ESTIMATING THE INFLATION-OUTPUT TRADE-OFF WITH TRIANGLE MODEL IN PAKISTAN

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CERTIFICATE

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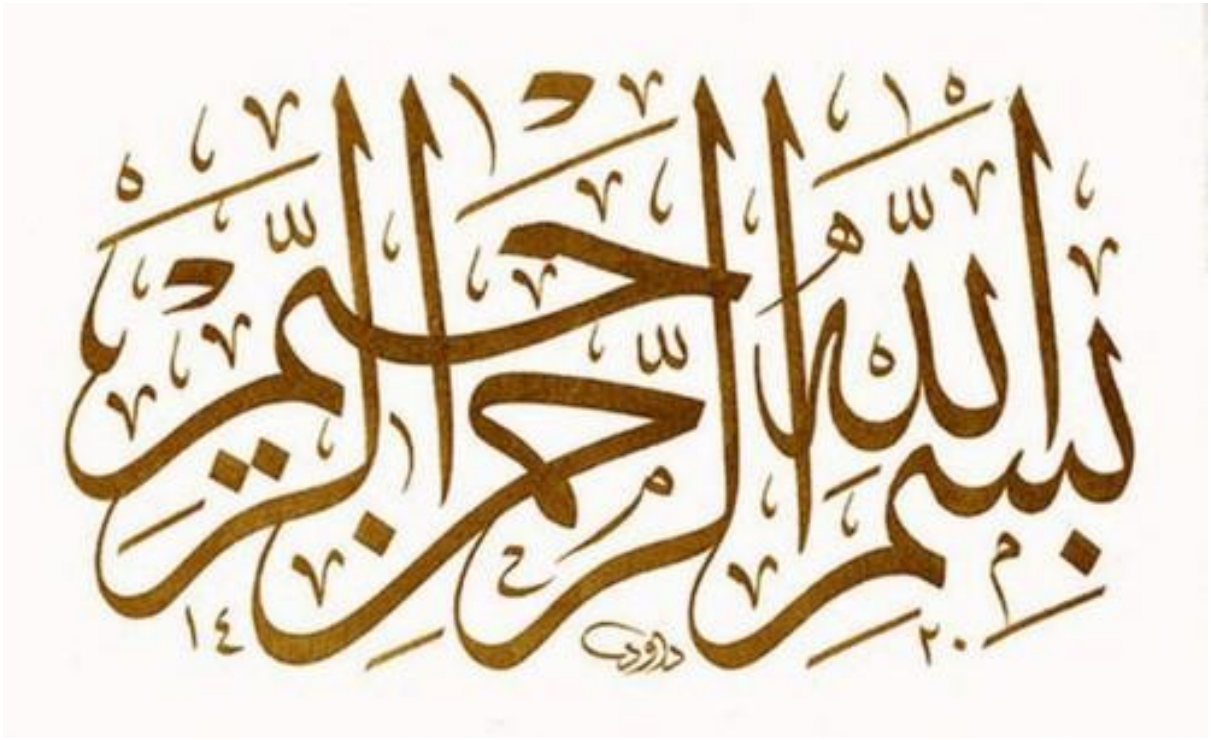

بسم الله الرحمن الرحيم

Dedication

To My Beloved Parents

ACKNOWLEDGEMENT

All praise is to Almighty Allah Who showered His countless blessing upon us and opened new horizons of knowledge for mankind. All respect goes to the Holy Prophet (PBUH), who enlightened our conscience with the spirit of faith in ALLAH SWT.

I would like to take this opportunity to express my deepest and most sincere gratitude to Dr. Abdul Qayyum for his invaluable guidance, encouragement and supervision throughout this study. My special thanks to my parents, brothers and sisters, teachers and friends for providing for making the time I have spent in PIDE truly enjoyable and me the means to learn and understand.

Bushra Sharif

Table of Contents

LIST OF TABLES

LIST OF FIGURES:

ABSTRACT

The aim of this study is to estimate an Inflation-output Trade-off with Triangle model in Pakistan and other objective of this study also investigate a Time instability of inflation-output trade-off with triangle model in Pakistan using Time Series data over the periods of 1971-2016 in case of Pakistan. For this purpose we used a three step methodology to estimate an inflation-output trade-off with triangle model such as Unit root Analysis, Cointegration Analysis and Error Correction Model. Dynamic of inflation has significant impact on output containing different two dummy variables in inflation. Empirical finding of this study shows that long run and significant relationship exist between inflation and supply variables such as oil prices and nominal exchange rate but no long run relationship exist between inflation and output gap. Output gap has positive and significant impact on inflation in short run but supply variables have no impact on inflation dynamic in short run. The environment of inflation is important to determine the relationship between inflation and output.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The main objective of the Pakistan economy is to achieve sustained economic growth and stable inflation rate is the main indicator of macroeconomic stability. Inflation refers to general increase in price level lead to decrease the purchasing power. Higher rate of inflation have a negative impact on economic growth of a country. If inflation is increased by aggregate demand then we called it demand-pull inflation. Supply shock is caused by cost-push inflation and it is supposed to have a positive correlation with the output gap. Over the last few decades, some empirical studies showed that long term inflation-targeting had exposed the long run trade-off between inflation and output and the negative short run trade-off between inflation and output.(Debelle,1999).

The dynamic of inflation have changed substantially in many economies over the last few periods, leading to renewal of interest for Phillips curve. Many empirical and theoretical studies have documented that inflation is highly persistent phenomena [(O'Reilly and Whelan, 2005), (Pivetta and Reis, 2007)] and inflation is less responsive to variation in output [(Robinson, 2010), (Gorden, 2011)].

On the other hand, recent research has challenged the traditional Phillips curve as it is usually estimated. It first identified that failing to account for change in inflation period mistakenly lead to estimate the inflation to be a quite persistent phenomina [(Musso et al., 2009), (Russell and Chowdhury, 2013)] secondly, Phillips curve have many ranges like convexity, concavity (Dolado et al., 2005).

If there is price stickiness then inflation is less responsive to fluctuate in the output gap and under this certain economic conditions, traditional Phillips curve which assumes that economic slack has linear effect on inflation.

Describing the inflation-output trade-off has long been controversial. According to Fried-man and Phelps hypothesis, there exist no long run trade-off between inflation and output but this hypothesis has clearly won over many macroeconomists but debate on this hypothesis has continued over what, if any, trade-off remain. The subtle notion that an uncertain short-run trade-off, but no long-run trade-off, exists between inflation and output has proved more difficult to analyze and describe. (Taylor, 1994).

The inflation-output gap trade-off is almost vertical at high inflation and flattens at low inflation, implying progressively higher output costs of reducing inflation. Macroeconomic volatility (among other factors) shifts the curve outwards, generating output and employment costs, and suggesting the need for stabilization policies. In this perspective, Phillip discovered the theory of Phillips curve in 1957 and explained the inverse relationship between inflation and unemployment and observe that one stable curve represents the trade-off between inflation and unemployment. The main objective of the central bank is to achieve price stability level and the objective of monetary policy is to recognize to price rigidity. If Phillips curve is nonlinear then monetary policy must be nonlinear (Dolado et al. (2005).

The history of Phillips curves has divided in two stages, before and after the periods of 1975. Before the periods of 1975, Phillips' findings were soon formalized by Samuelson and Solow (1960) using United States data. Phillips curve popularized by Samuelson and Solow, was followed by a brief period in which policy-makers presumed that they could exploit the trade-off to lessen unemployment at a small

cost of additional inflation. Then the natural rate hypothesis revolution of Friedman, Phelps and Lucas reversed the policy-exploitable trade-off in favour of long term monetary neutrality. Those who had implemented the econometric version of the trade-off Phillips Curve in the 1960s revolved in disbelief when Sargent proved the logical failure of their test of neutrality, and finally were condemned to the 'wreckage' of Keynesian economics by Lucas and Sargent following the rotation of the inflation–unemployment correlation from negative in the 1960s to positive in the 1970s. The planners of neutrality and the opponents of the Keynesian trade-off appeared successful, with two major cautions that their own models based on information hurdles were unconvincing, and that their main result, that business cycles were driven by price or monetary surprises, struggled without supporting evidence.

