

Factors Affecting Inflation Rate – Evidence from Pakistan by ARDL Approach

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Abstract

The economy of Pakistan is suffering from many economic problems and in this regard inflation is also one. So, it is an attempt to capture the actual determinants of inflation by taking supply of money, population growth rate, imports of agricultural inputs, government expenditures and exports as an independent variable and consumer price index as proxy variables for inflation. These independent variables are significantly at the back of this problem and this study proposed how government can control the high price level to maintain the high living standard for the common people. We can say that it is an attempt to see how these independent variables are determining the inflation in the economy of Pakistan.

Key words: inflation, supply of money, population growth, exports, imports

JEL Code: G2, R23, Q41, F1

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1. Introduction

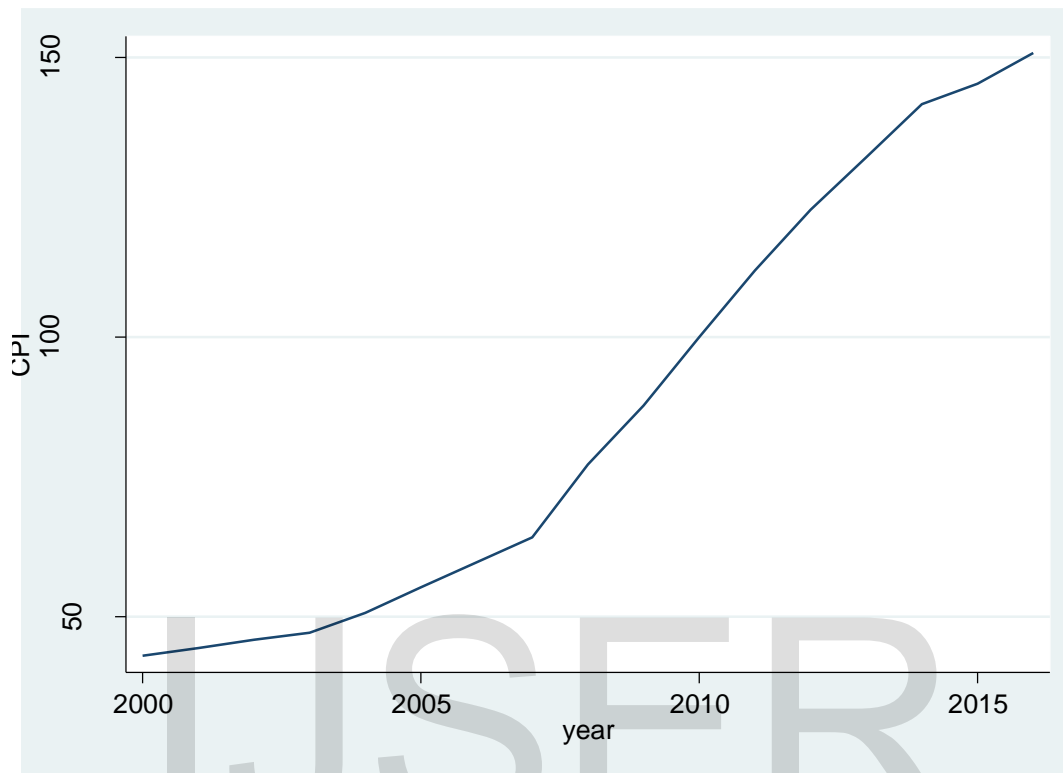
1.1 Background

Pakistan is a developing country and there are so many problems are existing here, if we look towards the previous history of Pakistan there always exist problems, among all the problems inflation is also one because it directly hits the purchasing power of the common people because in Pakistan most of the people are poor and there are also many people who are unable to fulfill their basic needs so they disturb with this economic problem very much. About inflation we can say that a period of above-nominal general price increases as reflected generally the phenomenon of increasing price levels¹.

