

Determinants of Inflation in Pakistan: Demand and Supply Side Analysis

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Abstract: *The present study analyzes the demand and supply side determinants of inflation in Pakistan. In order to achieve the objective, time series data is collected over a period of 1972 to 2014. Autoregressive and distributed lag model is utilized for long run and short run results. The demand side factors of inflation are population, roads and government expenditure while supply side factors are imports, government revenue, electricity generation and external debt. In the long run, inflation is caused by roads, government expenditure, imports, government revenue and external debt. There is decline in price level due to foreign direct investment, electricity generation and population in long run.*

Keywords: Population, government expenditure, exports, imports, government revenue, electricity generation, consumer price index, autoregressive and distributed lag model.

Introduction

Inflation comes from 'inflate', which is referred to general rise in the price level of a country (Brooman & Jacoby, 1970). According to Shapiro (1972) Inflation rate is defined as constant increase in the general price level with regard to increase in the prices of goods and services. Rising inflation seemed to be general phenomena in any economy. Among all issues of the economy, Inflation is one of the most important in Pakistan. High inflation is not always in favor of the economy as it adversely affects economic performance and purchasing power of the society.

Various theories of inflation were presented by the economists. Demand Pull inflation theory is the most ordinary and conventional theory of inflation. It is occurred in the economy when aggregate demand (AD) is exceeded as compared to aggregate supply (AS). There is an increase in aggregate demand (AD) categorized through four sectors of the economy such as business, households, foreign buyers and Government. Cost Push Inflation is occurred in the economy when there is an increase in cost of production, overall price level also increases. Such type of inflation arises due to an increase in cost of any one of the four factors of production like as land, labor, capital and entrepreneurship. Quantity theory of Money presented by Fisher (2006) proposes that money supply is the main cause of inflation. Faster expansion in money supply leads to high inflation in the economy. Keeping other things constant, the price level is directly related to the money supply. Doubling the money supply would double price level.

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Moser (1995) concluded concurrent fiscal and monetary policies as major factors affecting inflation in Nigeria. Cottarelli, Griffiths, and Moghadam (1998) explained fiscal deficits, relative price changes, central bank independence, exchange rate regime and degree of price liberalization as having significant effect on inflation in industrial and transition economies. Edwards and Tabellini (1991) investigated political instability and political polarization in explaining cross country differences in inflation in case of developing countries. Catao and Terrones (2005) showed a strong positive association between deficits and inflation among high inflation and developing country groups but not among low inflation advanced economies. Kandil and Morsy (2011)) studied oil revenues as having inflationary pressure through higher growth of credit and aggregate spending in oil? rich Gulf Cooperation Council (GCC).

The objective of this study is to examine the related variables influencing inflation in Pakistan using both demand side and supply side. Section 1 is introduction, section 2 presents review of literature on inflation conducted nationally as well as internationally, section 3 elaborates model, variables, data and methodology. Section 4 examines the empirical results of short- run and long-run. Section 5 concludes the study and lastly references are provided.

Literature Review

A lot of empirical researches have been done for estimating factors that affect inflation nationally as well as internationally. This section mentions some empirical studies with their main findings as under.

Reviews from Pakistan's Economy

M. S. Khan and Schimmelpfenning (2006) analyzed the monetary determinants that helped to forecast inflation in Pakistan. This study used a monthly data set for the time period 1998 - 2005. Johansen co-integration technique was applied to formulate the results. The analysis illustrated that role of monetary factors was dominant in affecting the rate of inflation with a One year lag. In addition, Broad money growth and Private sector credit growth were important indicators of inflation which could be used for estimation of future inflation.

A. A. Khan, Ahmed, and Hyder (2007) intended to identify the central causes of recent inflation in Pakistan from 1972 to 2006. The study used Ordinary least square (OLS) technique and indicated that real demand, private sector borrowing, public sector borrowing, import prices, previous year consumer price index (CPI), Government taxes, exchange rate and wheat support price were directly related to inflation in Pakistan.

R. E. A. Khan and Gill (2010) conducted study to find out major determinants of inflation in case of Pakistan. Findings of the study were based on four indicators of inflation i.e. consumer price index (CPI), whole price index (WPI), sensitive price index (SPI) and GDP deflator. Ordinary least square method was employed to have estimates. By using time series data from 1972 to 2006, the study suggested that exchange rate, wheat support price, budget deficit, support price of sugarcane, imports and money supply were founded to be directly affecting the price indicators (WPI, SPI, CPI, GDP Deflator) and interest rate was found to be indirectly related in Pakistan.