After 1975 the evolution of the Phillips Curve literature divided in two parts. In econometrics test, the improvement of Phillips curve trade-off in a coherent and unified by aggregate supply and demand that exist in 1970s and Gorden(2009) called this approach 'mainstream', because the inflation rate is influenced by persistence and inertia in the form of long lags on past inflation. A significant difference between the mainstream approach and other post-1975 growths is that the role of past inflation is not limited to the foundation of expectations, but also includes a pure persistence effect due to fixed-duration wage and price contracts, and lags between changes in crude materials and final product prices. Inflation is displaced from its past inertial values by demand and supply shocks.

The econometric implementation of this approach is called the 'triangle' model, sees inflation and inflation as a function of three-cornered dependence on demand, supply and inertia. Demand is proxied by the output gap, and explicit

supply shock variables include changes in the relative prices of food, energy and imports, changes in the trend growth of productivity. The triangle approach explains the two peaks of inflation and output gap in the 1970s and early 1980s as the result of supply shocks, and it emphasizes that inflation and output gap can be either positively or negatively correlated, depending the source of the shocks, the policy response and the length of lagged responses (Gordon, 2009).

At high inflation rate, the inflation-output trade-off is vertical and at low level of inflation rate, inflation-output trade-off is flat, implying increasingly greater output cost of decreasing inflation. A great change in price substance in the inflation-output trade-off is also dangerous for the rationality of new Keynesian model. A new Keynesian Phillips curve is the absence of inertia and consequently a major challenge to the rational expectation to sticky price model. A new Keynesian Philips curve model is understanding the approach of end of hyperinflation periods but Gorden triangle model is best to explain the historical data of inflation process in Pakistan.

Moreover, Gorden extended the standard backward looking expectation Philips curve model by allowing supply shocks and this model is called triangle model. Triangle model see inflation as a function of three components; inertia-inflation already built into the economy, output gap and supply shocks. Gorden extend the traditional backward-looking Phillips curve model with supply shock model and Villavicencio and Mignon (2015) used triangle model to explain the instability of inflation and output trade-off with triangle model so, we used this triangle model to estimate the inflation-output trade-off in Pakistan. This study introduces two simple changes in the Phillips curve and better explaining the different periods of inflation in Pakistan.

1.2 Significance of the Study

A lot of research has been done on inflation and economic growth in Pakistan but still the study is silent about the instability of inflation-output Trade-off with Triangle Model. So, this study is an attempt to estimate the instability of inflation-output trade-off for Pakistan.

1.3 Objectives of the Study

Main objective of the study are

I. To estimate Inflation-Output Trade-off by using Triangle Model.

II. To estimate the time instability of Inflation-Output Trade-Off during different period of inflation in case of Pakistan.

1.4 Hypotheses of the Study

Main hypotheses of the study are

H_{01}: There is insignificant impact of output gap on inflation.

H_{02}: Inflation-output trade-off with Triangle Model is instable.

H_{03}: Can oil price and Nominal exchange rate shocks effects the instability of

Inflation -Output trade-off with Triangle model.

1.5 Plan of the Study

The plan of thesis is as follows: chapter 2 explains the salient features of Pakistan economy, chapter 3 explain the literature review. Chapter 4 explain the methodology in which explains the economic theory of methodology and then explains the econometric methodology explaining three steps of estimation unit root analysis, Johnson Maximum Likelihood Method and Error Correction Dynamic model. Chapter 5 explains the result and conclusion of the study.

CHAPTER 2

SILENT FEATURES OF INFLATION AND OUTPUT GAP

2.1 Introduction

A stable predictive relationship between inflation and the output gap often referred to as a Phillips curve, provide the basis for countercyclical monetary policy in many models. Inflation is referred to as the overall price increasing phenomina resulting decrease the purchasing power of currency. In addition to the price stability, one of the core functions of monetary authorities is to stabilize the output fluctuations. The main challenge for policy makers is to evaluate the indicators that assess the actual picture of current situation of the economy. Initially output gap is measured by Mitchell (1927). Output gap generally referred to as the difference between what the economy is producing and what it can produce. Output gap can be positive or negative. Output gap is positive when economy has surplus and actual output is greater than potential output. Positive output gap lead to inflationary situation. Negative output gap performs economic activity below their maximum efficiency level. A negative output gap indicate low demand in economy and actual output less than potential output. Negative output gap boost disinflation. It is basically the noisy indicator of the economy due to the presence of potential output, as policy makers have to estimate the potential output.

Output gap propose that economy is running at inefficient rate either overworking or underworking its resources.

The main methods which are used to measures the output gap are linear trend, quadratic trend and Hodrick-Prescott Filter. The output gap, it is measuring by the Hodrick-Prescott filter and The HP filter technique as introduced two Economics in Hodrick and Prescott (1980, 1997) measures the output gap and the output gap

correspond to the difference between the percentage points among the real GDP and the Potential GDP.

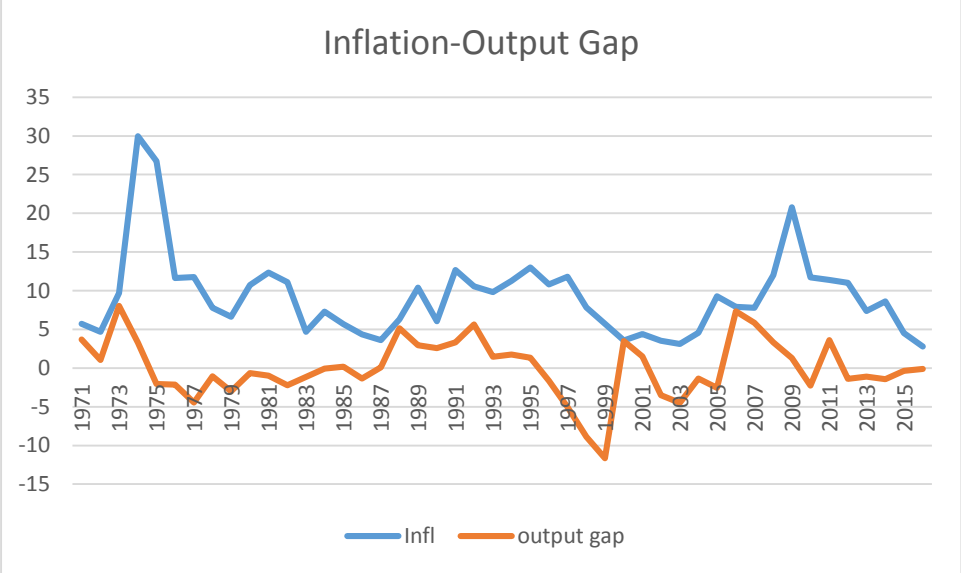
$$\sum_{t=1}^{T}(Yt - Tt)^2 + \lambda \sum_{t=2}^{T}(\tau_{t+1} - 2\tau_{t} + \tau_{t-1})^2$$

This formula is related to HP filter and this would be used to measures the output gap. The output gap is abstractly engaging because it provides the indications about inflation developments.

2.2 Analysis of Inflation and Output Gap

In Pakistan, main objective of monetary policy is to achieve low inflation rate and stable output growth. Fig 2.1 shows that the relationship between inflation and output gap for the period of 1971 to 2016.

Fig *2.1.* INFLATION VS Output Gap



This Figure 2.1 shows the Pakistan estimated inflation rate and output gap. inflation and output gap is positively correlated and in fig we see that inflation rate in Pakistan is 2.79 percent and 29.97 percent is the minimum and maximum inflation rate in Pakistan during the 1971-2016 and output gap for the year of 2016 is -0.12 %. In

1974, oil price shocks led to a positive output gap 3.78 and the inflation rate is 29.97 which is higher inflation level during the year of 1971-2016. The main reason of high inflation in Pakistan in 1974 is that Nationalization, oil price shock, devaluation of domestic currency decrease and private investment decrease and devaluation of domestic currency up to 120. In 2016, output gap became negative and inflation rate is fell by 2.79% and in Pakistan history the lower the inflation rate which is lowest in 13 years and the reason of low inflation is that low oil and commodity prices, stable rupees, smooth supply of commodities and monitoring of prices at both federal and provincial level. Output gap in 1973 is 8.04. For most part of output gap persisted below the potential level and it meant economy can't attain a high level of income. Negative output gap downward pressure on inflation. Positive output gap means that high demand of good and services and Pakistan economy has surplus. Positive output gap upward pressure on inflation and negative output gap means low demand for goods and services and companies perform their economic activity below their maximum efficiency level. output gap in Pakistan is negative in 1975-84, 1986, 1996-2000, 2010 and 2012 -16 reason that in economy actual output less then potential output and low inflation and positive output gap in Pakistan during the periods of 1971-72, 1987-99 and 2006-11 because of inflationary pressure and actual output is greater than potential output. (Pakistan Economic Survey 2015-16).