So, inflation is an economic variable which stands for the high price level, the high price level of those goods which a common man or an average man uses for maintaining his/her existence. But if there is a situation where a common people is unable to fulfill his/her basic needs due to the high price level it means economy is suffering from high price level or inflation. It is also important to know that only 4% of inflation is an ideal type of situation but according to the analysis of 2008 Pakistan was suffering from 20% inflation. Consumer price index also represents the prices and below is the graph which is telling the situation of consumer price index in the case of Pakistan

¹ Definition is taken from Michael P. Todaro

Graph1: Trend of CPI 2000 to 2015



The main inspiration behind this research work is to explore the main determinants of the inflation by using consumer price index as a proxy variable for inflation, because due to this economic problem many people are suffering from low purchasing power. The above graph is presenting the graphical picture that how inflation is increasing rapidly in the previous fifteen years. So, to represent the inflation there is an index used that is called consumer price index by taking the base prices of 2010 and By taking broad money, population growth rate, raw material imports, government expenditure and the exports. For this purpose following are the main objectives of this study.

1.2 Objectives

1. To highlight the main Determinants of inflation in Pakistan
2. To present the suitable policy to overcome inflation

1.3 Hypothesis and Organization of Study

In this research analysis Auto Regressive Distributed Lag is used, we can say that it is an attempt to check the co-integration for this purpose the null hypothesis would be there is no co-integration among the variables and the alternative hypothesis would be there is co-integration among the variables.

After comprehensive introduction with inflation there is also need to know the complete organization of this study. So, after introduction there is a literature review which is presenting how previous researcher tried to find out the determinants of inflation. After that there is data and methodology section where there is complete information of the variables along with data source functional form and estimations and then interpretation of the estimations. In the end there is conclusion and policy implementation.

2. Literature Review

Hassan et al (2016) also attempt to capture those determinants which are affecting the inflation in the case of Pakistan by applying the Auto Regressive Distributed Lag (ARDL) to co-integration on a time series data from 1976 to 2016 to see the long-run and short-run effects of independent variables on the dependent variable along with the error correction model. For this purpose they have selected per capita exports of Pakistan, per capita indirect taxes, per capita external debt, rate of exchange, crude and oil prices as independent variables. So, in this research we can easily examine the significant effects of independent variable that is inflation.

Haider et al (2015) tried to find out the main determinants of inflation in Pakistan with the help of Vector Autoregressive Approach with quarterly data in the period 1991Q1-2007Q4. In this study CPI is representing inflation and the independent variables are govt.'s borrowing for state bake, oil prices, supply of money and exchange rate in this research paper he has used all the variables in the logarithmic form. According to this study these independent variables are affecting inflation in Pakistan more intensely.

Sheikh et al (2014) investigated the main determinants regarding inflation along with its nature in the case of Pakistan with the help of combined approach of co-integration, they also put some light of two main types of inflation these are demand-pull inflation as well as cost-push inflation.

For this purpose the independent variables are supply of money, gross domestic product, exchange rate, prices of inputs for industries and oil prices in this research paper he has used all the variables in the logarithmic form. According to this study these are the variables which are responsible or affecting the price level.

Saleem et al (2013) also put some effort to find out the determinants of inflation in the case of Pakistan by applying simple ordinary least square method. In this study the independent variables are, gross domestic product, exchange rate and fiscal deficit, and rate of interest these are variables which are affecting consumer price index (inflation) in Pakistan.

Ahmed et al (2013) investigated the determinants of inflation with the help of Johansen Co-Integration approach in the case of Pakistan. For this purpose the dependent variable is CPI which is representing inflation and it is influenced by money supply in this study it is representing by money aggregate, gross domestic product, prices of goods which are exported and prices of those goods which are imported, output gap energy crises, govt. expenditures, development expenditures, and all the variables are in logarithmic form. By applying all the techniques related to Johansen Co-Integration these researchers tried to find out the actual determinants of the inflation in Pakistan.

Bashir et al (2011) focus on the main determinants of inflation in the case of Pakistan with the help of Johansen Co-Integration approach. According to them inflation is a kind of economic problem which is very harmful for the poor people. In this the dependent variable is CPI which is presenting the inflation along with the independent variables which are broad money (money supply), gross domestic product, imports of goods and services, exports of goods and services, government expenditures and government revenue and in this research paper he has used all the variables in the logarithmic form. In this effort he tries to capture the real effect of independent variables on the dependent variable with the help of these detailed estimations.

Rashid S. and Azam M. (2015) tried to test the monetarist's hypothesis of inflation; basically they want to critically analyze the monetary school of thought regarding inflation in the case of Pakistan. For this purpose they have applied the simple least square method (OLS) to estimate the coefficients. In this study only one variable is used as an independent variable that is supply of money.

