sectors. The Manufacturing value added is projected to increase by more than 10 percent by 2020 followed by services sector which is projected to grow by 8.8 percent by 2020. In terms of GDP (in real terms), no significant change is expected in the share of services by 2020. The share of agriculture is projected to decrease from 13.4 percent of GDP in 2016 to 10.4 percent of GDP in 2020; compensated by increase in the share of manufacturing from 51 percent of GDP in 2016 to 54 percent of GDP in 2020. On the demand side, investment and net exports will remain the main drivers of growth by 2020.

Despite the planned and ongoing diversification of markets, Turkmenistan's exports are increasingly dependent on a single large market (China) and continue to be dominated by a single product (natural gas)[103], making the economy vulnerable to fluctuations in global prices beyond its control. Thus, in the medium term, higher exports of natural gas to China along with more favorable terms of trade are expected to be the main growth drivers. At the same time, the economy faces the risk of a downturn if oil prices turn out to be lower than expected.

In Turkmenistan, despite devaluation in early 2015, the decline in prices for food and services and the import-substitution policy of the government helped in containing the inflation rate at 6.4 percent in 2015. In 2016, the central bank focused on maintaining the currency peg by tightening liquidity and restricting foreign exchange operations. The

[103] In this context, a planned third pipeline to China and the proposed Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline, if they materialize, would more than double gas export capacity.

annual inflation rate averaged 6 percent in 2016, supported by lower public spending, administrative price controls, and higher domestic production of consumer and industrial goods. Due to insufficient data on consumer prices, we projected medium term forecast for inflation using GDP deflator. According to our projections, inflation will remain below 4 percent by 2020.

Turkmenistan recorded a fiscal surplus of 10 percent of GDP in 2008. Since then it has narrowed to 0.8 percent of GDP in 2016.[104]. Lower hydrocarbon exports limited revenues in 2015 and 2016[105]. The Government continued to adjust its fiscal policy to low hydrocarbon prices. Higher revenue transfers from off-budget funds and lower capital outlays helped in improving fiscal balance in 2017despite a large increase in public sector wages and pensions. Fiscal consolidation is expected to continue, which should strengthen fiscal and debt sustainability.

Turkmenistan's economic outlook will depend essentially on the price and external demand of natural gas, although industrial policy is anticipated to support non-hydrocarbon activity[106].

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[104] This reflects continued spending on social programs, including rise in public wages, pensions, and students' stipends, along with higher investment outlays.

[105] Energy revenues largely covered the fiscal deficit in the non-hydrocarbon economy.

[106]World Bank country website for Turkmenistan; economy; available at: http://www.worldbank.org/en/country/turkmenistan/overview#3

13.3. Conclusion

The macro-econometric model of Turkmenistan's economy has focused on simulation and forecasting of major segments of the economy including production, demand, fiscal and monetary framework and foreign trade. Like many other economies in the region, Turkmenistan' economy is driven by hydrocarbons and consequently its macroeconomic environment depends largely on international developments in hydrocarbons. The public sector plays a dominant role in the economy and there is a need for greater participation of the private sector in diverse manufacturing and services activities. While the economy is expected to grow strongly in the medium term, the growth would likely be concentrated in the energy sector making the economy vulnerable to international shocks. Turkmenistan needs to diversify its economy for a more broad-based sustainable growth. Similarly, though the economy has managed to stem hyperinflation that it experienced in the initial years, there is a need to continue prudent fiscal and monetary management to stabilize the economy, promote private investment and encourage inclusive economic growth.

Chapter 14 - Uzbekistan: Modelling Exercise and Forecasts

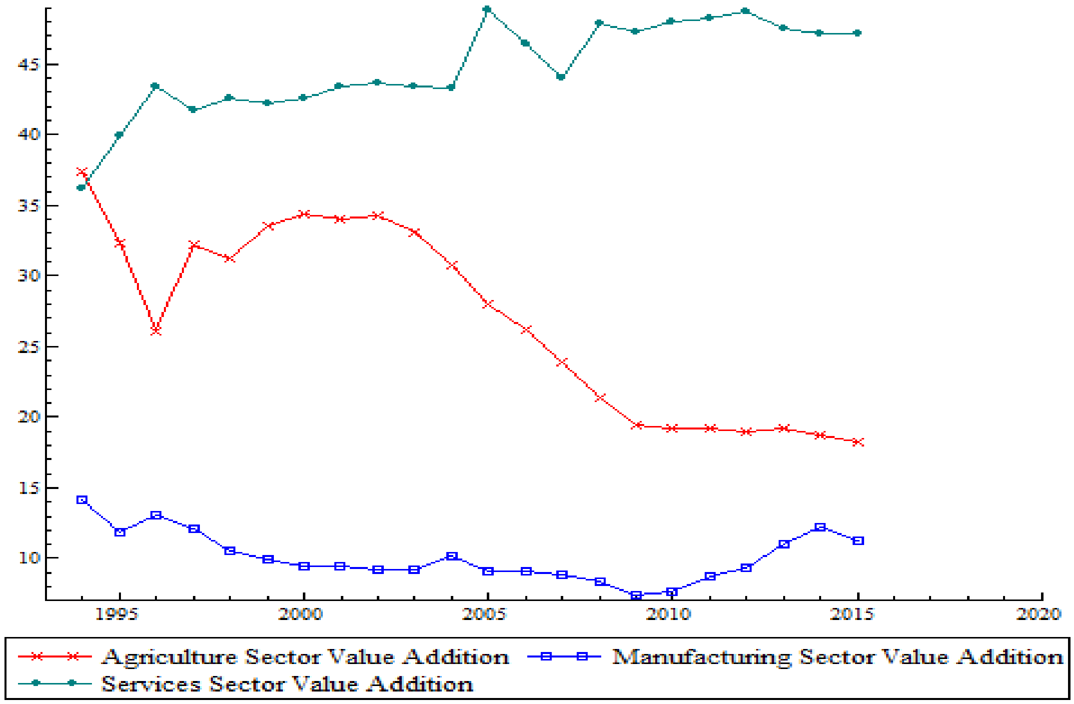
The modelling exercise for Uzbekistan has focused on key macroeconomic variables for which time series data of adequate duration was available. The model specifications have also been dictated by data availability and consequently there may be some missing variable bias.

14.1. Modelling Exercise

14.1.1. Production Block

In production block, agriculture value addition, services sector value addition and manufacturing sector value added are given as percentage of their share in GDP. The trends evident in Figure 14.1 suggest that services sector value addition remained the highest through the data span while the share of manufacturing sector has been the lowest. Also, it can be observed that agricultural sector value addition is continuously decreasing; a reason for this might be continuously growing urbanization trend in Uzbekistan.

Figure 14.1: Value Addition by Sector



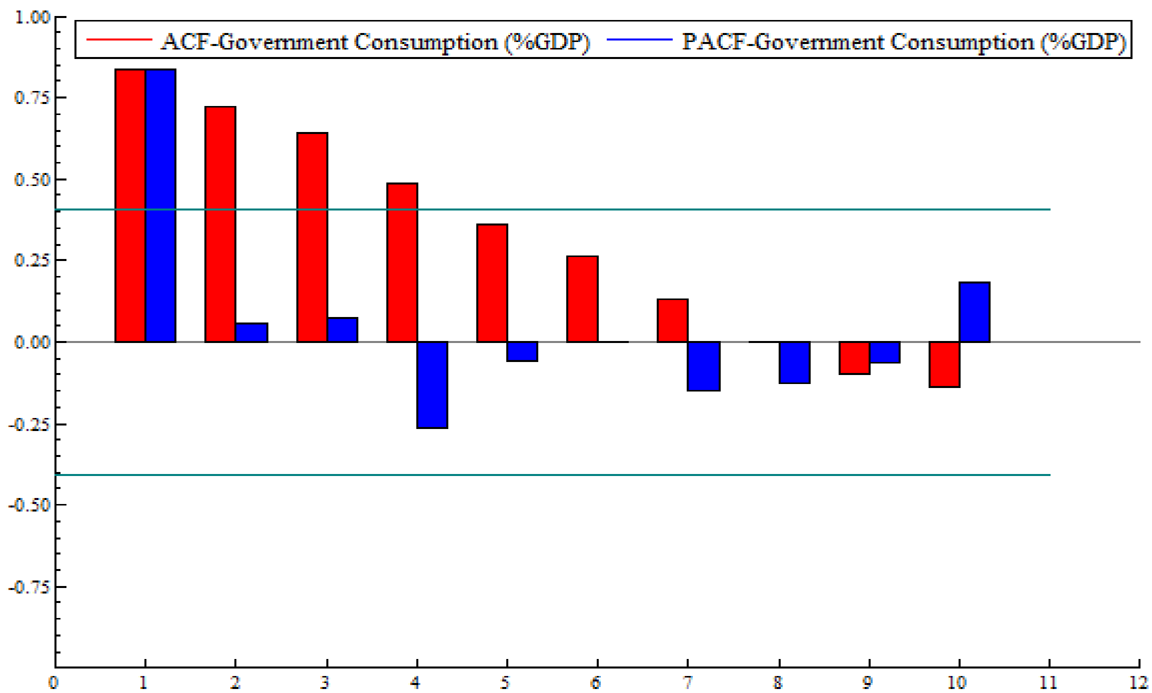
14.1.2. Aggregate Demand Block

On the demand side, data is available only for real private investment and government consumption as percentage of GDP. A brief discussion on trends of these macro variables is presented below. Contemporary simulation techniques are used and projected trends for both variables are estimated. Also, in-sample forecast is depicted to show the suitability of simulation technique employed.