CHAPTER 3

LITRATURE REVIEW

3.1 Introduction

A lot body of theoretical and empirical literature has examined the inflation-output trade off. This chapter consist of two types of literature review one is theoretical framework and other one is empirical literature. Section 3.2 discussed the international Section 3.3 discussed the Pakistan literature review. In Last discussed the conclusion of the literature review in section 3.4.

3.2 Review of International Studies

Robert E and Jr (1973) estimate a trade-off between inflation and output with built on annual data was taken for eight countries from the period of 1951-1967. This study also estimates a natural rate hypothesis that output invariant with the time pattern change in inflation. Empirical finding of this study shows that no association found between average inflation and average output.

Taylor (1979) observe the substitute monetary policy rules by introducing a new dimension of inflation and output trade-off. This study used a rational expectation model with stunned wage contract to estimate the trade-off among inflation-output trade-off. Result has shown that no long run relationship exist among the inconsistency of inflation-output. However policymaker select substitute facts along with inflation/ output inconsistency limit through fluctuating the comparative weight laid on inflation versus output stabilization

Taylor (1994) reinvestigate the trade-off between the variability of inflation-output by introducing a stochastic optimal control technique. The trade-off exist because of the sluggish variation of price. This study compare the trade-off among

variability inflation and output with other types of trade-offs. Evidence of this study shows that no long run trade-off exist between inflation and output gap. Empirical finding of this gap that no negative trade –off exist between inflation and output at different historical periods of United States and other countries. In history countries far from the trade-off because of inadequate monetary policy.

Razzak (1997) used the quarterly data of New Zealand for the period of 1982q3- 1996q1 to estimate the asymmetric relationship between inflation and output study has used Generalised Method of Moment (GMM) to estimate the single-equation Expectation-augmented Philips-curve. The data of New Zealand is rejected the null hypothesis of that the single-equation expectation-augmented Philips-curve is asymmetry. A small open economy model with a Philips curve, rational expectation, persistent inflation and monetary policy reaction function that is known by the public is using the parameter estimated from GMM**.**

Akerlof (1996) develop a downward-sloping Phillips curve model which influence to a long run trade-off between inflation and output gap when the rate of inflation is very low.

Fuhrer (1997) estimates the effective long-run trade-off between the instability of inflation and output gap. Outcome of this study displays that the inconsistent trade-off becomes relatively severe when the standard deviation of inflation or output less than 2 percent. Concluded results propose that almost equal reactions to plan of objectives are reliable with rational preferences over inflation and output variability.

Orphanides and Wieland (2000) derived a nonlinear optimum monetary policy response function, when monetary policy is nonlinear then Phillips curve is

non-linear. This study agree that zone –linear Phillips curve, inflation rate is stable at certain level of output gap, if inflation is below the certain level them monetary authority could encourage economic growth without making inflationary pressure.

Dolado et al (2005) examined a optimum monetary policy reaction toward inflation and output gap relationship with five central banks. This study states that nonlinear Phillips curve derivative through the optimal monetary policy then such policy response can arises. Two empirical approaches used to estimate such asymmetric Shocks features which one is Euler equation that allow aimed at the relationship between inflation and output though second one is "Ordered Probit Model" to catch the distinct environment of change in discount rate permit that interaction term again. Empirical results approve that operating system of central banks are nonlinear when setting a unimportant term interest rate to control monetary policy.

In this study of Gottschalk and Fritsch (2006) examined a long run relationship among interest rate, unemployment and inflation. Annual data from the period of 1960 to 2004 was taken for West Germany to investigate a long run relationship by introducing a multivariate cointegration analysis. The study conclude that negative correlation between inflation and unemployment.

Pivetta and Ries (2007) estimate a persistence of inflation changed in US since 1965. This study estimates a Bayesian nonlinear model of inflation dynamics over time by using different estimation procedure. Outcomes of this study shows that inflation is extremely persistent phenomena and remain unchanged with time.

Stock and Watson (2008) evaluate inflation forecast in the United States and conducts an extensive empirical analysis that reviews and clarifies this literature

using a consistent data set and methodology. Empirical results are gloomy and indicate that Phillips curve predict are better than other multivariate predictions. Sometimes the performance of Phillips curve is better periodic but most of the time it is not as good univariate benchmark.

Benigno and Ricci (2010) used a Dynamic Stochastic General Equilibrium Model to investigate a long run Phillips curve by presenting a downward nominal wage rigidity in inflation periods. This study make a closed-form of long run Phillips curve which fits to average output gap to average inflation. The study concluded that no trade-off exist inflation and output gap once inflation is high but in low inflation then trade-off among inflation and output gap is relevant.

Hasnan & Omay (2011) investigate the causal relationship between inflation rates, output growth rate and also examine the uncertainties of inflation rate and output growth rate for ten Central and Eastern European transition countries. This Study has estimates a Bivariate GARCH model to estimate the inflation rate, output growth rate and their uncertainties. Findings of the research shows that inflation rate induces uncertainties of inflation rate and growth rate which is determined for real economic activity and Growth rate reduce macroeconomic uncertainties.

Binder (2012) used expected inflation rate to investigate the linearity and consistency assumption of augmented Phillips curve. Quarterly data from the period of 1994Q2 TO 2010Q2 was taken for Croatia. Bai and Perron technique was used to identify unknown breaks.

Villavicencio & Mignon (2015) investigate that the time variability of Philips curve in inflation environment, price stickiness. Quarterly data from the periods of 1960Q1 TO 2013Q2 was taken for the five countries to investigate the varying

nature of Philips curve during the different periods of inflation. Finding of the study shows that the mean inflation and the threshold mean inflation are period varying. The inflation atmosphere is a main element of the inflation–output affiliation, rejecting the proof of a flat curve and renovating the inflation–output trade-off above definite inflation beginnings.

After WWII Benati and Berrn (2015) examined a long run trade-off among inflation and output with the application of classical and Bayesian structural VAR identified based on long run restriction in the US, Euro area and UK and Canada after the WWII periods. Results of classical Var shows that one inflation shock doesn't allow to reject the null hypothesis long run vertical Phillips curve and the results of Bayesian VAR presents that four inflations shocks. Johnson cointegration between inflation and output for all countries exist with long run phillips curve being negative and substantial.

3.3 Pakistan Review

Many Pakistani researchers have done their studies on monetary policy, inflation and GDP growth rate. As money supply effect on inflation and output with some lags was checked by Shahid (2006). The Results of his paper showed that the result of monetary policy conveys into inflation with a lag of half of a year and then yield another year to extent at the top and also described that in successive high inflation monetary authority's degree of slope in contradiction of the wind is nearly zero.

Satti et al (2007) estimate the New Keynesian Phillips Curve explain with the dynamic of actual inflation as it possess different policy implication regarding disinflation. The study employed a GMM econometric technique to estimate the

NKPC .Annual data of Pakistan country is used from the period of 1976-2005. The study proposed that variables such as real marginal cost, inflation, GDP is used to find the results of final demonstration. Which clearly displays that there is progressive correlation among inflation and real marginal cost and also indicate that there existence a high degree of price stickiness but on the other hand a very low fraction of firms using backward – looking rule found in the setting of price in case of Pakistan?

Bhatti and Qayyum (2016) used annual time series data from 1971 to 2016 of real output and inflation rate to quantify the real cost of disinflation and used main indicator of sacrifice ratio to measures the real cost of disinflation. The results of research display that the estimate the sacrifice ratio are subtle to diverse estimation method and tight monetary policy has insignificant welfare loss. From policy point of view, it clearly indicates that small sacrifices ratio marks it helpful for policy maker to change the inflation into one number without fear of substantial output decrease.

3.4 Conclusion

The above discussion discloses that there is no consensus among the researchers regarding the nature of relation between inflation and output gap. The above discussion shows that in Pakistan there are few studies found relationship between inflation and output growth but no research has found on estimating inflation and output gap with Triangle model in Pakistan. So we are move forward to next chapter discussed the methodology of economic triangle model and Econometric Model.