Gill and Knan (2010) also find out the impacts of different factors on inflation in Pakistan from the period 1970 to 2017 in this regard the independent variables are used in this study are budget deficit, exchange rate, wheat support price in rupees, interest rate, imports in rupee, exports in rupee. The most remarkable thing in this study is this there is four dependent variables are used one by one in this study and these are also the three indicators of price level these are consumer price index, wholesale price index, sensitive price index and GDP Deflator.

Ghumro N H. and Memon P A. (2015) tried to estimate the determinants of inflation in Pakistan by applying the Auto Regressive Distributed Lag (ARDL) on the time series data for the period 1980 to 2012 to calculate the long run and short run coefficients along with error correction model. In this regard the independent variables are used by these researchers are supply of money, rate of exchange, total reserve and the gross national expenditure by the side of government, and these all variables are affecting dependent variables.

Jaffri et al (2016) tried to find out the determinants of inflation by applying ARDL approach basically they tried to capture the effect of demographic change on inflation. For this purpose this research work has used population growth rate and proportion of middle age working population as indicators of demographic change, and estimated two models with the help of these proxy variables.

Asghar et al (2013) tried to find out those factors which are affecting inflation in Pakistan with the ARDL approach from the time period 1970 to 2016. For this purpose the independent variables are money supply growth, lagged inflation, foreign inflation and dummy variable for global financial crises 2008 have positive and significant. The long run and short run results of this research paper are telling that independent variables are significantly affecting inflation in Pakistan.

KebretTaye (2012) investigated the determinants of inflation in Botswana for this purpose dependent variable is CPI representing inflation and the independent variables are real GDP, real broad money supply, South African CPI, Real effective exchange rate, nominal Interest Rate and a dummy variable D1 is equal to a dummy variable which is denoting 2005 - 2010 = 1 otherwise = zero, by applying ARDL approach.

2.1 Research Gap

According to the above presented literature review it is quite clear that no one has used money supply, population growth rate, foreign inflation, exports and official exchange rate in the case of Pakistan from the time period 1970 to 2016. So the sample size and the combination of independent variables make this research work unique from the others. Not only this, the results are also significant and according to the theory.

3. Data and Methodology

Inflation is a well-known economic problem and so many developing countries are suffering due to this problem Pakistan is also one of them in this research paper consumer price index based on the prices of 2010 is used as a proxy of inflation. The determinants of inflation in this study are broad money, population growth rate, imports of raw material, government expenditures and exports. The broad money is representing the money supply which is also stands for M2 we can also say that the total money which is in circulation.

Imports of agricultural inputs are also included in this study, because Pakistan is agricultural based economy and several inputs are needed to import from the other countries including high quality seeds, and machineries, and the prices of these commodities are directly to the price level of Pakistani agricultural goods.

Similarly government expenditures are also related with the inflation, because it leads to increase in demand for goods and services and similarly due to this price level will go up. Exports are representing the total amount of goods and services which is exported from Pakistan to the international market and exchange rate means rupee per dollar. For this purpose the representation of the variable is in the following form:

LNCPI is the natural log of consumer price index

LNGBM is the natural log of broad money

LNPOP is the natural log of population growth rate

LNRIMP is the natural log of import of agricultural raw material

LNGEX is the natural log of government expenditure

LNEXPO is the natural log of exports

It is a research analysis based upon the secondary type of data collected from World Development Indicators (WDI). The functional form of the above stated variables would be as follows

3.1 Model

Below is the functional form which is being used in this research paper.

$$\text{LNCPI} = f(\text{LNGBM}, \text{LNPOP}, \text{LNRIMP}, \text{LNGEX}, \text{LNEXPO})$$

To estimate the coefficients the well known multiple regression line in general form would be:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

In the above model ε is an error term therefore, together with these variables the regression line would be look like as follows:

$$\text{LNCPI} = \beta_0 + \beta_1 \text{LNBM} + \beta_2 \text{LNPOP} + \beta_3 \text{LNRIMP} + \beta_4 \text{LNGEX} + \beta_5 \text{LNEXPO} + \varepsilon$$

In the above model β_0 is the intercept term and it tells when all independent variables are equal to zero and hen the value of dependent variable is equal to intercept. Moreover β_1 is the coefficient of LNBM, β_2 is the coefficient of LNCPIC, β_3 is the coefficient of LNPOP, β_4 is the coefficient of LNEXPO and β_5 is the coefficient of LNOER.