14.1.2.1. Government Consumption

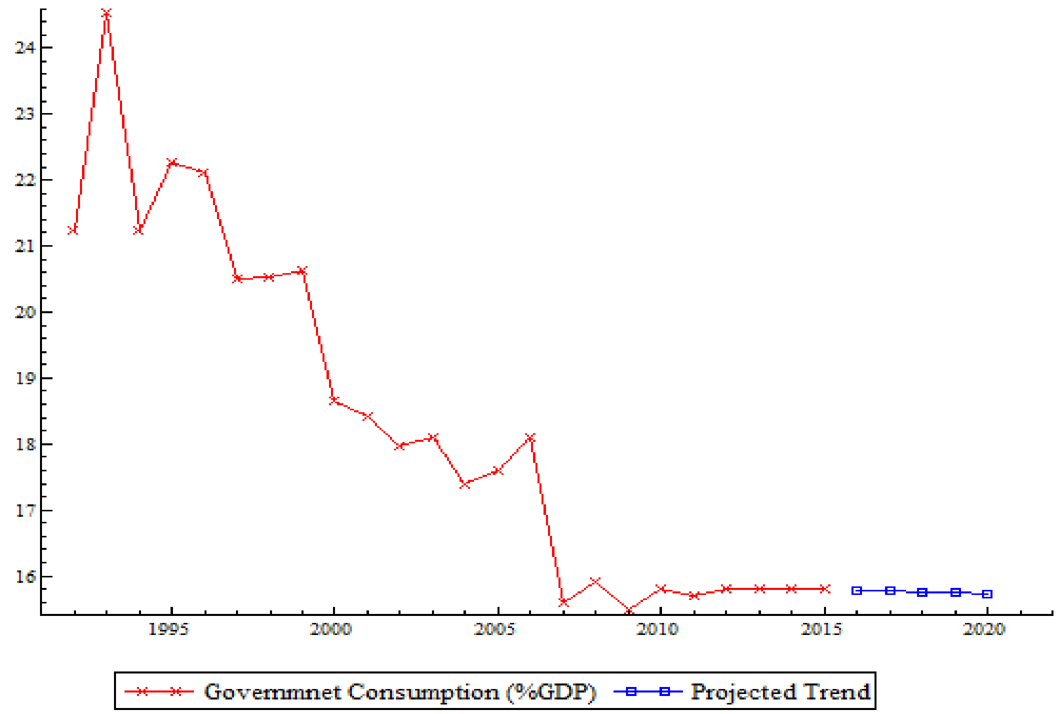
Figure 14.2 presents ACF and PACF for Government Consumption (share in GDP - percent) and clearly indicates an ARMA process that fades out after several lags.

Figure 14.2: ACF and PACF Plots for Government Consumption



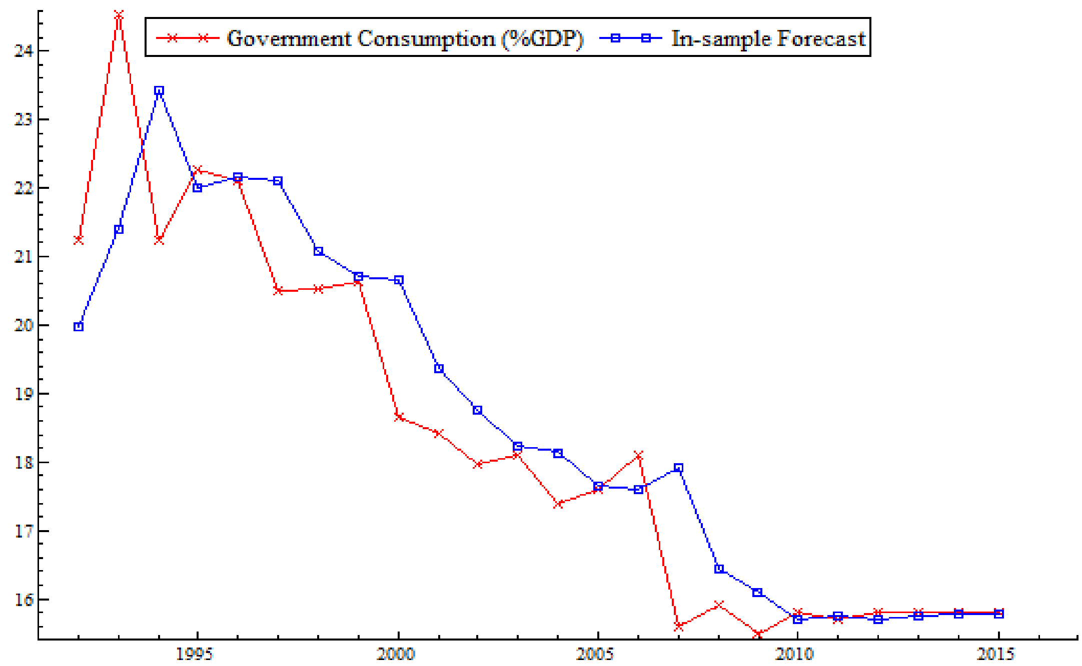
With a short data span, an ARFIMA (1, 0, 1) process is used to estimate the projected trend for Government Consumption (share in GDP - percent) (log-likelihood: -40.217, T = 1992 – 2015). A clear decreasing trend can be seen in Figure 14.3, throughout the projected span of Government Consumption from 2016 to 2020.

Figure 14.3: Actual and Projected Trends - Government Consumption: 2016 to 2020



Plots of in-sample forecasts, for both actual and predicted series of government consumption in Uzbekistan indicate how closely the estimated model predicts the actual series. A continuous decreasing trend of Government Consumption can be seen clearly.

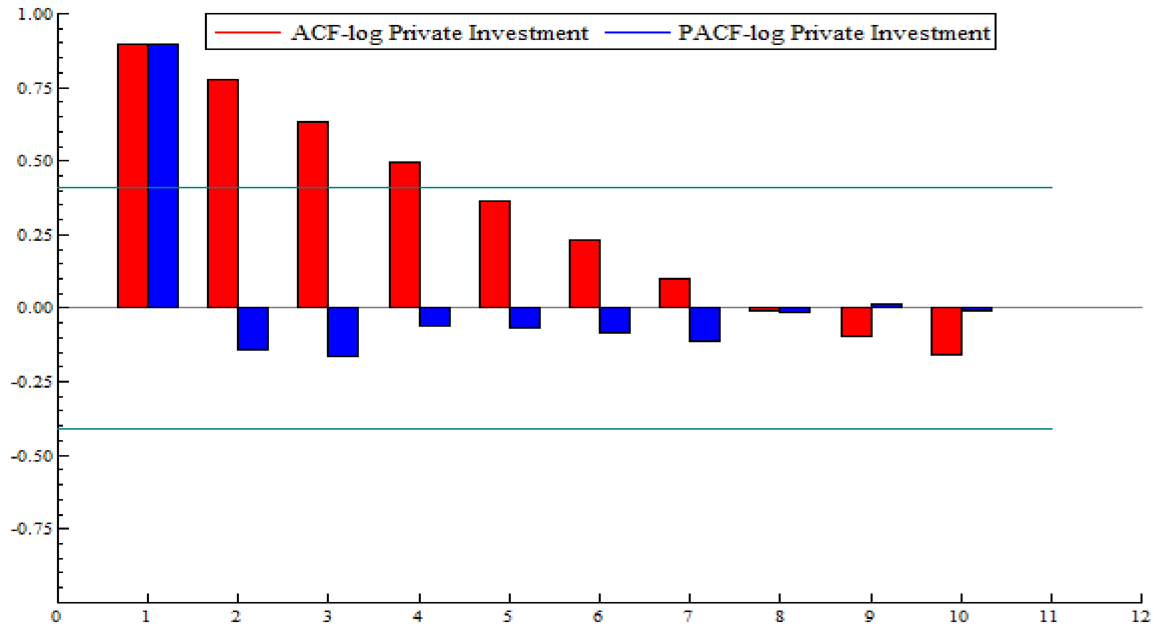
Figure 14.4: In-sample Forecast Government Consumption - 1992 to 2015



14.1.2.2. Private Investment

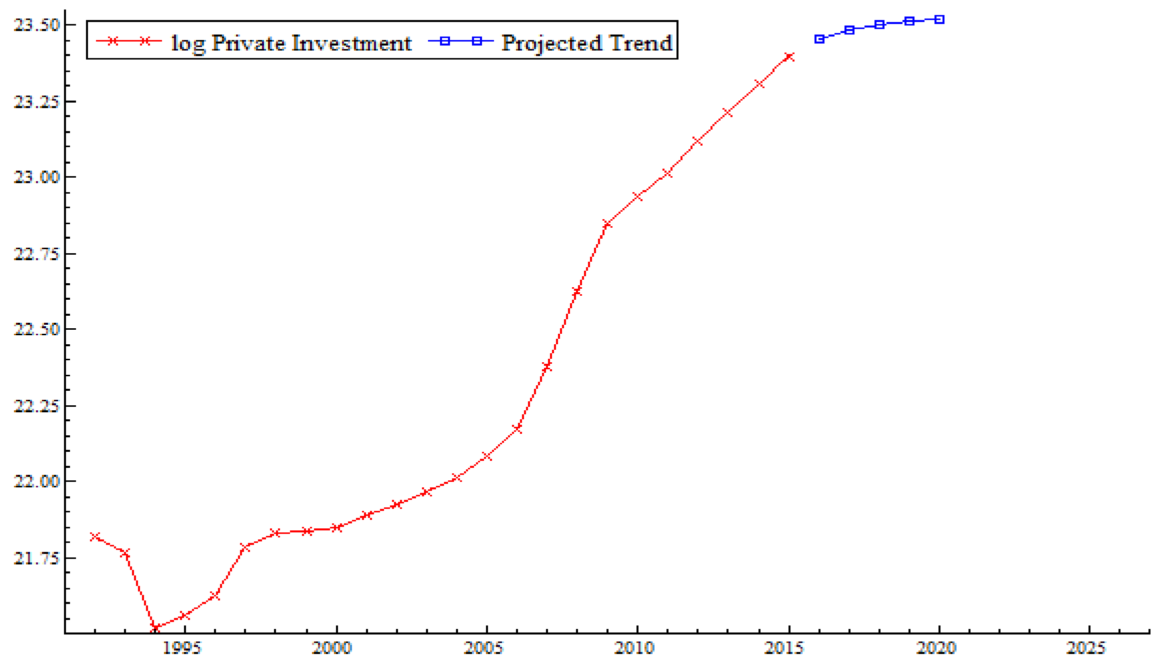
ACF and PACF plots for log private Investment (Figure 14.5) clearly indicate the series follows an ARMA process which fades out after several lags.