CHAPTER 4

METHODOLOGY

4.1 Introduction

In this chapter we will briefly describe the methodology of economic modling and estimation technique we adopted to carry this research. In this chapter, in Second section discuss the economic model specification. Third section of this chapter contains econometric model and then the econometric methodology in which we discuss the HP Filter to measures the output gap. ADF test check the stationarity of the data then Johnson Maximum Likelihood Method to examine the Long run association among variables then check short-run adjustment of variables with the Error Correction Model (ECM) and forth section of the chapter discuss the Diagnostic Test and the last section of this chapter discuss the source of the data is given.

4.2 Economic Triangle Model

The Phillips curve initiated by Phillips (1957), found that inverse relationship between inflation and unemployment. When change in interest rate and unemployment in the UK from 1861 to 1957. He explained the unemployment level when change in wage rate then also change in level of unemployment in reaction to worker demand of labour services. In 1970s, when oil prices increase rapidly then no exact trade-off found among inflation and output.

To maintain stability of the relationship between inflation and economic growth then main emphasis on the Traditional backward looking Phillips curve. Possibility to keep this identification alternative of new Keynesian Phillips curve to explain through different aspects.

According to New Keynesians Phillips curve, inflation leads measures the output gap and trade-off among inflation and output gap not exist and inflation is always looking forward and lagged inflation is irrelevant and disinflation can be obtain costlessly but according to empirically evidence shows that stability of inflation require a large fluctuate in output gap and inflation seems to show a lot of inertia and the output gap appears measures of inflation (Fuhrer,Olivei and Tootell 2012) so in this way, traditional Phillips curve is suitable to present the inflation as a substitute of New Keynesian Phillips curve(Gorden,2011) .Gorden(2011) use traditional phillips curve method instead of New Keynesian phillips curve because traditional backward phillips curve is suitable to explain the historical data .So Gordon (1982,1997) expand the traditional backward phillips curve then augmented Phillips curve. Villavicencio and Mignon (2015) using the Gordon (1982,1997) augmented phillips curve and they use supply shocks model also called triangle- model and write the function form of triangle model retain

$$\boldsymbol{\pi_t = f(y*_t, oil_t, s_t, \varepsilon_t)} \qquad \textbf{(4.2.1)}$$

Following Gordon's triangle model (1988) sees inflation as a function of three components: inertia as a lagged inflation; output gap; and supply shocks. Gordon triangle model is better explaining the historical data. Now we write the model are backward-looking Phillips curve as augmented Phillips curves and use with supply shock wave also called the Triangle Model as follows

$$\boldsymbol{\pi_t = \alpha + \Sigma_{i=1}^{n} \beta_i \pi_{t-i} + \gamma Y*_t + \theta \Delta oil_t + \phi \Delta s_t + \varepsilon_t} \qquad (\mathbf{4.2.2})$$

In this model where

π_t = inflation rate

Y^* = it is output gap and Yt-Y_{HPF}

oil_t= oil prices Rupee per tons

s_t= Nominal exchange rate per unit of dollar

ε_t~N $(0,\sigma^2{}_\epsilon)$

In this triangle model inflation as function of three components, inertia as lagged inflation, output gap and supply shocks. In this model there are two supply shocks and this is oil price shocks and exchange rate shocks .Russell et al. (2010) display a high no of unacceptable breaks and Russell and Chowdhury (2013) examined the relation between the m numbers of breaks in the inflation and minimize the sum of the squared residuals. Bai and Perron (1998) used the impulse indicator Saturation techniques identifies this shift containing breaks close to the beginning and end of the sample and recently Hendry and Johnsen (2008),Johansen and Nielsen (2008) and Castle,Doornik and Hendry (2012) further investigate this approach.

Now we use the two-regime smooth transition regression model with shifting mean.

$$\boldsymbol{\pi_t = \alpha + \sum_{i=1}^{n} \beta_i \pi_{t-i} + \gamma y_t^* + [\gamma^*(y_t^*) \times g\,(r_t;\xi,c)] + \theta \Delta oil_t + \phi \Delta s_t + \sum_{m=1}^{m} \Psi m\, Dm + \varepsilon_t} \quad \textbf{(4.2.3)}$$

In this model

Dt = represents the dummies and inflation depends on dummies and t is the inflation period

g (r_t;ξ,c) = represent the transition purpose in which ξ is the slope parameter and processes the speed of transition among regimes and r_t is transition variables and c is threshold parameter. This equation examined the nonlinear least squares that allow

the measures the output-inflation Trade-off with different periods of inflation. g (r_t; ξ, c) function lies between the 0 and 1. The g (r_t; ξ, c) is the first order logistic transition function

$$g(r_t; \xi, c) = [1+\exp(-\xi(r_t - c))]^{-1}$$

(Anderson and Terasvirta, 1992 and Terasvirta, van Dijk, and Franses, 2002)

First we check the series is stationary or not if series is not stationary then we transform this series into stationary and develop long run relationship

$$\mathbf{X_t}=\sum_{i=1}^{k} \boldsymbol{\Pi_i X_{t-i}} + \boldsymbol{\mu} + \boldsymbol{\Phi D_t} + \boldsymbol{\varepsilon_t} \qquad (\mathbf{4.2.4})$$

Where

$X_t = \begin{bmatrix} \pi_t \\ Y*_t \\ oil_t \\ s_t \end{bmatrix}$ and

μ = is a constant term

ε_t~ iid (0, ∧) disturbance term

If the time series data is generated are generated by non-stationary process therefore VAR can be first differenced form. From general model using Δ-1-L, anywhere L is the lag operator, we able to get the following dynamic error correction model;

$$\Delta \boldsymbol{X_t} = \Gamma_1 \Delta \boldsymbol{X_{t-1}} + \cdots .. + \Gamma_{k-1} \Delta \boldsymbol{X_{t-k-1}} + \prod \boldsymbol{X_{t-k}} + \boldsymbol{\mu} + \boldsymbol{\Phi D} + \boldsymbol{\epsilon_i}$$

Where

$\Gamma_i = -I + \Pi_t + \ldots.. + \Pi_i, \qquad i=1, 2, \ldots, k$

4.3 Econometric Model

4.3.1 Hodrick-Prescott Filter Technique

I use the HP filter technique to measures the Output gap, the output gap, it is Measuring by the Hodrick-Prescott filter and The HP filter technique as introduced into Economics in Hodrick and Prescott (1980, 1997) measures the output gap and the output gap correspond to the difference between the percentage points among the real GDP and the Potential GDP.

$$\sum_{t=1}^{T}(Yt - Tt)^2 + \lambda \sum_{t=2}^{T}(\tau_{t+1} - 2\tau_{t} + \tau_{t-1})^2$$

This formula is related to HP filter and this would be used to measures the output gap.

4.3.2 Bai and Perron Test (1989)

Bai and Perron (1998) provide a comprehensive treatment of multiple structural change model, consistency of the estimates of the breaks and consider the following multiple regression model with m breaks

$$Y_t = Z_t \delta_{j+\mu t} \qquad t=T_{j-1+1},\ldots,T_j$$

Johnson and Hendry (2008), Johnson and Neilson (2008) and Doornik,Castle and Hendry (2012) further investigate this approach and present the Impulse Indicator Saturation techniques to identifies the shift containing breaks near to the start and finale of the sample. This study estimate the dynamic model by applying the time series properties and Qayyum (2002) use a three steps Methodology Univariate time series analysis, multivariate cointegrating analysis function and estimation of error correction model.

4.3.3 Test of Integration

In univariate analysis, to determine the series is stationarity or not and check the unit root exist in the series. Mostly time series data is non stationary at level and their mean and variance are not constant and vary with time. For this purpose, we check the stationary of the data or order of the variables. To check the order of the integration of the variables or unit root exist in the series or not, we employed a first Dickey-Fuller (1979) test.

$$\Delta Xt = \delta X_{t-i} + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.3.1)$$

The hypothesis of the test of the unit root in a univariate time series, null and alternate hypotheses are given as follows;

$H0: \delta = 1$ Unit root

$H1: \delta < 1$ No unit root

Dickey and Fuller established two test statistics such as τ and ϕ statistics to check the unit root series. Aimed at the validity of the Dickey-Fuller test, check the problem of autocorrelation. If the series has the problem of autocorrelation then we don't estimate the problem of unit root. To overcome the problems of autocorrelation in error term then introduced the lag of dependent of variables as independent variables. So the validity of Dickey-Fuller test, Dickey and Fuller proposed an Augmented Dickey-Fuller test

$$\Delta Xt=\alpha + \beta_t + \delta X_{t-i} + \sum_{i=1}^{m} \delta_{\mathrm{i}} \Delta X_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.3.2)$$

Where represents the X□ is a time series variable being tested, β□ represents time trend in the model and Δ represent the difference operator. t represents the number of lags of X built-in the model to make sure that the error term of the model are

white noised. The choice of lag length is important while estimating the ADF regression. The ADF test is explained through the Dickey fuller equation

$$\Delta X_t = (\rho-1)\, X_{t-1} + \varepsilon_t \qquad 4.3.3$$

If the value of ρ=1 then series have unit root and (ρ-1) so root of equation is $\delta = 0$.