3.2 Methodology

These coefficients are estimated with the help of Auto Regressive Distributed Lag (ARDL), it is called so because we use the lag of the Dependent variable. But before we move towards the estimations let we have the proper reference of all the variables which are being used in this model. The first variable is taken with the reference of quantity theory of money because Irving Fisher has used it in the quantity theory of money. Population growth is also affecting the inflation in the case of Pakistan in this regard Jaffri et al (2016) has used growth rate of population as an independent variable.

Ahmed (2013) has used imports as a determinant of inflation in Pakistan, but in this study it is a little bit change, because the import of raw material of agricultural imports is taken as an independent variable. If we talk about the exports so, Ahmed et al (2013) used it as an independent variable and Ghumro (2015) has also used exports as well as government expenditures as independent variable in their research work.

Below are the further estimations of this model.

Table 1: Descriptive Statistics

	LNCPI	LNBM	LNPOP	LNRIMP	LNGEX	LNEXPO
Mean	3.124879	27.04604	0.950440	1.446295	25.64237	25.80980
Median	3.131694	27.05115	0.973164	1.430169	25.82828	26.08576
Maximum	4.978807	30.31460	1.212065	1.819655	28.73336	28.75638
Minimum	1.061799	23.75591	0.713363	1.194370	22.30142	22.00585
Std. Dev.	1.115180	1.971981	0.179537	0.158989	1.853836	2.000534
Skewness	-0.087567	0.014088	-0.017800	0.610049	-0.127013	-0.216312
Kurtosis	2.034452	1.840578	1.515153	2.637191	1.996810	1.870748
Jarque-Bera	1.845662	2.578017	4.228242	3.105513	2.052596	2.802883
Probability	0.397392	0.275544	0.120739	0.211664	0.358331	0.246242
Sum	143.7444	1244.118	43.72026	66.52956	1179.549	1187.251
Sum Sq. Dev.	55.96322	174.9919	1.450505	1.137494	154.6518	180.0962
Observations	46	46	46	46	46	46

The above estimations of table number 1 are related to the descriptive statistics and presenting the results regarding all the variables which are used in this model. For this purpose, firsts of all there is the mean and median of the data and then maximum and minimum values of the data and after than there is standard deviation which is telling the variation in the data from the mean point. And then there is skewness which is telling that whether the data is positively skewed or negatively skewed. Here the most remarkable thing about the above table of descriptive statistics is the probability value of Jarque-Bera test. If the p-value of this test shows the insignificant results it

means that the data is normal, so there are insignificant results regarding this test it means that data is normally distributed.

Table 2: Unit Root Test

Variables	At Level		Variables	At 1 st Difference	
	t – Statistics	P – Value		t – Statistics	P - Value
LNCPI	-1.585610	0.4816	LNCPI	-3.219717	0.0253
LNGBM	-0.264459	0.9221	LNGBM	-5.556864	0.0000
LNPOP	-2.204850	0.2090	LNPOP	-1.820677	0.3658
LNRIMP	-6.336435	0.0000	LNRIMP	-6.526838	0.0000
LNGEX	-0.858026	0.7925	LNGEX	-6.640494	0.0000
LNEXPO	-2.611741	0.0979	LNEXPO	-5.851873	0.0000

To check trend in the variables there is a need to apply the unit root test on all the variables. In the above case we can see the ADF test of unit root on both level and 1st difference along with their probability value. In this regard if probability value of ADF test is 0.1 or above then it will accept null hypothesis which states that variable has unit root or trend or it is non-stationary variable. In level all the variables are non-stationary except LNEXPO and LNRIMP because its value is less than 0.1, Moreover at 1st difference all the variables are stationary except LNPOP.

In the light of above estimations we can say that all the variables including dependent variable contains mix order in the context of unit root. These are the results of unit root test at level as well as results of 1st difference.

In the conclusion of above unit root test under Augmented Dickey-Fuller (ADF) test we can say that all the variables having mix order of unit root in the result the condition of applying co-integration test of ARDL is fulfill, so we'll apply ARDL method to calculate the values of coefficients.