Figure 14.5: ACF and PACF Plots for Log Private Investment



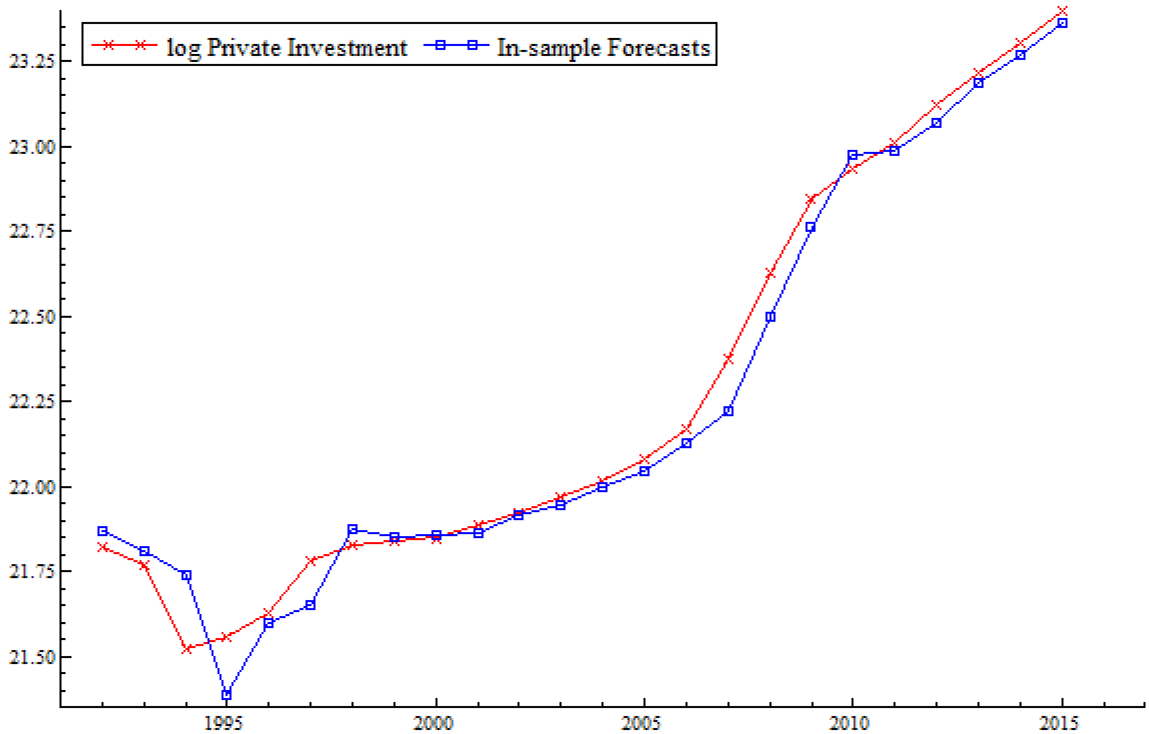
With a short data span an ARFIMA (1, 0.363 , 1) process is used to estimate the projected trend for log of private investment (log-likelihood: 22.637, T = 1992 – 2015), and a clear increasing trend can be seen throughout the projected time span from 2016 to 2020 (Figure 14.6).

Figure 14.6: Actual and Projected Trends - Log Private Investment - 2016 to 2020



Time plots of in-sample forecasts, both actual and predicted series indicates how closely the chosen model predicts the actual series. A continuous increasing trend for log of private investment in Uzbekistan's emerging economy is evident in Figure 14.7.

Figure 14.7: Actual and In-sample Forecasts - Log Private Investment - 1992 to 2015



14.1.3. Fiscal Block

In the fiscal block, only data for Government Expenditure and Inflation is available. A brief discussion on trends of these macro variables is given here. Contemporary simulation techniques are employed and projected trends for these macro variables are estimated. Also, in-sample forecast is depicted which shows the validity of employed simulation technique. ACF and PACF plots are analyzed to reveal the Autoregressive and Moving average structure of the series that helps employing appropriate model for simulated projections.

14.1.3.1. Government Expenditure

ACF and PACF plots for log of government expenditure suggest that the series has an ARMA process that fades out after several lags. An ARFIMA (1, 0.379, 1) process is employed to derive the projected trend for government expenditure (log-likelihood: 15.753 , T = 1991 – 2015).

Figure 14.8: ACF and PACF Plots for Log of Real GDP Per Capita

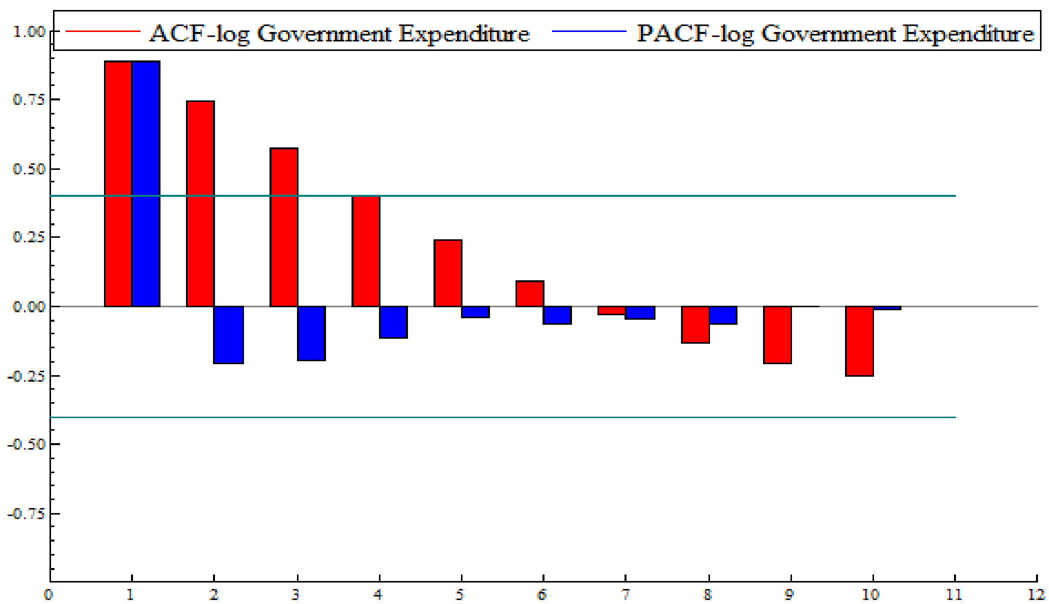


Figure 14.9 presents projected trend for log government expenditure from 2016 to 2020. A stable pattern is seen from 2016 to 2018 then a slight decrease is observed in the following two years.

Figure 14.9: Actual and Projected Trends for Log of RGDP Per Capita - 2016 to 2020

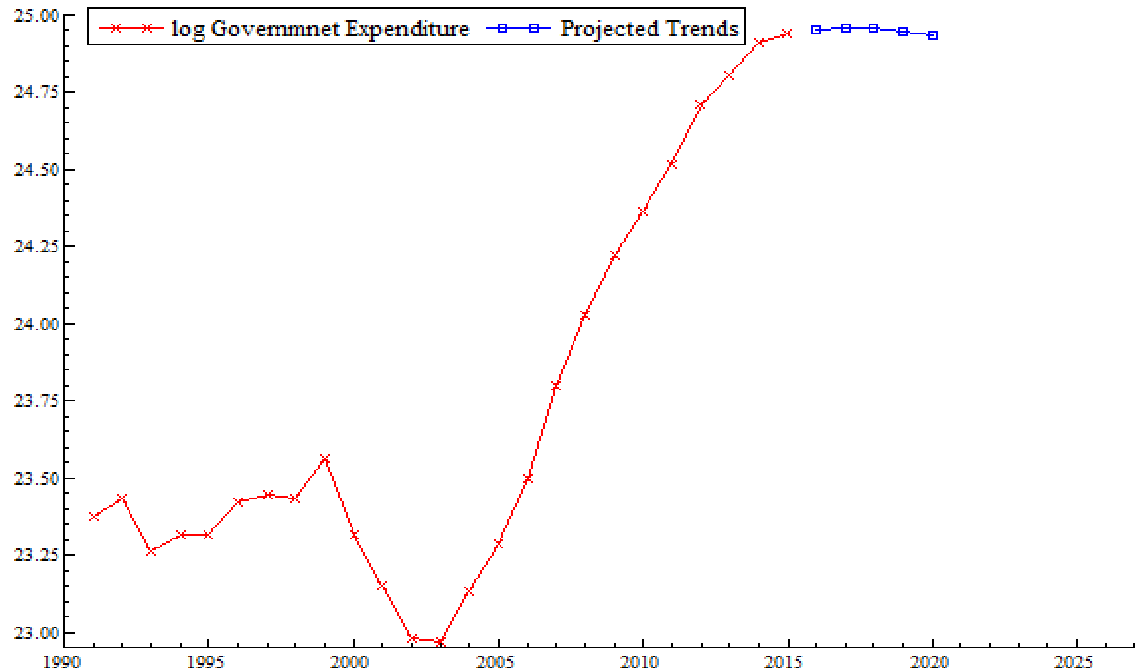
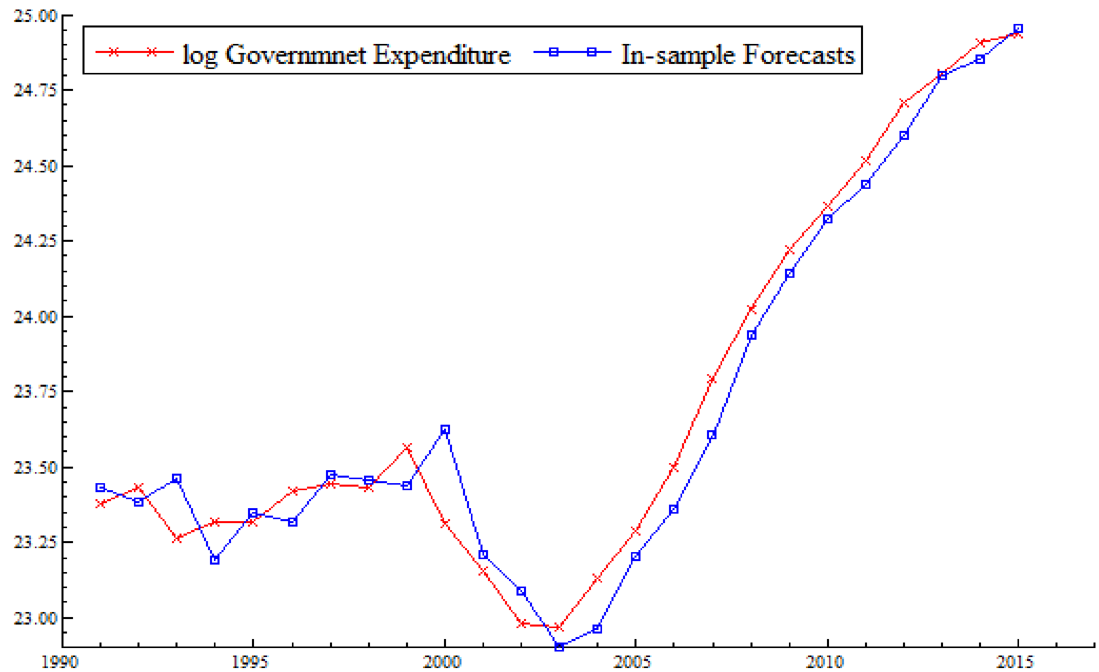