ADF hypothesis fellow the left hand tailed test.

Hypothesis Testing

H_0: $\delta = 0$ (the series is unit root)

H_1: $\delta < 0$ (the series is no unit root)

ADF check with the hypothesis $\boldsymbol{\delta = 0}$ with the application of $\tau\alpha\mu$ statistics.

4.3.4 Johnson Maximum Likelihood Method of Co integrating Analysis

In cointegration analysis, we estimation the long run relationship among the variables. Cointegration theory on one side deals with the unit root and on the other side it treat the long run relationship between variables. The Johnsen (1988) and Johnsen and Juselius (1990) Maximum Likelihood Estimation Technique applied to examine the long run relationships among the variables because it is best available method to deal with the non-stationary data. If it is annual data, we include dummies and constant. Mostly economic time series data overall non stationary and usually VAR (4.3) model present in term of first differenced form and used differenced operator denote Δ and in general model using as Δ=1-L anywhere L is used as the lag operator. We can found the succeeding Dynamic Error Correction Model. VAR model generally expressed as First differenced form but only term ΠX_{t-k}. Main objective is to observe the long-run cointegrating association between the variables

then we estimate the Π matrix and this Π matrix contain information concerning the long run relationship among variables. Π Matrix can be decomposing into p x r matrix of α and.

$$\Pi = \alpha\beta'$$

Generally Π Matrics has three cases

I. Rank (Π) =P, or Π has full rank, its means that series X□ series is a stationary process.

II. Rank (Π) =0, It mean, there is no long run facts in the variables.

III. Rank (Π) =r and $0< r < p$ it means that r co-integrating relationship exist between variables. It implies that into p x r matrix of α and β that $\Pi = \alpha\beta'$

To determine the long run cointegration relationship between inflation, output gap, oil prices and nominal exchange rate. To check the number of cointegrating relationship among the variables is exist or not, there are two long run statics

i. Maximum Eigen Value Statics

ii. Trace Statics

i. Maximum Eigen Value Statics

Maximum Eigen Value Statics test shows that how many Eigen value is equal to zero. The hypothesis of maximum Eigen value statics are

$$\boldsymbol{\lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1})}$$

Null hypotheses are

H_0: rank (Π) = r

H_a: rank (Π) = r + 1

ii. Trace Statics

Trace statics test is to check the joint significance of Π matrix. This test check the calculated value is increasing through the summing of Maximum Eigen value statics or not. The hypothesis of trace statics is

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_i)$$

H0: rank k (Π) = r

HA: rank k (Π) > r

4.3.5 Estimation of Dynamic Error Correction Model

Last the Error correction model of the inflation-output function would be estimated by employing the general to specific methodology and if the variables are the integrated of order I (1) then the long-run relationships among the variables are estimated using OLS method and ECM help to estimate the short run adjustment of the variable and the preferred model have all diagnostic tests.

4.4 Diagnostic Tests

Diagnostic test is used in model specification and we used different test to estimate the problems of Autocorrelation, Non-Normality and ARCH test. To overcome the problem of Autocorrelation we used the test such as Durbin-Watson (1950) statistics and Breusch-Godfery (1978) Serial Correlation LM test, if we check the normality then I used the Jarque-Berra (1980) test $X^2_{(2)}$ and I use CUMSUMand CUSMSQ test to check the stability of the parameter by Brown, Durbin and Evans (1975).

4.5 Data Sources

Annual data of Pakistan from the period of 1971-2016 was taken for all the hypothesized variables. Source of all data are collected from **State Bank of Pakistan (2017).** Hand Book of Statistics of Pakistan

Inflation Rate; Annual inflation rate is measured as percentage by growth rate of Consumer Price Index during FY2016.

Output Gap; Real Gross Domestic Product has been taken as measures of output gap. Output gap calculate through the percentage change between potential GDP and Real GDP. Output gap estimate in Hodrick-Prescott Filter.

Oil Prices; Annual data of oil prices (petroleum) data of Pakistan is taken from Hand Book of Statistics (2017).Oil price data has been measured in Rupees per tons.

Nominal Exchange Rate; price of one currency in term of another currency. Nominal Exchange Rate is measured Rupees per unit of dollar.

CHAPTER 5

RESULTS AND DISCUSSIONS

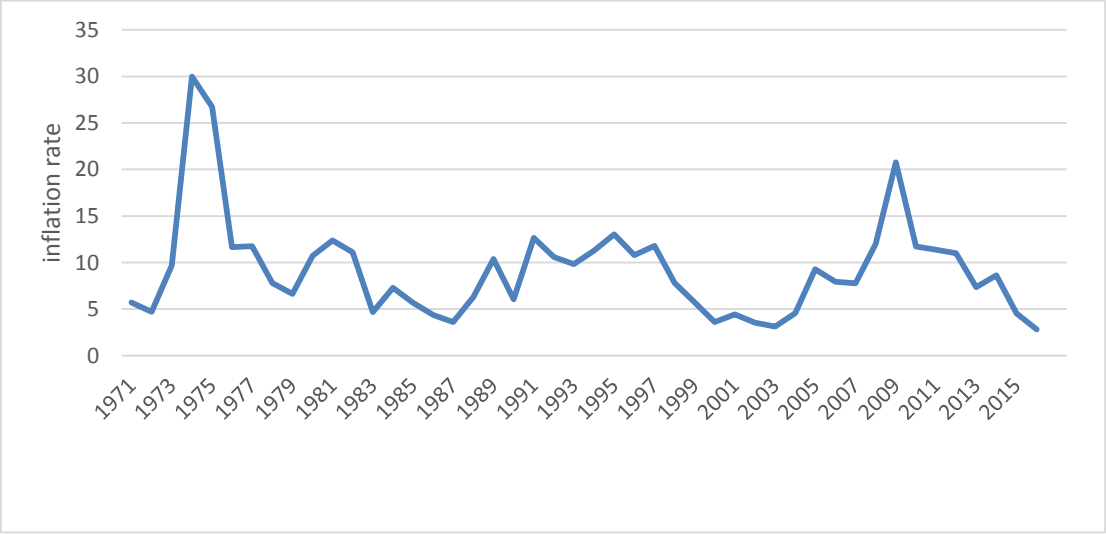
5.1 Introduction

This chapter is based on results and their interpretations. In section 5.2, the Graphical explanation of the variables is given. In 5.3 section we discussed the unit root results of variables by Augmented Dickey Fuller test (1979). Section 5.4 discussed the Johnson Maximum Likelihood Method of Cointegration, section 5.5 discussed the Dynamic Error Correction Models and 5.6 discussed the whole conclusion of the chapter.

5.2 Graphical Analysis

In section 5.2 the time series characteristics of the data and patterns of the data are checked through graphical analysis. In Fig 5.1 the descriptive properties of Annual rate of inflation in Pakistan are shown i-e the patterns of inflation rate during the years 1971 to 2016.