Table 3: ARDL Estimates

Dependent variable is LNCPI				
Optimum lags	1,1,1,0,0,0			
F-statistic	13.41			
W-statistic	80.48			
	Critical bound for F-statistics		Critical bound for w-statistics	
Significant Level	Lower critical Bound	Upper critical Bound	Lower critical bound	Upper critical bound
5 percent	2.92	4.18	17.57	25.11
10percent	2.44	3.59	14.66	21.59
LM Version				
Serial Correlation	0.59256 [0.441]	Normality	0.27509 [0.871]	
Functional Form	0.04114 [0.839]	Heteroskedasticity	0.97830 [0.323]	

In the above table we can see the estimations of Auto Regressive Distributed Lag (ARDL) and in that estimation the value of F-statistic is greater than upper critical bound so, we can say that there is an existence of co-integration among the variables. On the other hand we can also see the diagnostics of ARDL model in the LM version section and that portion there are the diagnostics related to Serial Correlation which is also known as autocorrelation, normality, functional form and at the end hetroskedasticity.

In the above estimations of LM version there is a chi-square test value regarding the each diagnostic along with the probability value in the bracket. All the probability values are greater than 0.1 and showing the insignificant results so we can say that the diagnostics are telling optimistic and desirable results and there is no issue of these econometric problems of serial correlation, normality, functional form and the end hetroskedasticity.

Table 4: Long-Run Coefficients

Dependent variable is LNCPI				
Variables	Coefficient	Standard Error	T-Ratio [P-vale]	Decision
LNGBM	-0.46524	0.20997	-2.2157 [0.033]	<i>Significant</i>
LNPOP	-0.38887	0.26372	-1.4746 [0.149]	<i>Insignificant</i>
LNRIMP	-0.18530	0.10746	-1.7243 [0.093]	<i>Significant</i>
LNGEX	0.47312	0.16099	2.9389 [0.006]	<i>Significant</i>
LNEXPO	0.57955	0.10964	5.2860 [0.000]	<i>Significant</i>
C	-10.2930	0.84826	-12.134 [0.000]	<i>Significant</i>

In the above table we can see that the long coefficient calculated by the ARDL approach and each coefficient is revealing the significant results except LNPOP, it also means that all the independent variables affecting the dependent variable significantly.

The interpretation is also very easy of above coefficients, first of all broad money (LNBM) it is also presenting supply of money the value of coefficient is -0.465 it means that one unit increase in money supply it would be responsible for decreasing CPI (inflation) of worth 0.465. If we talk the *quantity theory* of money according to this theory due to increase in money supply it would also be caused to increase inflation in the economy. So, the results are presenting inaccurate results in the case of Pakistan, there may be many reasons behind this because Pakistan is a developing economy may be in Pakistan the supply of money isn't in a desirable quantity. We can also say that the supply of goods and services are greater than the supply of money that's why increase in money supply leads to decrease in inflation.

Secondly there is a population growth rate (LNPOP) its coefficient is revealing insignificant results it means that the impact of population growth on inflation is zero. So there is no need to explain the results of population growth rate further.

Pakistan is a developing country and also based upon agriculture moreover Pakistan also needs to import many agricultural goods. In this study imports of agricultural imports are presented by LNRIMP and it is also having significant impact on inflation the value of its coefficient is -0.185. It means that it is responsible for decreasing the inflation for the sake of interpretation we

can say that one unit increase in the raw material imports leads to decrease in inflation worth 0.185. Further we can say that due to increase in agricultural raw material imports production become increase and in this way price people also become employed and increase in production also leads to decrease in the price level.

Pakistan is a developing country and here so many economic problems are prevailing and population growth is also one, but government always tries to overcome these problems for this purpose government has to increase its expenditures. But the results are indicating government isn't spending in a right direction because government spending usually related to deficit financing. Consistent with this study we can say that after every one element increase in the government spending leads to inflation worth 0.473. It means in Pakistan inflation is positively related with the government expenditure.