Figure 14.10 presents in-sample forecasts, both actual and predicted series for real GDP per capita. The figure indicates how closely our model predicts the actual series. After a sharp decline in 2003 a continuous increasing trend of government expenditure can be seen clearly in Uzbekistan's emerging economy.

Figure 14.10: Actual and In-sample Forecasts - Log RGDP Per Capita: 1991 to 2015



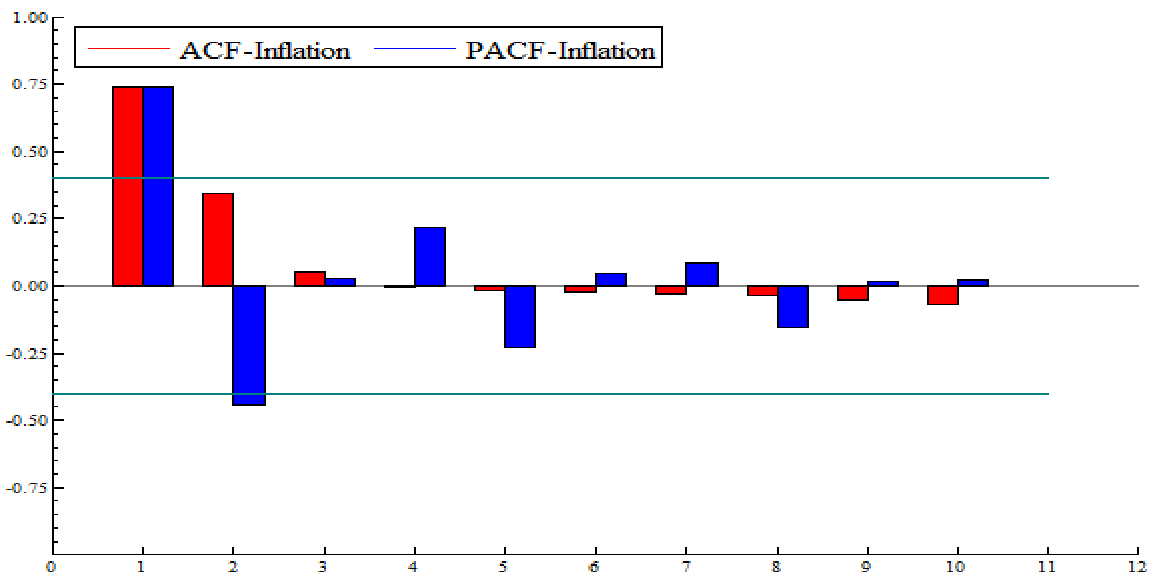
14.1.3.2. Inflation

Since the emergence of Uzbekistan as sovereign state, this important central Asian economy experienced hyperinflation. The highest inflation rate of 1,239 percent was observed in 1994; within a decade the inflation rate decreased to double digit figures and further declined to 8.7 percent in 2015. Moreover, despite a global hike in commodity prices in 2008, the Uzbekistan economy maintained a decreasing pattern of inflation rate that year.

Two possible factors may be responsible for hyperinflation in the Uzbekistan economy. First the lack of coordination between fiscal and monetary policies may have made it difficult to carry out contractionary monetary policy to combat inflation. Second if inflationary expectations are entrenched, the effectiveness of monetary policy is reduced as agents base their contracts on their expectations of high future inflation.

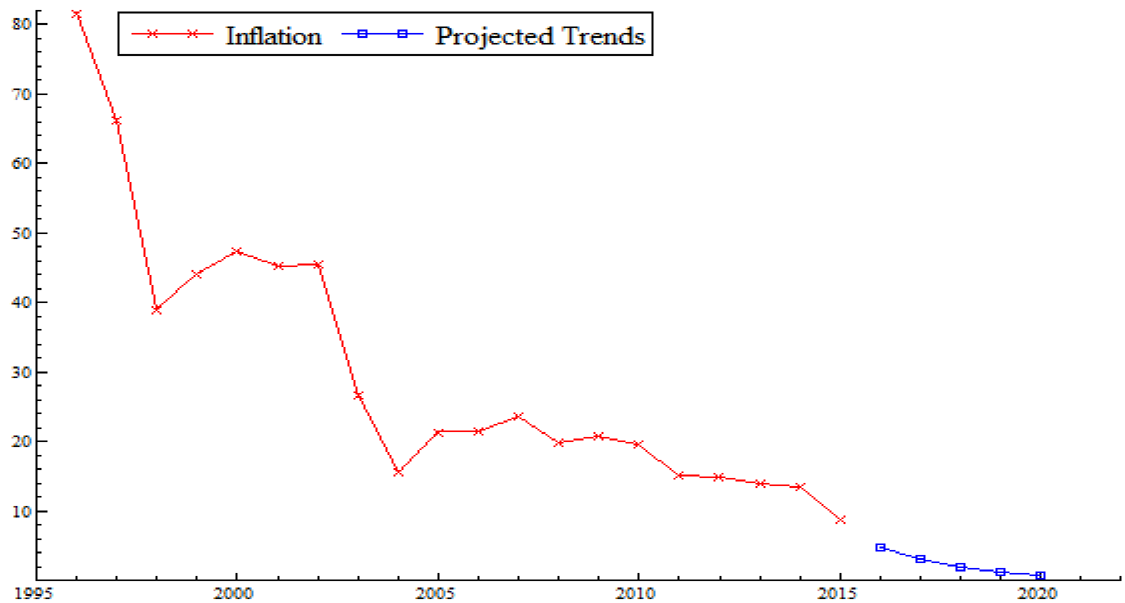
Plots for ACF and PACF for inflation clearly indicate an ARMA process that fades out immediately (Figure 14.11). An ARFIMA (1, 0, 1) process is employed to derive the projected trend for inflation (log-likelihood: -168.725 , T = 1991 – 2015).

Figure 14.11: ACF and PACF Plots for Inflation



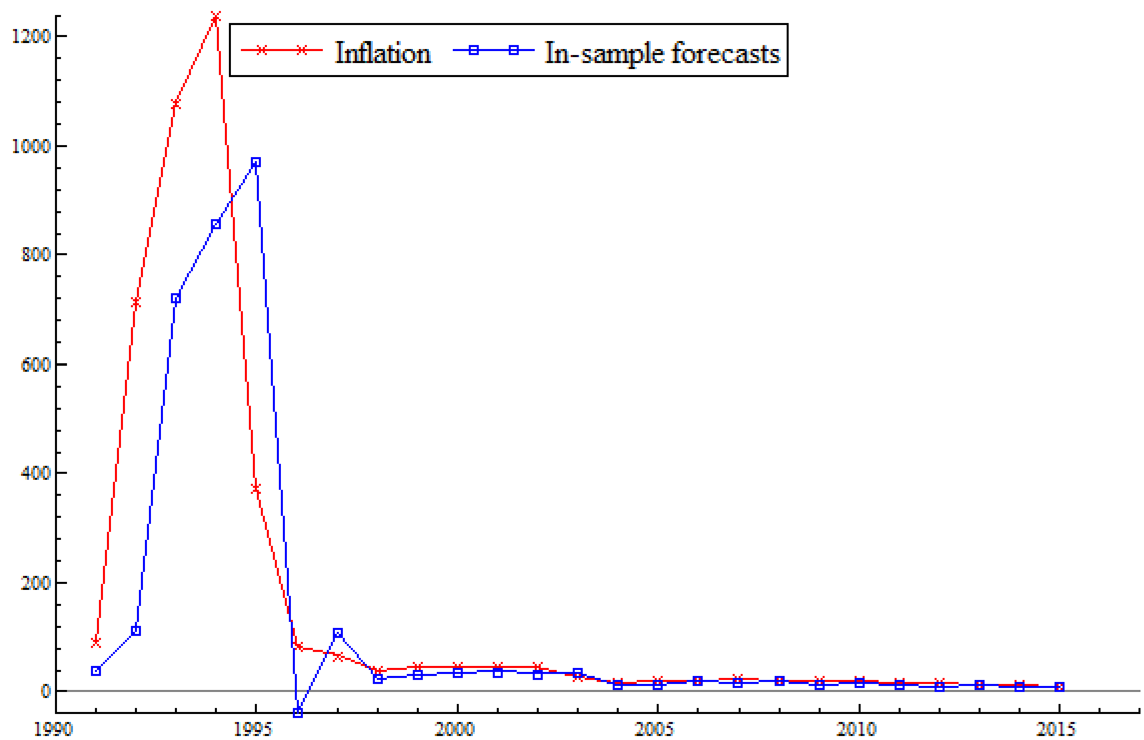
Plotting the projected trend for inflation from 2016 to 2020 reveals a continuous, sharp decreasing trend that can be observed throughout the projected period (Figure 14.12).