Bashir et al. (2011) examined demand and supply side determinants of inflation in Pakistan. Time series data from 1972 to 2010 was used in the study. Moreover, Johansen Co-integration and error correction approach was employed in order to estimate the long-run and short-run associations between inflation and other macroeconomic variables. The results of study indicated

that there was long run relationship between GDP, imports, money supply, Government revenue, Government expenditure and inflation in Pakistan.

[Aurangzeb \(2012\)](#) investigated the determinants of inflation in Pakistan. Time series data set was used for the period from 1981 to 2010. By applying multiple regression analysis, the researchers identified significance of different factors. Findings of the study indicated that interest rate, exchange rate, fiscal deficit, and unemployment rate had positive influence on inflation where as gross domestic product had inverse effect on inflation.

[Ahmed, Raza, Hussain, and Lal \(2013\)](#) explored determinants of inflation in Pakistan. The researchers used time series data set for period of 1971 to 2012. Johansen co-integration technique and Error Correction Model (ECM) were used to explore long run and short run dynamics of inflation. The results of analysis revealed that gross domestic product, Money supply, output gap, energy crises, imports of goods and services, current Government expenditures and adaptive expectations were the basic reasons of inflation in Pakistan while development expenditure had negative impact on inflation.

[Shams, Parveen, and Ramzan \(2013\)](#) conducted study to find out long run relationship between inflation and its fiscal determinants in case of Pakistan. The study used time series data set from 1975 to 2008. Using Johansen co-integration approach, it was resulted that there was long run positive relationship between macroeconomic variables such as Local Credit, Exchange rate and Inflation and negative relationship of GDP with inflation.

[Asghar, Jaffri, and Asjed \(2013\)](#) investigated long run and short run relationship between foreign inflation, lagged inflation and money supply growth. Annual data from 1972 to 2010 was used. By applying ARDL approach, the study examined long run positive relationship between foreign inflation, lagged inflation, money supply growth, global financial crises and inflation in Pakistan while nominal effective exchange rate was indirectly influencing inflation in long run as well as in short run.

[Saleem et al. \(2013\)](#) empirically estimated the impact of macroeconomic variables i.e. unemployment rate, exchange rate, gross domestic product, interest rate and fiscal deficit on inflation rate in Pakistan's economy. Time series data set from the period of 1990 to 2011 was used in the study. By using regression analysis, study showed negative relationship between unemployment rate, fiscal deficit and inflation while positive relationship was examined between exchange rate, GDP, interest rate and inflation.

Reviews from International Economies

[Papi and Lim \(1997\)](#) examined determinants of inflation in Turkey. To investigate the results of study, time series data set was used ranging from 1970 to 1995. Johansen co-integration technique was applied to investigate the association between exchange rate, money supply, prices of exports, wages, prices of imports and inflation. The findings of the study revealed that there was significant positive relationship between wages, money supply, prices of exports, prices of imports and inflation in Turkey while exchange rate had negative influence on inflation.

[Kuijs \(1998\)](#) applied vector autoregressive model on quarterly data to investigate the determinants of inflation in Nigeria. Time series data from 1983 to 1996 was employed in the study. The results of the study indicated that 1 and 3 years lag of price, 1st lag of output gap and money supply were positively contributing in inflation.

[Liu and Adedeji \(2000\)](#) highlighted some key determinants of inflation in the Islamic Republic of Iran by employing Johansen co-integration technique using time series data from 1989 to 1999. The analysis concluded money supply and expected inflation as directly associated with inflation

whereas exchange rate had negative impact on inflation.

Sumaila and Laryea (2001) investigated determinants of inflation in Tanzania using Quarterly data from 1992 to 1998. The results of Johansen co-integration suggested that increase in exchange rate and money supply would be reasons of higher inflation while inflation rate was decreased due to Gross domestic product (GDP).

Ramady (2009) described determinants of inflation in Saudi Arabia for data covering the period from 1986 to 2007. The results of analysis revealed that money supply and interest rate affected the inflation positively while stock price index, nominal effective exchange rate and oil price were negatively associated with inflation.