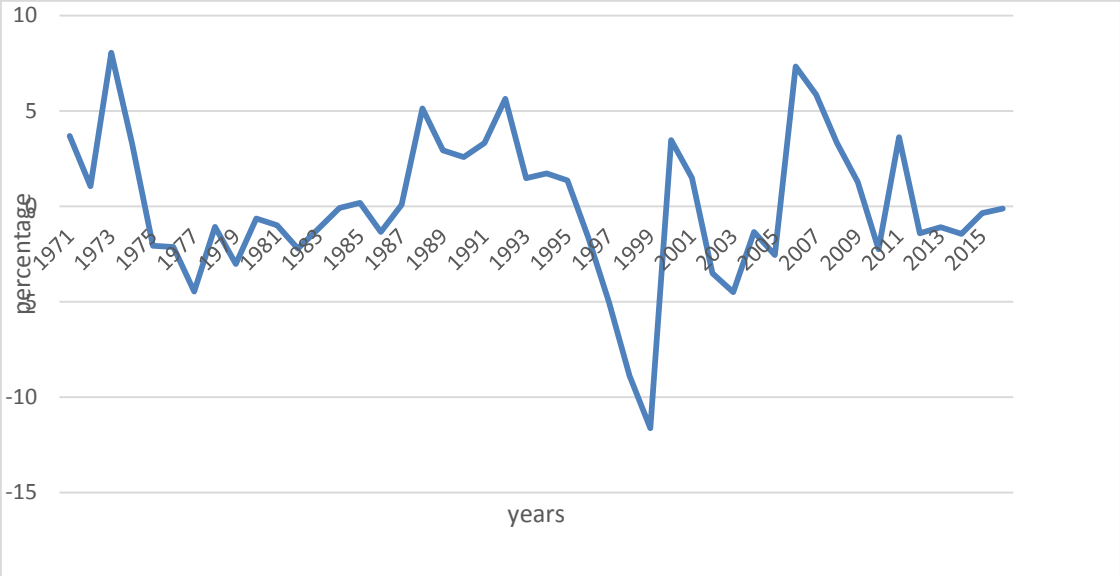
Figure 5.1: Rate of Inflation in Pakistan (1971-2016)



(Source: Pakistan Economic Survey)

The pattern of inflation rate shows that intercept and time tendency changes over time. This figure shows that there are two structural breaks i-e 1974 and 2009. In 1974 inflation rate is 29.97 which is higher because of separation of East Pakistan, devaluation of domestic currency, oil price shocks and private investment decrease.in 2009 the inflation rate in Pakistan is 20.79 % and inflation rate is high due to global financial crises. (Pakistan Economic Survey 2016-17)

Figure 5.2: Output Gap of Pakistan (1971-2016)

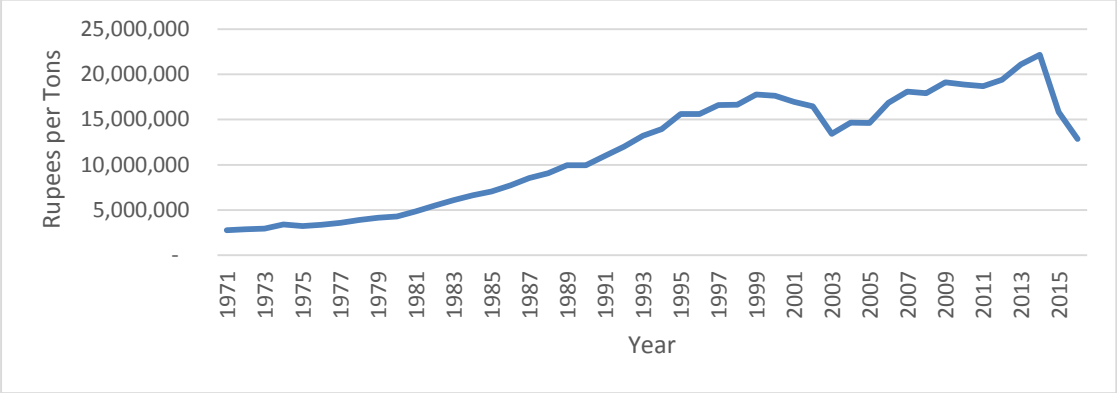


(Source: Pakistan Economic Survey)

Fig 5.2 shows output gap which depicts the intercept and random time patterns of output gap and output gap in Pakistan is negative in 1975-84, 1986, 1996-2000, 2010 and 2012 -16 . The reason that in economy actual output is less then potential output and low inflation and negative output gap downward inflationary pressure. Positive output gap in Pakistan during the periods of 1971-72, 1987-99 and 2006-11 and positive output gap brings inflationary situation . A positive output gap means higher demand of good and services, where economy is surplus while

negative output gap means that demand for goods and services is low ,which lead companies to perform their economic activity below their maximum efficiency level.

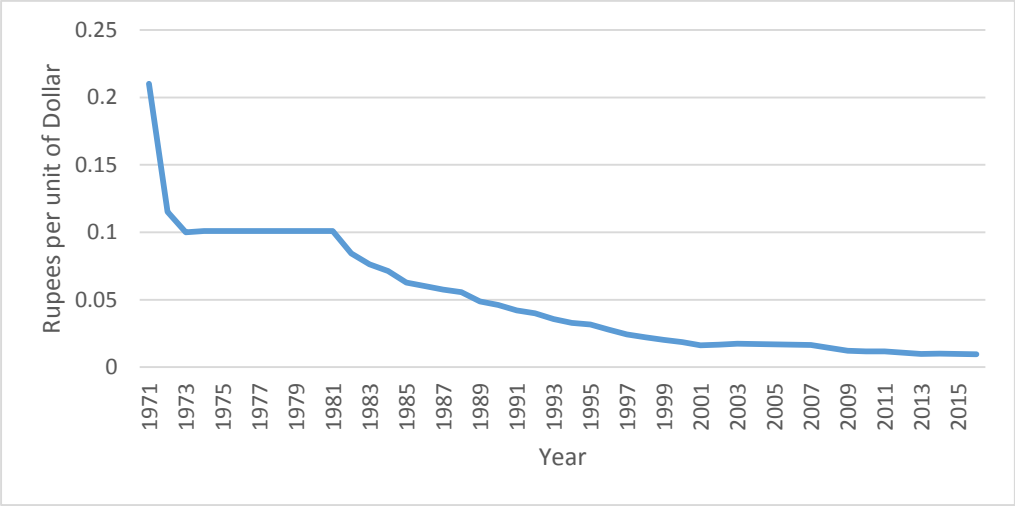
Figure 5.3: Oil Prices of Pakistan (1971-2016)



(Source: Pakistan Economic Survey*)*

Figure 5.3 shows the oil prices of Pakistan that increases all over the time period which implies that the oil prices is positively trended in Pakistan throughout 1971 to 2000. In 2002 to 2003 oil prices decrease due to inflows of Foreign Direct Investment in Pakistan against the war of terrorism (Pakistan economic surveys2016-17)) . In 2004 to 2016 oil prices in Pakistan increases rapidly because of terrorism and political instability. (Pakistan Economic Survey (2016-17).

Figure 5.4: Nominal Rupees per Dollar Exchange Rate of Pakistan (1971-2016)



(Source: Pakistan Economic Survey *)*

Fig 5.4 shows the patterns of nominal exchange rate rupee per unit of dollar. This figure shows that nominal exchange rate in Pakistan is negatively trended over the time. While 1971-72 shows negative trend of nominal exchange rate but in 1973-81 nominal exchange rate is constant at 0.1 value and again during 1982 to 2016 nominal exchange rate trends negative.

5.3 Results of Structural Breaks

Since this analysis considers annual data therefore Bai and Perron (1999) test is applied and Bai and Perron approach are able to detect and identify the break and found that there is one structural breaks in inflation such as:

Table 5.1 Results of Structural Breaks

Sequential Test all subsets F statistics determined break				**1**
Break Test	Break	F statistics	Scaled F statistics	Critical Value
0 vs 1	2009	2.17	2.17	8.58

*significance at the 0.05 level, Bai-perron (Econometric Journal, 2003) critical value 8.58

The results reported in the above table 5.2 shows that there is one structural break in inflation. Applying dummy to such break yield that inflation is not seriously affected by this break.

5.4 Results of Unit Root Test

To check unit root we used Augmented Dickey-Fuller Test which implies that variables are stationary or not .We transformed the oil prices variables into log form and check the stationarity.

Table 5.2: Augmented Dickey Fuller Test of Unit Root (Annual Data (T=46))

Variables		C	T	L	t-State	Critical value at 5	Level-of-integration	Result
Inflation	πt	-	-	0	-1.58	-1.96	I(1)	Unit root
	$\Delta\pi t$	-	-	0	-6.657	-1.96	I(0)	NoUnit
Output	Y	-	-	0	-4.09	-1.96	I(0)	NoUnit
Oil Price	$loilt$	C	T	0	1.07	-3.52	I(1)	Unit root
	$\Delta loil$	C	T	0	-4.09	-3.52	I(0)	NoUnit
NER	s_t	C	T	1	-2.797	-3.52	I(1)	Unit root
	Δs	C	-	0	-9.60	-2.95	I(0)	NoUnit

*Indicate significance level at 5%. And c, t are drift and trend terms.