Figure 14.12: Actual and Projected Trends for Inflation - 2016 to 2020



Plots for both actual and in-sample predicted series of inflation indicate how closely the model predicts the actual series (Figure 14.13). After 1996 the model forecasts comparatively better compared to the period 1991-1996.

Figure 14.13: Actual and In-Sample Forecast Plots for Inflation - 1991 to 2015



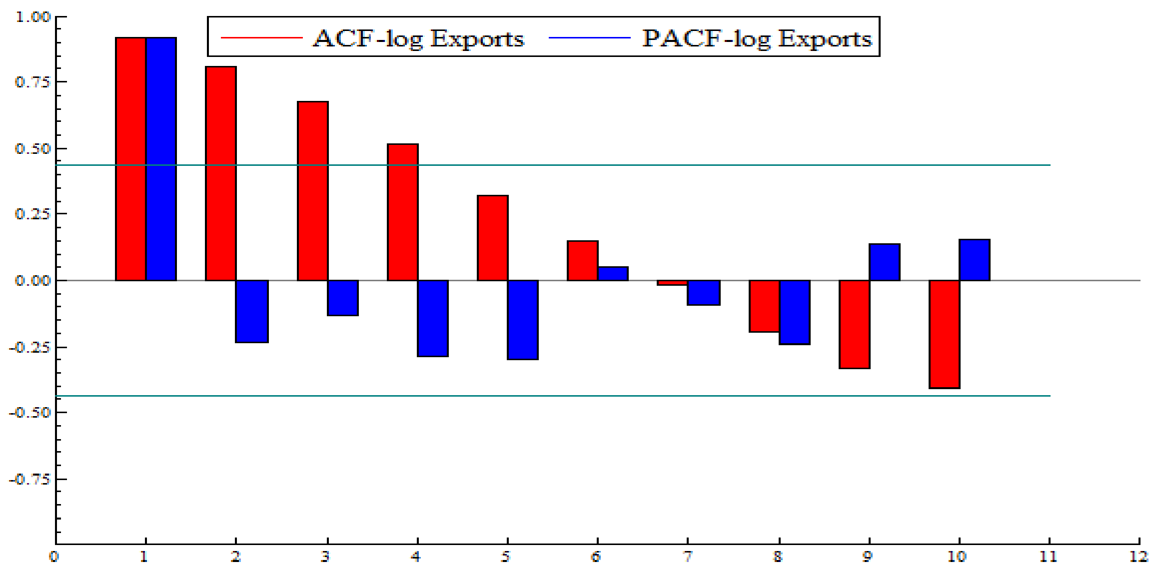
14.1.4. Foreign Trade Block

A brief discussion on the trends of real Exports and real Imports of the Uzbekistan economy is presented here. Contemporary simulation techniques are employed and projected trends for exports and imports have been estimated. ACF and PACF plots reveal Autoregressive and Moving Average structure of the series that helps in employing an appropriate simulation model.

14.1.4.1. Exports

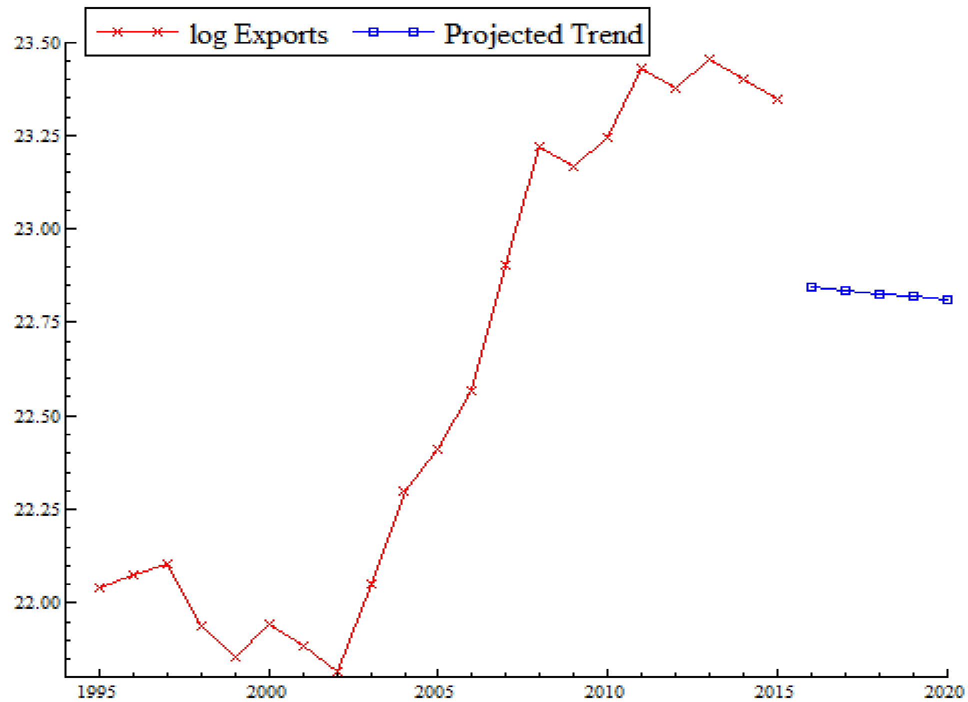
Theoretically, exports of goods and services are determined by world income, the real effective exchange rate and the relative price of exports. Based on the functional form specified in Section (4.3.4.1), data for relevant macro variables required to estimate macro-econometric model for Exports of the Uzbekistan economy is lacking. Instead the trends and present projected trends of exports are discussed. ACF and PACF for log of exports clearly indicate an ARMA process which fades out after several lags (Figure 14.14).

Figure 14.14: ACF and PACF Plots for Log of Exports



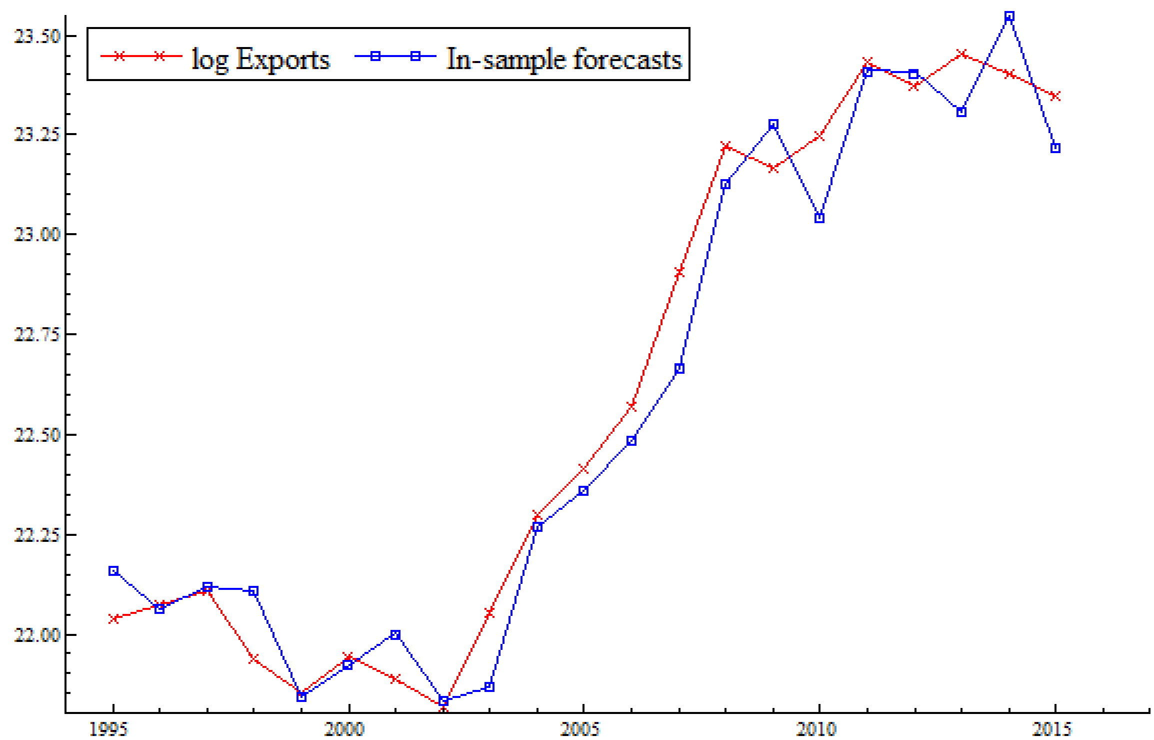
With this short data span an ARFIMA (1, 0, 1) process is employed to generate the projected trend for real exports (log-likelihood: 12.213 , T = 1995 – 2015) which reveals in a decrease in exports projected from 2016 to 2020.