Olatunji, Omotesho, Ayinde, Ayinde, et al. (2010) investigated the factor effecting inflation in Nigeria using time series data and concluded that lagged values of Consumer Price Index, imports, and exchange rate were positively affecting inflation. Although the factors that reduced inflation was lagged values of interest rate and exports.

Fatukasi (2003) conducted study to investigate the determinants of inflation in Nigeria between 1981 and 2003. The study suggested that money supply, fiscal deficit and interest rate had positive impact on inflation in Nigeria. On the other side, exchange rate had negative impression on inflation.

Altowaijri (2011) traced out internal and external factors that affected inflation in Saudi Arabia for the period from 1996 to 2010. The analysis showed external factors as main source of inflation while money supply had no impact on inflation in kingdom of Saudi Arabia. Sahadudheen (2012) explored that GDP and broad money were positively contributing inflation while exchange rate was negatively correlated with inflation in case of India.

Data and Methodology

Data Description

The study utilizes annual time series data over the period from 1972 to 2014 from Economy of Pakistan. The data is collected through reliable official sources of Pakistan like Economic Survey of Pakistan (2013 -2014) published by Federal Bureau of Statistics, Pakistan; Handbook of Statistics on Pakistan Economy 2010 compiled by State Bank of Pakistan and World Development Indicators provided by World Bank Group.

Demand and Supply Side Models of Inflation

Keeping in view the objective that is to find out demand and supply side factors affecting inflation of Pakistan, the study specifies following models. To trace out inflation; consumer price index and whole sale price index are included. For estimation of elasticities, all variables are taken in natural log form.

Demand side factors

The demand side models of inflation are presented as;

$$CPI = \beta_0 + \beta_1 EX + \beta_2 RDS + \beta_3 POP + \beta_4 BM + \beta_5 GX + \mu_i \quad (1)$$

$$WPI = \gamma_0 + \gamma_1 EX + \gamma_2 RDS + \gamma_3 POP + \gamma_4 BM + \gamma_5 GX + v_i \quad (2)$$

Supply side factors

The supply side models of inflation are stated as;

$$CPI = \alpha_0 + \alpha_1 IMP + \alpha_2 GR + \alpha_3 ELECG + \alpha_4 FDI + \alpha_5 INDSE + \alpha_6 DEBT + u_i \quad (3)$$

$$WPI = \delta_0 + \delta_1 IMP + \delta_2 GR + \delta_3 ELECG + \delta_4 FDI + \delta_5 INDSE + \delta_6 DEBT + w_i \quad (4)$$

$\alpha_i, \beta_i, \delta_i$ and γ_i are elasticities of price level with respect to various demand and supply side factors included and μ_i, v_i, u_i, w_i are stochastic random terms. Detail of the variables used in above equations is provided in table 1.

Table 1
Data Description

Variables	Description	Unit of Measurement	Expected Relationship
WPI	Wholesale Price Index	Price Index	
EX	Exports of goods and Services	Million Rupees	Positive
RDS	Roads	Kilometers	Positive
POP	Population	Millions	Negative
BM	Broad Money	Million Rupees	Positive
GX	Government Expenditure	Million Rupees	Positive
IMP	Imports of Goods and Services	Million Rupees	Positive
GR	Government Revenue	Million Rupees	Positive
ELECG	Electricity Generation	Kilo Watts Per Hour	Negative
FDI	Foreign Direct Investment	Million Rupees	Negative
INDSE	Industrial Sector Output	Million Rupees	Positive
DEBT	External Debt	Million Rupees	Positive
CPI	Consumer Price Index	Price Index	Dependent Variable

Source: Authors

Methodological Discussion

Examination of unit root problem in the time series data is considered as the foremost step. Ng and Perron (2001) unit root test is employed for this reason. Autoregressive and Distributed Lag model (ARDL) is most appropriate method for estimation proposed by Pesaran, Shin, and Smith (2001) in a situation when order of integration of variables is mixed I (0) and I (1) means level and first difference. At second step, the criterion for selecting the lag length is considered as important. Then long run relationship among variables is necessary to be examined via Wald test. For long run and short run estimates, ARDL long run and short run models are estimated.

Ng and Perron (NP) Unit root test

These are four tests that are based upon the GLS detrended data YDt constructed by Ng and Perron (2001) These test statistics are modified forms of Philips and Perrons Za and Zt statistics, (Bhargava, 1986) $R1$ statistics, and the Elliot, Rothenberg, and stock point optimal (ERS) statistic.