If we talk about the exports of Pakistan in the framework of inflation the estimated results regarding exports are also telling that due to increase in exports inflation is also going up. We can say that due to one unit increase in exports it leads to increase inflation of worth 0.579. The explanation is quite easy of this result; we can say that due to increase in exports inflation is going up in Pakistan. Increase in exports means that in the world the demand of Pakistan's product is increasing which leads to create shortage of goods in Pakistan and due to this price goes up many people become unable to pay increased prices and in the result their purchasing power would also be low down, eventually they now become more affected from the high price level and inflation becomes high in Pakistan.

Moreover if we talk about the intercept term its value is also in negative and equal to -10.293 it means that when all the independent variables are equal to zero the value of dependent variable would be equal to -10.293.

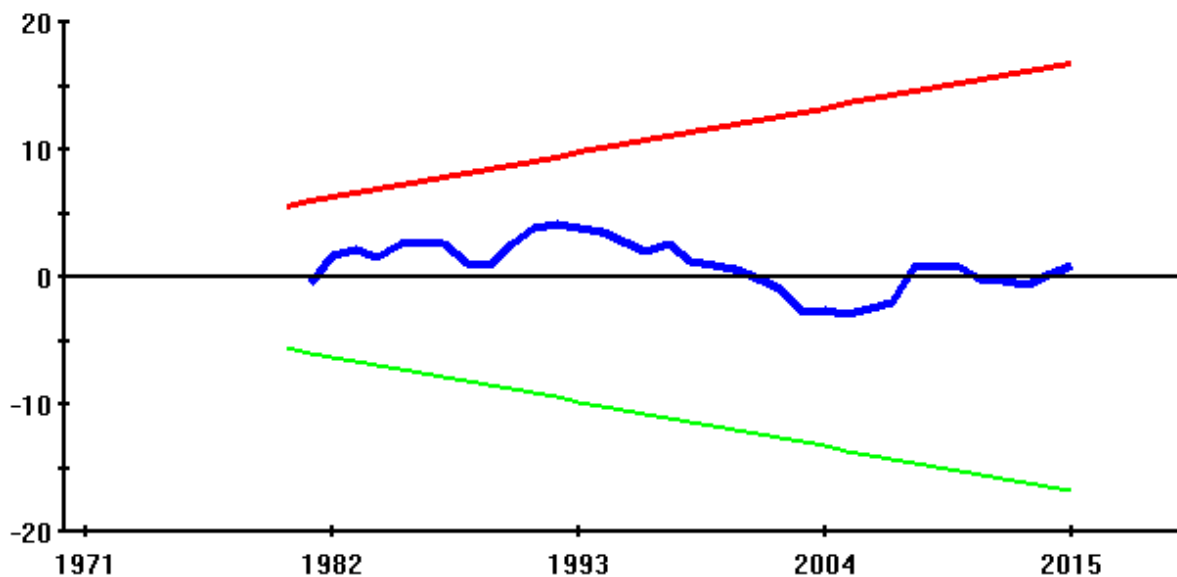
Table 5: Error Correction Model

Dependent variable is ΔLNCPI
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Variables	Coefficient	Standard Error	T-Ratio[P-value]	Decision
Δ LNGBM	-0.3520	0.068373	-5.1483 [0.000]	<i>Significant</i>
Δ LNPOP	2.2563	0.26128	8.6359 [0.000]	<i>Significant</i>
Δ LN RIMP	-0.0464	0.028106	-1.6525 [0.107]	<i>Significant</i>
Δ LN GEX	0.1185	0.032996	3.5940 [0.001]	<i>Significant</i>
Δ LNEXPO	0.1452	0.023474	6.1882 [0.000]	<i>Significant</i>
ECM-1	-0.2506	0.045273	-5.5364 [0.000]	<i>Significant</i>

In the above table we can see that the error correction model along with short run coefficients all the coefficients are showing significant results as well as their interpretation would also be right as the long run coefficients. But the most remarkable thing is the error correction model here (ECM-1), in this attempt its value is negative and significant which is -.250 it means that if in case disequilibrium prevails in the economy then 4 years are required to come again in the equilibrium.