Figure 14.15: Actual and Projected Trends for Log of Exports - 2016 to 2020



Plots for actual and in-sample predicted series for log of exports indicate how closely the model predicts the actual series. After a sharp decline in 2002 a continuous increasing trend of exports is observed in the sample from 1995 to 2015 (Figure 14.16).

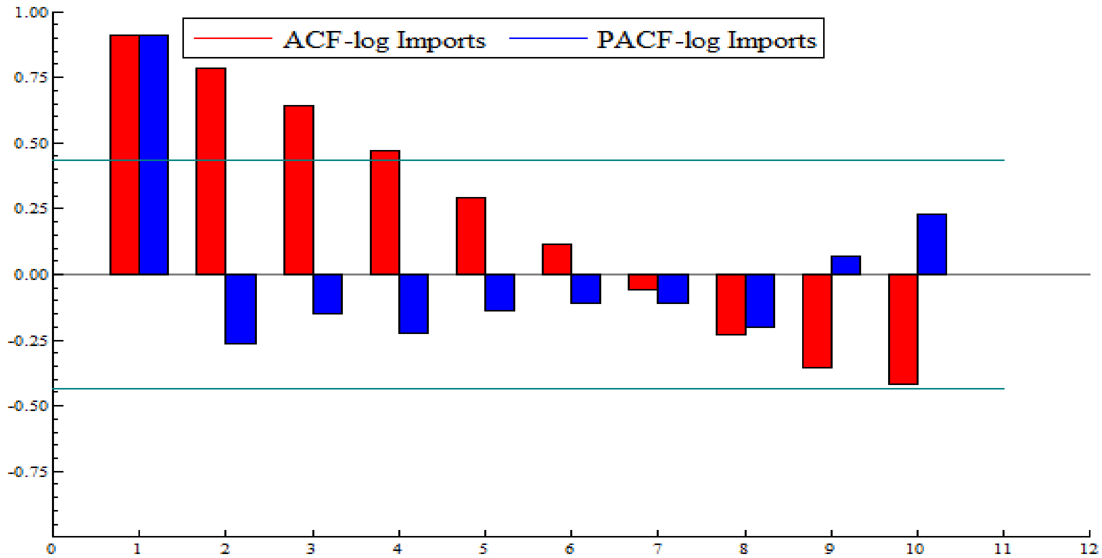
Figure 14.16: Actual and In-sample Forecasts for Log of Exports - 1995 to 2015



14.1.4.2. Imports

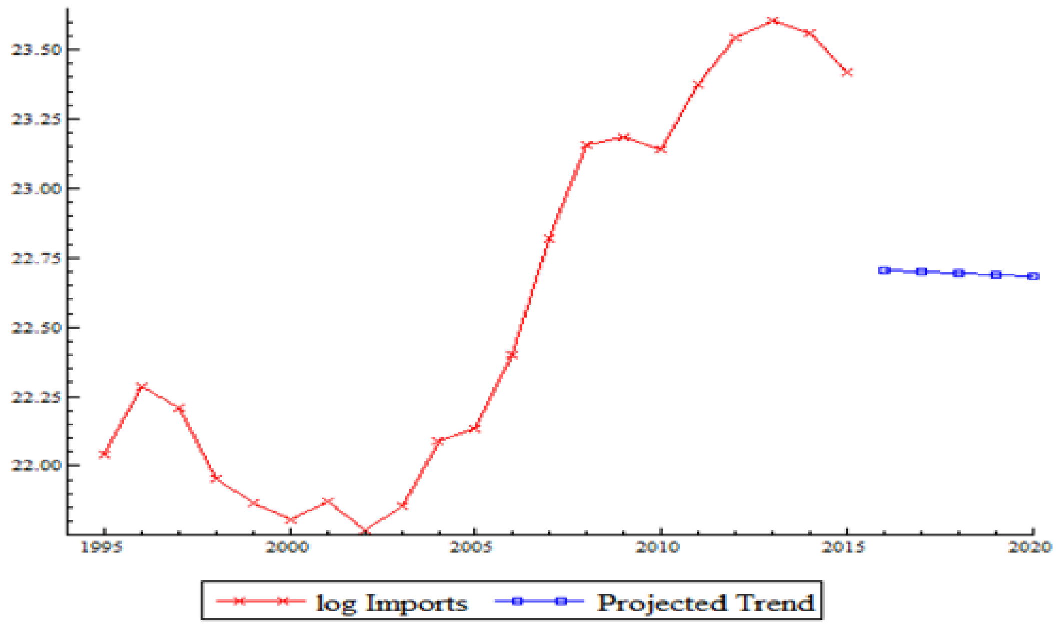
The import of goods and services is estimated as function of real domestic income, real effective exchange rate, relative price of imports and foreign capital inflows. Data for relevant macro variables to estimate a macro-econometric model for Imports into the Uzbekistan economy is unavailable. Instead a discussion on trends and present projected trends of imports is presented. ACF and PACF plots for log of real imports indicate an ARMA process that fades out after several lags.

Figure 14.17: ACF and PACF Plots for Log of Imports



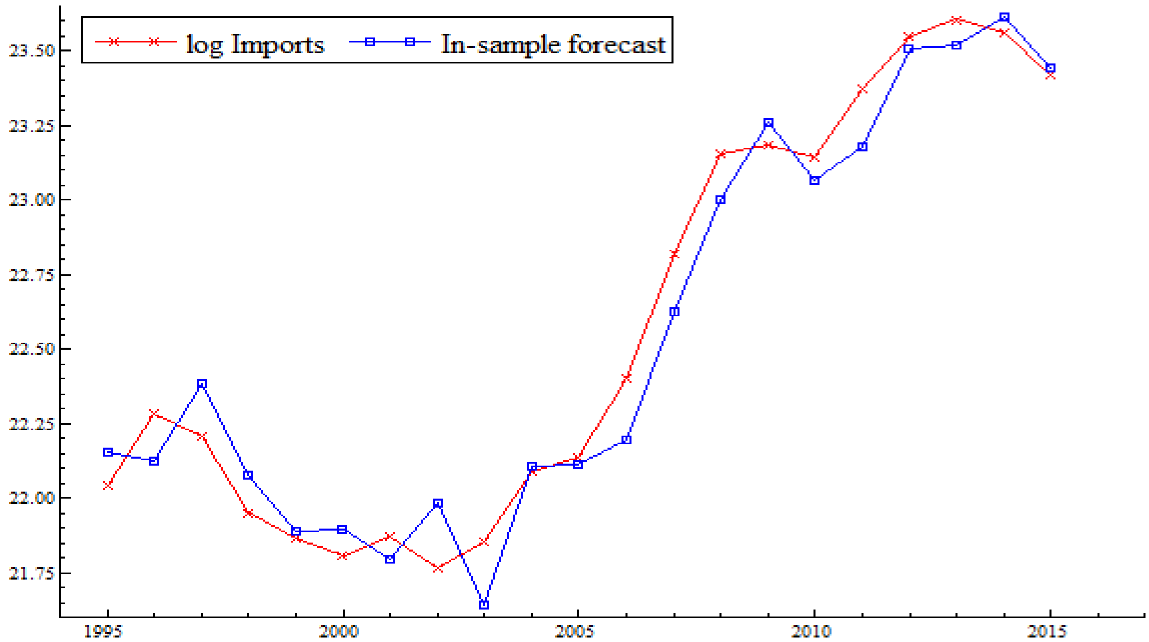
With a short data span, an ARFIMA(1,0,1) process yields the projected trend for real imports (log-likelihood 9.869 ; T = 1995-2015) is derived. Figure 14.18 depicts a projected decrease in imports from 2016 to 2020.

Figure 14.18: Projected Trends for Log of Exports - 2016 to 2020



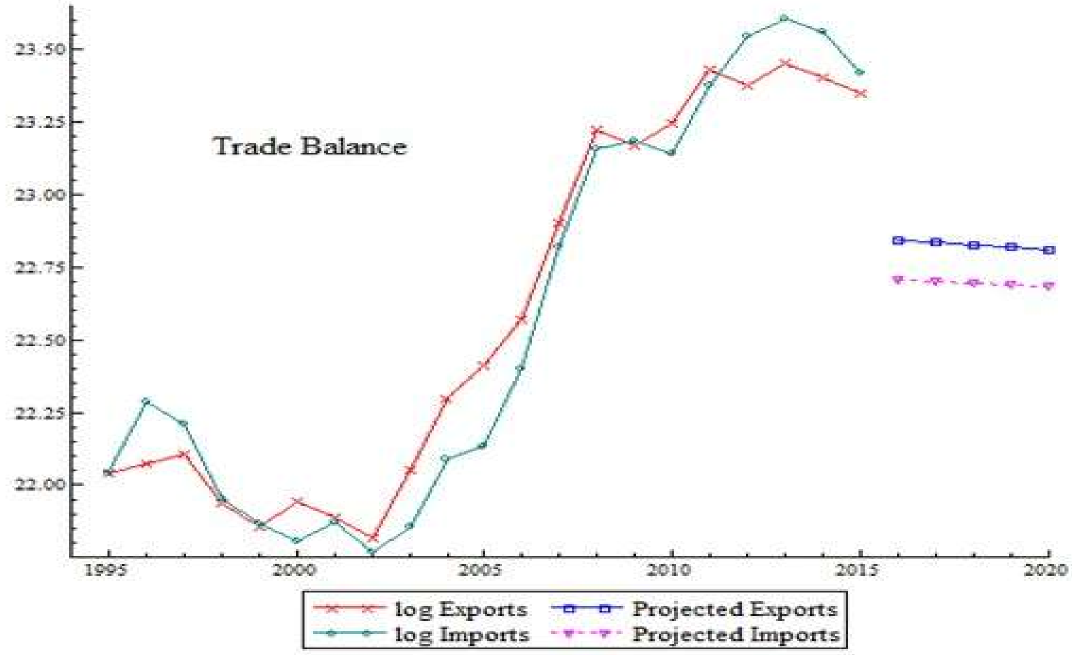
Plots of actual and in-sample forecasts of predicted series of log of imports indicate the model does predict the actual series, but with some minor deviations at various points in time (Figure 14.19). An increasing trend for imports is evident in the sample from 2005-2015.