First define the term;

$$K = \sum_{t=2}^T \frac{(y_{t-1}^d)^2}{T^2}$$

The modified statistics may be written as,

$$MZ_a^d = \frac{T^1(Y_t^d)^2 - f_o}{2K}$$

$$MZ_t^d = MZ_a \times MSB$$

$$MSB^d = \left(\frac{K}{f_o}\right)^{1/2}$$

$$MP_T^d = \frac{\bar{c}^2 K - \bar{c}T^{-1}(y_T^d)^2}{f_o}$$

$$MP_T^d = \frac{\bar{c}^2 K + (1 - \bar{c})T^{-1}(y_T^d)^2}{f_o}$$

Information Criteria via VAR Lag Order

The perception of an information criterion is to provide a measure that strikes stability between the measure of goodness of fit and parsimonious specification of the model. The various information criteria differ in how to strike this balance. Several selection criteria can be used to find out how many lags to use. There are different tests that would indicate the optimal number of lags as specified under;

Akaike Information criterion (AIC) = - 2 (l / T) + 2 (k / T)

Schwarz Information Criterion (SC) = - 2 (l / T) + k log (T) / T

Hannan - Quinn Information Criterion (HQ) = - 2 (l / T) + 2 k log (log (T)) / T

ARDL Bound test approach for long run relationships

Wald Test (F-statistics) is used to check the existence of long-run relationship between the variables. The existence of long run relationship may be found by following unrestricted error correction regression for all of the demand and supply side models at an appropriate lag length. The following model is written only for demand side inflation keeping consumer price index as dependent variable. Similarly, rest of the equations may be formed.

$$\begin{aligned} \Delta CPI = & \delta_o + \sum_{j=1}^q \delta_{1j} \Delta CPI_{t-j} + \sum_{j=0}^q \delta_{2j} \Delta EX_{t-j} + \sum_{j=0}^q \delta_{3j} \Delta RDS_{t-j} \\ & + \sum_{j=0}^q \delta_{4j} \Delta POP_{t-j} + \sum_{j=0}^q \delta_{5j} \Delta BM_{t-j} + \sum_{j=0}^q \delta_{6j} \Delta GX_{t-j} + a_o CPI_{t-1} \\ & + a_1 EX_{t-1} + a_2 RDS_{t-1} + a_3 POP_{t-1} + a_4 BM_{t-1} + a_5 GX_{t-1} + \omega_{1t} \end{aligned}$$

The Wald test or F - Statistics is followed for the existence of co-integration. The null hypothesis for no co? integration among variables is [Ho: a₀ = a₁ = a₂ = a₃ = a₄ = a₅ = 0](No evidence of long-run relationships).

Inflation Model in long run

Long run estimates of demand and supply side will be evaluated using the following ARDL (m, n, p, q, r, s, t) models;

$$CPI = d_o + \sum_{j=1}^m d_1 CPI_{t-j} + \sum_{j=0}^n d_2 EX_{t-j} + \sum_{j=0}^p d_3 RDS_{t-j} + \sum_{j=0}^q d_4 POP_{t-j} + \sum_{j=0}^r d_5 BM_{t-j} + \sum_{j=0}^r d_6 GX_{t-j} + \nu_{1t}$$

In the above long run equation d's are long run elasticities. The above model is formed only for demand side inflation keeping consumer price index as dependent variable. Similarly, rest of the equations may be written.

Inflation Model in short run

Short run coefficients can be examined by constructing an error correction model using following forms;

$$\Delta CPI = g_o + \sum_{j=1}^q g_1 \Delta CPI_{t-j} + \sum_{j=0}^q g_2 \Delta EX_{t-j} + \sum_{j=0}^q g_3 \Delta RDS_{t-j} + \sum_{j=0}^q g_4 \Delta POP_{t-j} + \sum_{j=0}^q g_5 \Delta BM_{t-j} + \sum_{j=0}^q g_6 \Delta GX_{t-j} + \psi_1 ECM_{t-1} + \xi_{1t}$$

In above equations, Δ is first difference operator, g's are short run elasticities and ψ_1 is speed of adjustment term which shows convergence towards long run if its sign is negative. The above model is mentioned only for demand side inflation keeping consumer price index as dependent variable. Similarly, rest of the equations may be specified.