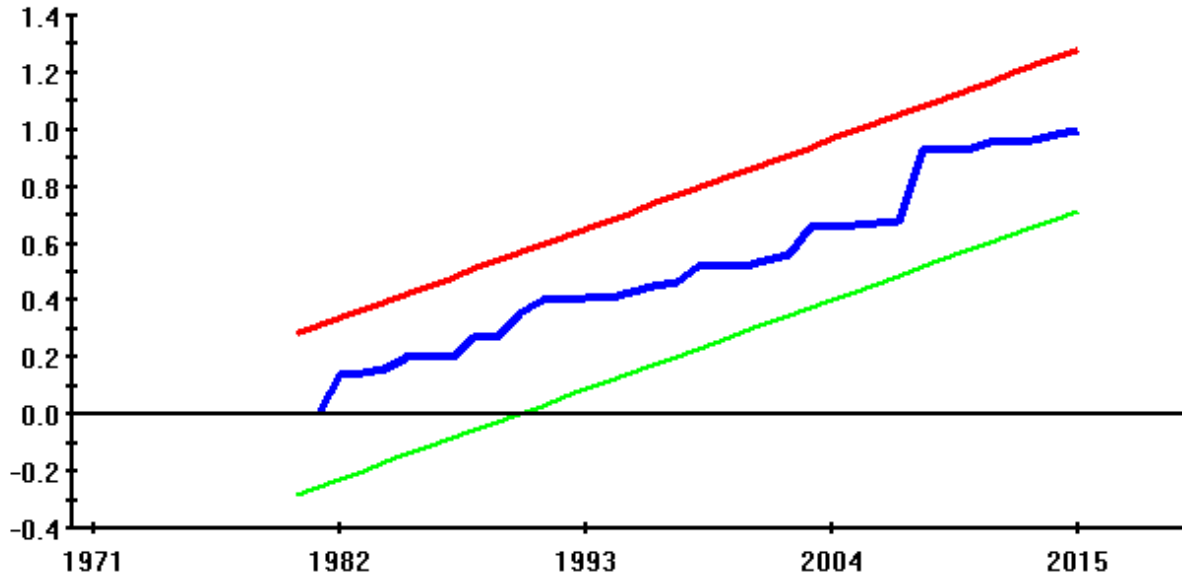
Graph 2
Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Graph 3

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

In the above graph we can see the stability of the mean of error term of this model in the graph 2, and in the graph it is a very well noticeable that it is within its critical bound. It means that the mean of the error term is normal. In the above graph we can see the stability of the variance of error term of this model in the graph 3, and in the graph it is a very well noticeable that it is within its critical bound. It means that the variance of the error term is normal.

4. Conclusion and Policy Implementation

To conclude this research analysis we can say alternate hypothesis is accepted because there is co-integration as presented in the table 3 ARDL test. Moreover inflation is an economic problem and there are many side effects in our economy because it directly affects the purchasing power of the consumer. The above results are clearly telling that there is a need to focus more and more on supply of money, raw material imports, government expenditure and exports.

The results are telling that in the market the supply of goods and services is greater than money supply that's why due to increase in the money supply leads to decrease inflation or on the other

hand we can also say that the resources aren't fully utilized. So in this regard there is a need take serious steps by the State Bank of Pakistan to maintain interest rate. Because due to decrease in the rate of interest rate investment would be increased and in this way due to multiplier effect capital formation increase and similarly supply of money would be increase and in a little while it would be at the desirable stage.

Raw material import is also leaving significant impacts on Pakistan's economy because increase in it leads to decrease inflation. Because it generates positive potential in the economy, many people get employment opportunities moreover production of agricultural sector also goes up. For this purpose government should provide the subsidy for the agricultural imports because Pakistan's largest population is living in the rural area by this government can control rural unemployment.

At present time there are so many development projects are going on in the country and it needs the resources in the results deficit financing happens due to government expenditure and it leads to increase the price of goods and consequently inflation increase. China is also taking interest in the economy of Pakistan and this country is also a major trade partner of Pakistan and CPEC project is also going on in here. In this way the inflation in China is also disturbing the inflation in Pakistan.

Basically the main reason behind inflation in Pakistan is to focus more and more on proper allocation of the resources. The independent variables we can see that are affecting very well to the dependent variable and that's why the people of Pakistan are suffering from the increasing price level. If we look at the Pakistan then we can say that there are lots of potential to overcome each and every economic problem. If we talk about the policy implementation in the light of above results we can say that there is a need for the central bank to take serious steps to control the money supply. Pakistan should also focus on exports it should observe the demand in the domestic market first and then in the foreign market in this way prices would be under control in the domestic market.

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