The outcomes are presented in table 5.3 which displays the ADF test results at level and 1st differences. For oil prices, lag is taken to remove the problem of autocorrelation then Dickey-Fuller test become Augmented Dickey-Fuller test. The results suggest that Output gap variable is stationary at level and this variable is not included in the cointegration analysis and the other remaining variables such as π,$loil$ and s are stationary at first difference and these three variables have same order of integration. These results suggest that cointegration may exist in the series. These three variables are of same order of integration and cointegration result also reveals that there exists long run relationship among them.

5.5 Cointegration Test

For the analysis of cointegration we used the Johnson Maximum Likelihood Method to estimate the autoregressive process. First we estimate the unrestricted vector autoregressive (VAR) which involves three variables π_t,$loil_t$ and$s_t$while two dummy variables D74, D09 and output Gap (Y^*_t) variable is included as exogenous variable because output gap is stationary at level and has no long run. To

decide the optimum lag length, we used lag selection criteria. We use the lag from 1 to 5. Lag Selection Criteria results are presented in the 5.4.Table.

Table 5.3 VAR Lag Selection Order

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-	NA	0.806238	8.298226	8.423609	8.3438
1	159.0120	588.6170	1.54e-07*	-7.17131*	-6.669785*	-6.98868*
2	166.6967	12.74527	1.66e-07	-7.107154	-6.229471	-6.787551
3	169.0437	3.549182	2.34e-07	-6.782620	-5.528786	-6.326043
4	180.8247	16.09106	2.13e-07	-6.918276	-5.288293	-6.324726
5	186.9624	7.484989	2.60e-07	6.7786	-4.772518	-6.048128

The results described in the Table 5.4 suggests that LR, FPE, AIC, SC and HQ measures confirms one lag for estimating VAR at 5%. So VAR model is estimated with one lag for each model. Now we investigate the test of autocorrelation, LM test upto the order 5.

Table 5.4. VAR Residual serial correlation LM Test

Lags	LM-STAT	Prob
1	9.767859	0.3696
2	1.369673	0.9980
3	7.641174	0.5707
4	4.351993	0.8868
5	2.508557	0.9807

The result in the above table shows that null hypothesis of no autocorrelation at order one is not rejected at 5% level. In the next step we checked the cointegrating relationship among the variables by using Maximum Likelihood Method of Johnson (1988). Now we choose the order of lags as one and no deterministic trend decision to test the order of the cointegration rank. Johnson presents the two statistics such as trace statistics and maximum Eigenvalue stats to check the order of the co-integrating vectors. Results are presented in the table in 5.

Table 5.5. Likelihood Ratio Trace and Maximal Eigenvalue Test for Cointegrating Rank

(λ trace)			
Null Hypothesis	Alternative Hypothesis	Trace statistics	5% Critical value
r=0	r>0	33.20186*	24.27596
r<1	r≥1	8.134588	12.32090
r<2	r≥2	1.443742	4.129906
(λ max)			
r=0	r>0	25.06727*	17.79730
r<1	r≥1	6.690846	11.22480
r<2	r≥2	1.443742	4.129906

*indicates significant at 5 %

The results are presented in the table 5.6. Here trace statistics shows one cointegrating relationship between the variables. The results of Trace statistics shows that null hypothesis r=0 is rejected at the 5% significance level against the alternative hypothesis r>0 and one cointegrating relationship among the variables in trace statistics. According to Max Eigen value statistics one cointegrating

relationship exists among the variables. The results of max Eigen value statistics rejects null hypothesis i-e r=0 at 5% significance level against the alternative hypothesis r>0.

5.5 Long Run Results of Johnson Maximum Likelihood Method

Now we estimate the long-run relationship among inflation rate, oil price and nominal exchange rate. The results are presented below, in equation 5.1 where long run normalized coefficients are given and Chi Square values are given in parentheses.

$$\boldsymbol{\pi_t = 1.04^{*} loil_t + 5.58^{*} s_t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{5.1})$$

(12.34) ***(0.030)***

Equation 5.1 shows the long- run cointegrating relationship between the inflation rate, oil prices and nominal exchange rate. We include output gap variables and two dummy variables as an exogenous variable because output gap variable is stationary at level and no long run relationship exists among inflation and output gap. These results show that output gap is insignificant and no long run relationship exists between inflation-output gap in Pakistan. Output gap is not significant in Pakistan, implying flat Phillips curve during the whole period. (Moccero et al, 2011). No long run trade off exists between inflation and output (Phelps and Friedman (1967). While examining the cointegration equation (5.1) oil prices and nominal exchange rate have positive influences on inflation rate. Oil price and nominal exchange rate variable shows positive long run relationship with inflation rate variable. Pakistan imports mostly consist of petroleum products so oil is overpriced product and positively impacts inflation rate. So oil price has positive impact on inflation rate about 1.04 % observed long run relationship. The relationship between

inflation and nominal exchange rate is significantly positive. The nominal exchange rate has significant positive relationship on inflation about 5.58% of Pakistan. In long run the slope of Phillips curve in Pakistan is not significant. Chi Square values are given in the parenthesis, the calculated chi square value of oil prices is 12.34 and this calculated value is greater than the critical value 3.84 then we reject Ho, it means that oil price shock doesn't effect the instability of inflation-output trade-off with Triangle model and the calculated chi square value of nominal exchange rate is 0.030 which is less than the critical value 3.84 so,we don't reject Ho it means that nominal exchange rate effect the instability of inflation-output trade-off with Triangle Model. According to this Costly Adjustment model, the relationship between inflation and output gap to make or cause choice may modify with the level of inflation and inflation is highly persistent. If we do not include this kind of instability then Phillips curve is bias. In second case we include two structural change dummies in the model to estimate time instability of inflation-output trade-off during different time periods of inflation. If we do not include this structural change dummy in second model then results may give the false impression that inflation is highly persistent.

5.6 Dynamic Short Run Error Correction Model

Previously discussed long run cointegrating relationship among variables, now we evaluate the dynamic short run relationship between the variables So, we estimated the Dynamic Error Correction Model. Dynamic Error Correction Model (ECM) we used the first differenced form of variables and the term ECM depicts the long run relationship between the variables. To estimate the ECM, we employed general to specific methodology. General to specific methodology (David Hendry, 2004) and the idea behind this methodology is that we successively drop the

insignificant coefficients one by one from the model. The rest of the model is called the parsimonious model. To account for nonlinearities and those important changes in inflation rate we estimate nonlinear model by incorporating shift dummies that represents the identified inflation periods. Now we investigate a time instability of inflation-output trade-off during different periods of inflation environment. In fig 5.1 we can see that the two main breaks are identified this breaks are 1974 and 2009. In 1974, the inflation rate is 29.97% because of oil price shocks, domestic currency value decreased and political instability and in 2009 the inflation rate is 20.97 and is high due to global financial crises which tended to slow down the economic growth and lost the confident of investors. The short run dynamic equation is given below, we used one lag in the parsimonious model, and t- statistics show the significance of the coefficients.

Estimated equation (5.2) is given below (t statistics are given in parentheses)

$$\Delta\pi_t = 0.28^{*}Y^{*}_{t\text{-}i} + 19.06D1_{1974} + 9.80D2_{2009} - 0.45^{*}ECM_{t-i} \quad (5.2)$$

(2.47) (6.52) (3.48) (-6.25)

In equation (5.2) the above table 5.5 reports results of the error correction (ECM) model. We use general to specific methodology and drop insignificant variables one by one. Most of these variables including lagged inflation in the model were turned out to be insignificant. The first and important result in the ECM model is the negative and significant coefficient of the ECM term which is - 0.45. This implies that around four percent of the deviations are adjusted per year. This shows stability of the model although the speed of adjustment is not much quick. In other words coefficient of the ECM term is relatively small which implies that the adjustment of the short deviations around the long run time path is slow. Anyhow

the model is considered to be stable since the all the exogenous variables contribute to adjust all the short run fluctuations around the long run time path. The other variables in the model are the short run elasticities that highlight the short run trade-off exist between inflation and output. Most of these variables in the model were turned out to be insignificant. Estimate a nonlinear specification to account for nonlinear model to including a shift dummies that represents the identified inflation period. The coefficient of output gap is 0.28 and it is estimated slope and the result shows that the relationship between inflation and output is strongly depends upon the inflation environment. The parameter of ECM term is significant at 5% level, it means that long run cointegrating relationship between inflation, oil prices and nominal exchange rate exist. Other variables in the model such as output gap, two dummy variables D74, D09 have significantt values and short run impact on inflation. For more stability of the model two dummy is D74 and D09 include in this model. These dummies have significant effect on inflation.