Results and Discussions

Ng and Perron (NP) Unit root test

Table 2 presents the results of Ng and Perron - unit root test revealing that CPI (consumer price index), Wholesale Price Index (WPI), EX (Exports of goods and services), RDS (Roads) and GX (Government expenditure) are stationary at their levels while BM (Broad Money), GR (Government Revenue), POP (Population), INDSE (Industrial Sector Output), IMP (Imports of goods and services), FDI (Foreign direct investment), ELECG (Electricity Generation) and DEBT (External Debt) are stationary at 1st difference.

Table 2
Unit Root Test

Variables	Test for unit root in	Include in test equation	Ng-Perron Test Statistics				Result
			MZa	MZt	MSb	MPt	
CPI	Level	Intercept	-1.04	-0.39	0.38	11.83	I(0)*
		Trend and Intercept	-45.85	-4.72	0.10	2.31	
DEBT	Level	Intercept	0.67	0.46	0.69	34.87	I(1)*
		Trend and intercept	-3.53	-1.15	0.32	22.97	
ELECG	Level	Intercept	-17.55	-2.95	0.16	1.41	
		Trend and Intercept	0.06	0.06	1.00	56.91	I(1)**
GX	Level	Intercept	-2.63	0.66	0.25	21	
		Trend and Intercept	-17.6	-2.43	0.13	3.14	
FDI	Level	Intercept	-17.8	-2.84	0.15	1.86	I(0)**
		Trend and Intercept	0.36	0.34	0.94	54.86	I(1)**
IMP	Level	Intercept	-6.68	-1.48	0.22	13.79	
		Trend and Intercept	-16.25	-2.76	0.16	1.83	
INDSE	Level	Intercept	1.18	0.99	0.84	53.23	I(1)**
		Trend and Intercept	-17.17	-2.92	0.17	5.31	
POP	Level	Intercept	-15.13	-2.74	0.18	1.62	
		Trend and Intercept	0.87	0.72	0.82	48.19	I(1)*
GR	Level	Intercept	-9.34	-2.13	0.22	9.86	
		Trend and Intercept	-17.96	-2.99	0.16	1.36	
WPI	Level	Intercept	-1.28	-0.67	0.52	15.39	I(1)*
		Trend and Intercept	-5.40	-1.57	0.29	16.62	
BM	Level	Intercept	-17.98	-2.99	0.16	1.36	
		Trend and Intercept	1.08	0.77	0.71	39.22	I(1)*
EX	Level	Intercept	-15.70	-2.80	0.17	5.80	
		Trend and intercept	-17.68	-2.97	0.16	1.39	
RDS	Level	Intercept	-26.81	-3.5	0.13	1.41	I(0)*
		Trend and Intercept	-0.44	-0.20	0.44	15.45	I(1)*
RDS	Level	Intercept	-20.8	-3.31	0.15	4.45	
		Trend and Intercept	-16.52	-2.87	0.17	1.49	
RDS	Level	Intercept	0.82	0.66	0.8	46.14	I(0)***
		Trend and Intercept	-14.71	-2.68	0.18	6.34	
RDS	Level	Intercept	0.65	0.83	1.27	101.01	I(0)**
		Trend and Intercept	-24.72	-3.41	0.13	4.25	

Note: *, **, *** shows critical values at 1, 5 and 10 percent level of significance, Results are calculated using EViews-7.

VAR Lag Order Selection Criteria

Lag length selection is based on Schwarz Information Criterion (SC), Hannan-Quinn Information Criterion (HQ) and Akaike Information Criterion (AIC). The minimum values of information criterions will lead towards suitable lag length to be adopted for ARDL long run models. Table 3 proposes 1 as suitable lag length for long run and short run estimations.