Figure 14.19: Actual and In Sample Forecast Trends for Log of Imports - 1995 to 2015



Plots of the balance of trade for the Uzbekistan economy (Figure 14.20), as represented by real exports and imports reveal that real exports on average exceeded imports during the in-sample years, and consistently in the projected trends from 2015 to 2020.

Figure 14.20: Balance of Trade



14.1.5. Monetary and Price Block

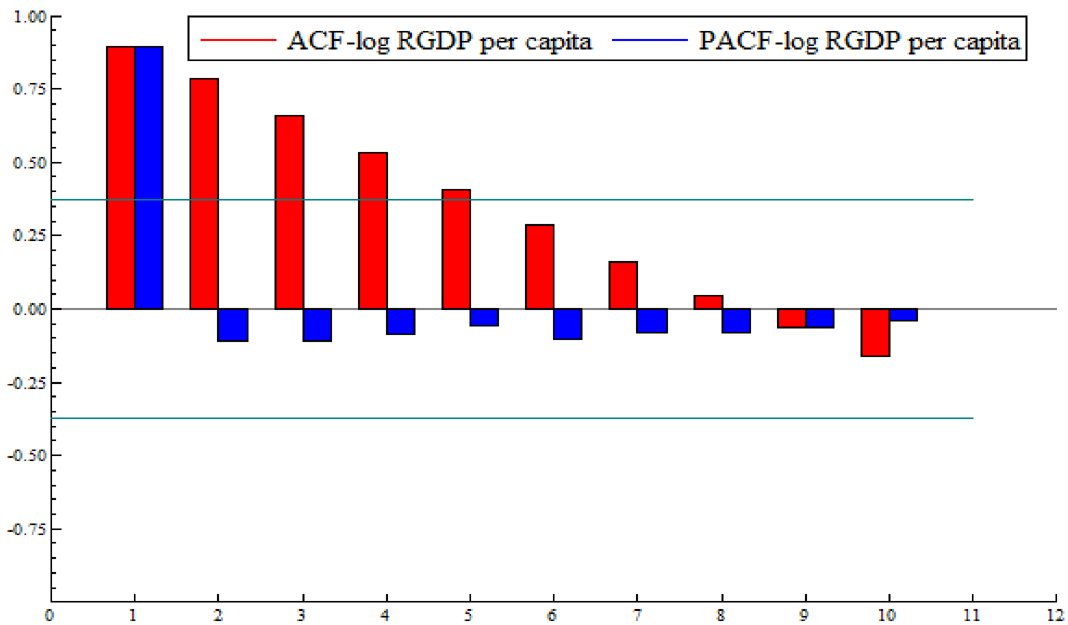
Only data for real per capita income is available for the monetary and price block so a brief discussion of the trend of this macro variable is given here. We employ Contemporary simulation techniques and projected trends for real per capita income are estimated, while in-sample forecast is employed to represent the suitability of simulation technique employed. From ACF and PACF plots the Autoregressive and Moving average structure of the series is revealed, aiding in the choice of an appropriate simulation technique.

14.1.5.1. Real Income Per Capita

ACF and PACF plots for log of real GDP per capita (LRGDPC) indicate an ARMA process that fades out after several lags (Figure 14.21). With this short data span an

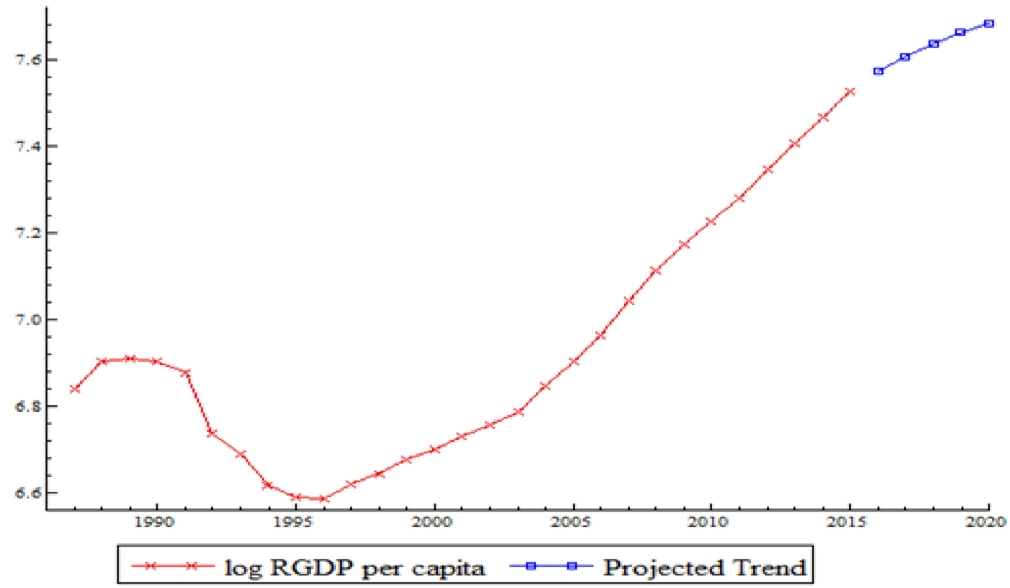
ARFIMA (1, 0.491, 1) process can be used to estimate the projected trend for real GDP per capita (log-likelihood: 44.493 , T = 1987 – 2015).

Figure 14.21: ACF and PACF Plots for Log of Real GDP Per Capita



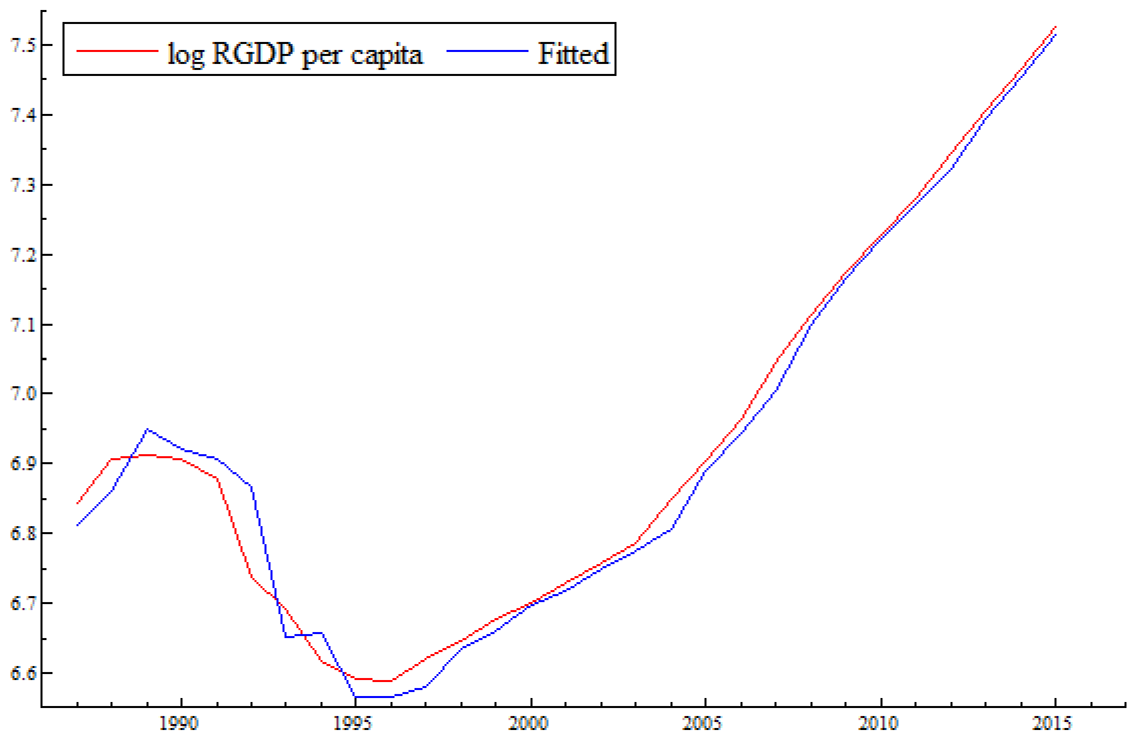
Plotting the projected trend for log of real income per capita from 2016 to 2020 reveals a clear increasing trend that is evident throughout the projected span (Figure 14.22). Growth in the Uzbekistan economy can be expected to continue in the medium term.

Figure 14.22: Actual and Projected Trends for Log of RGDP Per Capita - 2016 to 2020



Actual and in sample predicted trends for real GDP per capita of Uzbekistan indicate how closely the model predicts the actual series (Figure 14.23). After a sharp decline in 1996 a continuous increasing trend of real income can be seen clearly which indicates growth prospects of the economy in the medium term.

Figure 14.23: Actual and In Sample Forecasts for Log RGDP Per Capita - 1987 to 2015



14.2. Policy Forecasts

Uzbekistan is the most populous country in Central Asia (over 32 million people), with a strong agricultural base and abundant natural resources, including hydrocarbons, gold, copper, and uranium. Cotton is the main agriculture item, Uzbekistan is the fifth largest exporter of cotton and sixth largest producer. Uzbekistan is one of the most dynamic economies of the Commonwealth of Independent States (CIS).

Uzbekistan is relatively closed and centrally planned economy. In December 2016, the newly elected Government recognized the need to shift to a market-oriented economic structure supported by private sector growth. In February 2017, the Government announced a broad-based market-oriented reform program focusing mainly on improving public administration and state-building; ensuring the rule of law and judiciary reform; maintaining economic growth and liberalizing the economy; enhancing social safety nets; and ensuring security and implementing a constructive foreign policy. Additionally, the government-initiated efforts to improve business climate and guarantee macroeconomic stability in the country.