5.7 Diagnostic Test

We performed the diagnostic test such as LM test, normality test and heteroscedasticity test to check the rationality of the model. To check the constancy of the parameter of dynamic model through the plot of CUSUM and CUSUM of squared (Brown, et al 1975).

Table 5.6. Diagnostic Test

Diagnostic Test	**Calculated value**	
R^2	0.72	
Adjusted R^2	0.70	
Breusch Godfrey LM test of Autocorrelation	0.04	0.83
Jarque Bera test of Normality $\chi 2$ (2)	41.21	0.00
Breusch Pagan Godfrey Heteroscedasticity test	7.58	0.05
ARCH TEST	0.24	0.62

Table 5.6 result of certain diagnostic test shows that model doesn't suffer from the problem of autocorrelation and instability of parameter of the both model but this model suffer the problems of heteroscedasticity and normality .for Breusch Godfrey LM test of Autocorrelation where calculated value shows that there is no auto correlation problems and p value greater than 0.05 then we do not reject Ho and conclude there exist no autocorrelation problems. For Breusch Pagan Godfrey Heteroscedasticity test, calculated value is 7.58 and p value 0.05 and so we conclude the problem of Heteroscedasticity existts.for the normality test we check the Jarque Bera test of Normality $\chi 2$ (2) and the results show we will reject Ho and so there is a problem of non-normality .To check stability of the parameter, the CUSUM and CUSUMSQ techniques have been employed which are built on the ECM model that we have estimated. It is evident from the graphical presentation that both the CUSUM and CUSUMSQ series are lying between their critical bonds at the 5 percent level of significance. This confirms the stability of ECM model with respect to all the variables including structural break effects.

Fig 5.5 CUSUM Mean Stability for Inflation and Output Gap

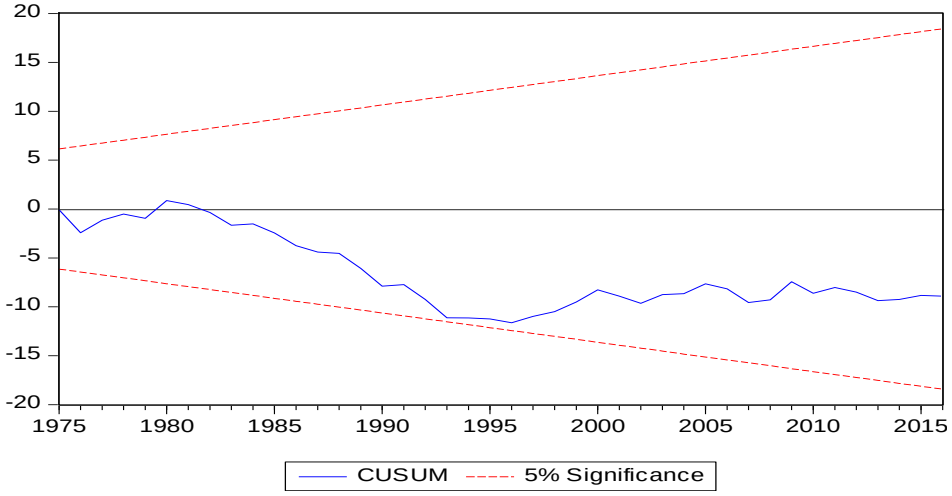
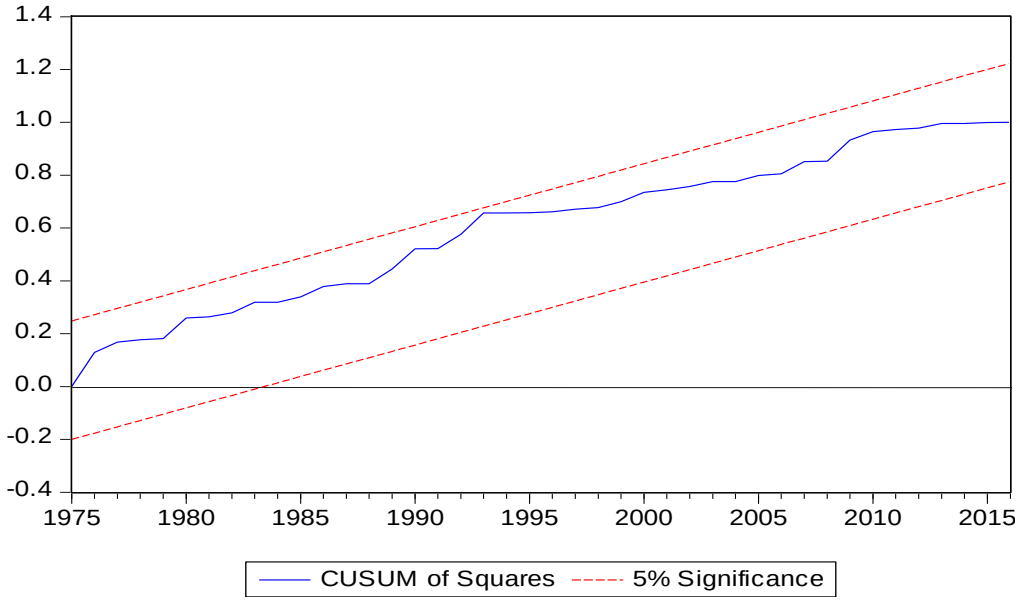


Fig 5.6 CUSUM Mean Square of Inflation and Output Gap



5.8 Concluding Remarks

In this chapter we discussed results and interpretations of the results. First we test unit root on all variables and check their stationarity and we found all variables are same order of integration except the output gap. Output gap variables are stationary at level and no unit root of output gap. Then we have checked the long run cointegration relationship among variable exist through Johnson Maximum Likelihood Method and we estimated a dynamic short run adjustment model and then used diagnostic test to check the validity of the model. In next chapter we discussed the whole conclusion of this study and policy recommendation

CHAPTER 6

CONCLUSIONS AND POLICY RECOMMENDATION

6.1 Conclusions

In previous literature in Pakistan not even a single study found that investigate a systematically the trade-off between inflation and output gap with triangle model.In my knowledge this study fill the existing gap by thoroughly studying the inflation-output trade-off with triangle model.

The aim of this study is to estimate the Inflation-output Trade-off with Triangle model in Pakistan. This study also investigate a time instability of inflation-output Trade-Off during different periods of inflation. At the end we identify an inflation-output trade-off with triangle model in Pakistan Between 1971-2016. Now we investigate a how inflation have a significant effect on inflation-output relationship. We also investigate a time instability of inflation-output trade-off during different periods of inflation. We examined how dynamic of inflation affects inflation-output relationship.

We used three steps methodology unit root analysis, Cointegration analysis and short run Error Correction Dynamic Model to estimate the long run and short run relationship among inflation-output trade-off then for supply shock variables such as oil prices and nominal exchange rate and dummies are also included in this gorden triangle model.

The main finding of this study can be review as Firstly no long run relationship exist between inflation and output trade-off in Pakistan. Two supply variable such as oil price and nominal exchange rate have long run relationship with inflation oil prices have significant impact on inflation but nominal exchange rate

have insignificant effect on inflation and this results suggests that inflation is highly persistent phenomina and secondly we estimate a time instability of inflation and output trade-off with Triangle model and we introduced two dummies to stable the model and these dummies have a positive and significant impact on inflation environment. So the end results shoe there is a short run trade-off exist between inflation and output, and environment of inflation is key determinant of inflation and output relationship.

6.2 Policy Recommendation

Finding of this study suggest that output gap can affect inflation. Policy makers should concentrate on fiscal policy to close output gap. Above findings have some policy recommendation for policy makers or central bank. Central bank should concentrate on expansionary fiscal policy that raise aggregate demand by increase government expenditure or low taxes can used to close a negative aggregate demand. When there is a positive output gap, tight fiscal policy adopted to reduce demand and combat inflation through lower spending or higher taxes. Output gap can play a central role in policymaking.

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