Table 3
VAR Lag Order Selection Criteria

Lags	AIC	SC	HQ	AIC	SC	HQ
Demand side Models of Inflation						
0	-1.88	-1.61	-1.79	-1.78	-1.52	-1.69
1	-14.71*	-12.65*	-13.87*	-13.81*	-11.94*	-13.16*
2	-14.51	-11.24	-13.51	-13.7	-10.23	-12.5
Supply side Models of Inflation						
0	-3.68	3.99	3.79	3.90	4.21	4.01
1	-5.88*	-3.39*	-5.02*	-4.97*	-2.28*	-3.91*
2	-5.67	-1	-4.06	-4.74	-0.27	-3.35

Source: *indicates lag order selected by the criterion

ARDL Bound test

To conclude co-integration relationship between variables, ARDL bound test is utilized as suggested by Pesaran et al. (2001) According to Bounds test, if calculated F-statistics is greater than critical value of upper bound, co-integration relationship among variables is confirmed. If F-statistics is lower than the upper bound critical value, it shows existence of no co-integrating relationship among variables. In addition, if F-statistics is between two critical bounds, then inconclusive conclusion is drawn about co-integrating relationships (Raza, Shahbaz, & Nguyen, 2015; Raza, 2015; Raza, Shahbaz, & Paramati, 2016). Table 4 confirms co-integrating relationships among demand and supply side factors determining inflation.

Table 4
ARDL Bound Testing Approach to Cointegration

Bound Test Model	F-Statistics	Probability	Critical Bound		Conclusion
			I(0)	I(1)	
Demand Side Models					
	4.22	0.05	-2.57	-4.04	Co-integration
	5.3	0.03	-3.43	-4.99	Co-integration
Supply Side Models					
	6.06	0.02	-3.43	-5.19	Co-integration
	5.72	0.06	-3.43	-5.19	Co integration

Note: Bound critical values are taken from Pesaran et al. (2001), Table C1. iii: Case III: Unrestricted intercept and no trend. *, ** and *** certify that co-integration exists at 1, 5 and 10 % level of significance. K: number of regressors demand side equal to 6 and supply side 7. F-Stats are calculated using E-views-7.

Demand Pull Inflation in the Long run

ARDL long-run results relating to demand side of inflation are given in table 5. In which, first column shows names of variable, long run coefficients with its probability values are displayed in 2nd and 3rd columns.

As regards, Exports (EX) is found to be positively related with inflation (CPI, WPI) in Pakistan with insignificant probability value. Exports affect inflation through demand side as higher exports raises demand for goods and services in the economy from foreigners that would lead to excess demand in comparison with supply. So ultimately, it would put pressure on price

level in the economy. These results are in line with previous studies i.e. [Olatunji et al. \(2010\)](#) and [Bashir et al. \(2011\)](#)

With regard to population, it is having negative impression on consumer price index and whole price index in case of Pakistan. In the long run, one percent rise in population will be a cause of lowering price level by about 0.21 or 0.28 percent on average. The rationale behind negative relationship between population and inflation may be that generally population of Pakistan is unemployed and living below the poverty line. When population of Pakistan increase, the members of family will also increase and it will be a cause of low income per capita. Due to low income, demand for goods and services will fall and eventually it will lead to lower inflation in Pakistan. The long run population elasticity of price level is 0.21 or 0.28.

The results of study show that there exists a statistically significant and positive relationship between roads and indicators of inflation (CPI, WPI) in Pakistan. With regards to Highway road construction, it is having direct effect on inflation. On average, price level will be higher by 0.20 or 0.21 percent due to 1 percent additional road construction in the long run. The justification of positive relationship between roads and inflation may be that highway road construction will boost up employment in Pakistan. Due to high level of employment, income of society will increase that would lead to higher demand for goods and services in the long run. The long run elasticity of price level with respect to roads is 0.20 or 0.21.

Broad money is positively and insignificantly affecting price level (CPI and WPI) in Pakistan. Positive sign correlates the results of study with Quantity Theory of Money given by Classical economists that argues about existence of proportional and direct relationship between money supply and inflation in any economy. Money supply affects inflation through demand side like increase in money supply raises investment and then employment opportunities hence generating higher aggregate demand in the economy. The positive sign is already concluded by [Liu and Adedeji \(2000\)](#), [Sumaila and Laryea \(2001\)](#), [Ramady \(2009\)](#), [Fatukasi \(2003\)](#), [Altowajri \(2011\)](#), [Sahadudheen \(2012\)](#), [Ahmed et al. \(2013\)](#).

As expected, government expenditure has tendency to increase inflation in Pakistan. The coefficients of Government expenditure are 0.40 and 0.66 suggesting 0.40 or 0.66 percent rise in inflation due to one percent additional government expenditure in Pakistan. It may be justified as Government spends its budget on different projects that will increase aggregate demand of the economy. Higher demand puts pressure on price level causing inflation in Pakistan in the long run. The findings of [Bashir et al. \(2011\)](#) are similar to results of the study. Government expenditure elasticity of price level is 0.40 or 0.66 in the long run.