Growth remained robust at an average of around 8 percent (from 2004 to 2012) led by wage and pension increases, high public investment spending, and large remittances. Additionally, increased exports of gas, gold and copper combined with high commodity prices, have generated revenues that financed large increases in public investment and salaries to strengthen consumption. On the supply side, all the three sectors contributed significantly to growth in Uzbekistan. However, declining world commodity prices in 2013 to 2016 and weak economic performance of China and Russia[107] adversely affected Uzbekistan's business exports, as well as state budget revenues and household income.

As per the medium-term forecasts, real GDP is projected to grow at about 6 percent by 2020 (Table 5.8) after a 7.8 percent growth in 2016. On the supply side, all the three sectors are expected to play a significant role in Uzbekistan's economy. Real value added in agriculture is projected to grow by about 5.6 percent by 2020. However, in terms of GDP its share is projected to decline from 17.6 percent in 2016 to 16.0 percent in 2020. Real value added in manufacturing is projected to grow by 5.5 percent by 2020.

[107] Russia is second largest trading partner after China and a main source of remittances in Uzbekistan.

Table 5.8. Forecasts for Uzbekistan

(%)

	2016	2017	2018	2019	2020
Real GDP	7.8	6.9	6.8	6.3	5.7
Nominal GDP	16.0	14.6	13.3	12.2	11.2
Real Agriculture Value Added	6.6	5.4	6.3	4.7	5.8
Real Manufacturing Value Added	6.7	6.3	5.6	5.2	4.9
Real Services Value Added	11.4	12.5	12.9	13.5	14.1
Private Consumption	16.0	15.8	13.3	11.7	10.7
Public Consumption	16.0	14.6	13.5	11.9	10.6
Gross Fixed Capital Formation	21.3	20.5	19.2	14.2	14.7
Imports	12.2	15.1	13.7	12.5	11.4
Exports	12.0	14.5	15.4	10.5	9.2
Trade Balance (share of GDP)	-1.8	-1.9	-1.6	-2.0	-2.3
Inflation	7.6	8.2	8.5	8.8	8.9
Current Expenditures	12.8	16.0	11.7	12.9	10.6
Revenue from Taxes	14.9	15.0	13.1	7.9	5.9

Note: For 2016 it is actual data; while projections from 2017 to 2020.
Inflation is based on GDP deflator.

Uzbekistan's industrial sector accounted for 36.6 percent of GDP in 1991. Despite some efforts to diversify its industrial base, industry remains dominated by raw materials extraction and processing, most of which is connected with cotton production and minerals. Additionally, its share in GDP declined to 32.9 percent of GDP in 2016. As per our projections, it is expected to decline further to 29.5 percent of GDP by 2020. In Uzbekistan, industrial production generally lagged behind consumption, making Uzbekistan a net importer of many industrial products.

In the past few years, the service sector in Uzbekistan has emerged as a key source of value added and new jobs. And in the medium term this trend will continue as services sector is projected to grow at about 13.2 percent by 2020. In terms of GDP, services sector is projected to increase its share from 49.5 percent in 2016 to 54.6 percent in 2020.

Financial services and telecommunications have been the main drivers of growth in the service sector in Uzbekistan. The banking sector is healthy but not very developed. Financial intermediation in the country is limited, with credit to the private sector amounting to roughly 22 percent of GDP.

On the demand side, slight deceleration in growth is likely to be influenced by the slowing in domestic demand. Total investment would get slightly weak relative to previous years, while remaining the main growth engine for the economy on the expenditure side. This is possible due to public investment programs in Uzbekistan, which supported a range of sectors (transport, utilities, oil and gas explorations, and housing) as well as private investment activity. On the other hand, private consumption is projected to slow down slightly in real terms due to inflationary pressures, despite the expected recovery in remittance inflows.

Uzbekistan's external environment is expected to stabilize moderately in the medium term as commodity prices gradually pick up and the Russian economy recovers from the recession of 2015-16. However, the external environment in 2016-20 is not expected to be as advantageous as during the boom commodity years. Uzbekistan's exports owing to relatively weak external demand are projected to grow slightly slowly as compared to its imports, thus leading to external trade deficit of 2.3 percent in terms of GDP by 2020. Exports are projected to grow by 12.4 percent by 2020, while imports are projected to grow by about 13.2 percent by 2020. The current account surplus is expected to narrow down as imports continue to rise in the face of trade liberalization, even as exports maintain a positive growth and remittances remain solid[108].

Inflation is projected to rise by 2020. Inflationary pressures will emanate from higher government spending and anticipated faster depreciation of the currency. Continued declines in global prices for food and other imports will offset these pressures to some extent. However, over the medium term, rising inflation will remain a challenge. Monetary policy is expected to be tighter than in previous years aimed at containing inflation from rising up. As rising inflation necessitate a vigilant and closely coordinated monetary and exchange rate policy.

Uzbekistan after remaining in surplus for several years has recorded a deficit of 0.1 percent of GDP in 2016 as lower international prices for gas, copper, and cotton kept revenues from supporting increased capital spending that raised total expenditures[109]. This trend is expected to continue, though current expenditures are projected to become less expansionary by 2020. But so is the case of revenue from taxes, they are projected to slow down even more. Given lower tax collection and higher expenditures, fiscal balance is projected to become negative from 2017 onwards. A large share of taxes in Uzbekistan is collected from public enterprises. In the past, these enterprises enjoyed many privileges, such as preferential access to credit to subsidized intermediate inputs, enabling them to

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[108] Uzbekistan's overall current account balance depends not only on stronger trade balance but also on remittances. With economic recovery in Russia, remittances are expected to increase thus having a positive impact on its current account balance by 2020.

[109] The augmented budget balance, which includes the Uzbekistan Fund for Reconstruction and Development, the sovereign wealth fund is estimated to have recorded a surplus equivalent to 0.2 percent of GDP for 2015 (dropped from 4.9 percent in 2010).

carry their elevated tax burden with relative ease. But as Uzbekistan is planning to move towards a market-based economy, this may wear out privileges enjoyed by these public enterprises, thus putting pressure on revenue collections from them. Uzbekistan needs tax reforms, to widen the tax net and prevent fiscal deficit from rising[110].

14.3. Conclusion

Uzbekistan's macro-econometric model consists of simulation and forecasting of supply and demand aggregates as well as fiscal and monetary variables and external trade. Over the years, the economy has diversified and productive sectors including manufacturing, agriculture and services play an important role. The Uzbekistan's economy has a robust growth outlook in the medium term though macro-economic stabilization may pose a challenge as inflation remains high and this trend may persist in the medium term. However, the strong fiscal position may allow the government to pursue a tight monetary policy to curb inflationary pressures in the economy. The government's economic reforms program is expected to boost private investment leading to job creation and sustained economic growth.

[110] IMF Mission Concluding Statement for Uzbekistan: 2018 Article IV Mission; available at: https://www.imf.org/en/News/Articles/2018/03/14/ms031418-uzbekistan-staff-concluding-statement-of-the-2018-article-iv-mission

Chapter 15 - Conclusion

Macroeconomic stability is a pre-condition for sustainable economic growth. Prudent macroeconomic management is thus essential to put in place an economic environment that is conducive to investment and growth. Effective macroeconomic management a rigorous framework to identify the key relationships in the economy and to estimate the impact of exogenous changes in policy variables on macroeconomic aggregates including for example fiscal position, external account balance, exchange rates, and domestic credit.

This study has developed a set of macro-econometric models for the ECO member countries that can help in understanding the macroeconomic structures and in developing appropriate macroeconomic policies for sustainable growth. The models provide a rigorous analytical platform for assessing the impact of macroeconomic policies in the economy. Such models are widely used to conduct evaluation of macroeconomic policies as well as to forecast the trajectory of key macroeconomic variables. A key objective of the ECO is to promote economic cooperation among the member countries in the areas of macroeconomic policies and regional trade. In this respect, the macro-econometric framework developed in the present study can be instrumental in promoting economic policy coordination among the member countries to achieve the shared goal of sustainable economic growth.

The models have been specified based on the latest research in macro-econometric modelling. Time series data on all relevant variables has been collected for ECO member countries, subject to availability, and the robustness of the models has been tested using accepted evaluation tests and statistical criteria. Furthermore, the study has developed policy forecasts to work out the quantitative impact of exogenous changes in policy variables on macroeconomic aggregates including, for example, fiscal position, external account balance, private investment and government consumption. Medium term forecasts of key economic variables have also been estimated.

For each country, the models have been developed keeping in view the underlying macroeconomic structure, policy framework and availability of data. The estimated models show that the model parameters reasonably capture the macroeconomic developments of the economies and hence can be used for policy simulations and forecasting. The results show that the large economies of the region including Pakistan, Turkey and Iran have well-diversified economies their macroeconomic policies have supported the process of economic growth. However, these economies face diverse macroeconomic challenges that can pose significant risk to their growth prospects. For example, Iran is struggling to cope with a fresh wave of sanctions whereas Pakistan is facing external imbalances that threaten to derail the economic recovery. Similarly, Turkey is facing a currency crisis and its corporate sector is winding down the external debt it accumulated during the last decade. These challenges call for concerted efforts by these economies to achieve macroeconomic stabilization and promote economic growth.

Other economies in the ECO region are largely dependent on the energy sector. While these economies have grown strongly in the recent past with few exceptions, lack of economic diversification makes them vulnerable to external economic shocks. Macroeconomic policies in these countries need to focus on greater economic diversification for broad-based growth. Given the diverse economic structures of the ECO member countries, these economies can gain from mutual cooperation in the areas of trade and investment. Also, macroeconomic policy coordination should be an important goal of the ECO member countries to shield themselves from external economic shocks. In this context, the macro-econometric models developed in the study can be instrumental in helping to understand the macroeconomic structures and in identifying appropriate policies to promote internal and external economic stabilization.

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