Table 5
ARDL Long run Results (Demand Side)

Regressors	Demand Side Models			
	Consumer Price Index		Wholesale Price Index	
	Coefficients	Probability	Coefficients	Probability
Exports	0.03	0.39	0.01	0.78
Population	-0.21	0.00	-0.28	0.00
Roads	0.20	0.08	0.21	0.10
Broad Money	0.14	0.18	0.00	0.98
Government Exp.	0.40	0.00	0.66	0.00
Constant	-4.96	0.00	-5.87	0.00

Source: Using Microfit 4.1, long run results are calculated

Cost Push Inflation in the Long run

Table 6 presents long-run results of supply side models relating to inflation. Imports of goods and services give positive impression on inflation (CPI, and WPI) in Pakistan with statistically significant coefficient value. Price level would rise by 0.07 or 0.08 percent due to 1 percent higher imports of goods and services in Pakistan on the average. Higher imports of goods and services will put negative pressure on investment projects in the long run. There will be reduction in supply of goods and services in the economy causing higher price level in Pakistan. Alternative explanation may be that due to an increase in imports of raw materials for textile or machinery, cost of production increases that may give rise to price level in the economy. These findings are matched with previous studies i.e. [A. A. Khan et al. \(2007\)](#), [Olatunji et al. \(2010\)](#), and [Bashir et al. \(2011\)](#). The elasticity of price level with respect to imports is 0.07 or 0.08 in the long run.

The results of study reveal that Government revenue is found to be directly related to inflation (CPI, WPI) in Pakistan. The values of coefficients are 0.14 or 0.19 signifying 0.14 or 0.19 percent rise in price level due to one percent increase in government revenue in the long run. Increase in government revenue will raise taxes that will give rise to cost of production and leading to inflation in any economy. The long run elasticity of price level with respect to government revenue is 0.14 or 0.19.

Industrial sector output and Inflation (CPI, WPI) in Pakistan are found to be insignificant. As expected, electricity generation is positive with significant coefficient suggesting that one percent increase in electricity generation will decrease inflation by 0.30 or 0.32 percent in the long run on average. Increase in power generation will decrease price of electricity that will lower cost of production in the long run. Long run elasticity of price level with respect to electricity generation is 0.30 or 0.32.

Table 6
ARDL Long run Results (Supply Side)

Regressors	Supply Side Models			
	Consumer Price Index		Wholesale Price Index	
	Coefficients	Probability	Coefficients	Probability
Imports	0.07	0.05	0.08	0.05
Government Revenue	0.14	0.00	0.19	0.00
Industrial Sector Output	0.02	0.16	0.03	0.16
Electricity Generation	-0.30	0.00	-0.32	0.00

Source: Using Microfit 4.1, long run results are calculated

The study shows statistically insignificant long run relationship between foreign direct investment and Inflation in Pakistan. External debt has significant effect on Inflation (CPI and WPI) in case of Pakistan. The coefficient values are 0.54 or 0.56 supporting that one percent increase in external debt will increase price level by 0.54 or 0.56 percent in the long run on average. External debt is actually resulted by mismanagement of resources or public funds. The repayment of debt or debt servicing has positive impact on cost of production of goods and services that give rise to price level. The elasticity of price level with respect to external debt is 0.54 or 0.56 in the long run.

Table 7
ARDL Error Correction Demand Side

Regressors	Demand Side Models			
	Consumer Price Index		Wholesale Price Index	
	Coefficients	Probability	Coefficients	Probability
DEX	0.01	0.40	0.005	0.78
DPOP	-0.07	0.00	-0.05	0.22
DRDS	0.06	0.13	0.11	0.18
DBM	-0.13	0.11	-0.001	0.98
DGX	0.13	0.00	0.13	0.23
Dc	-1.66	0.00	-3.08	0.00
ECM	-0.33	0.00	-0.52	0.00
R-square	0.70		0.56	
F-stat	8.85		5.74	
DW Stat	2.13		1.95	

Source: Using Microfit 4.1, short run results are calculated

Demand Pull Inflation in the Short run

The fundamental thing in the short run results is basically speed of adjustment term. Speed of adjustment term illustrates that how much time will be required in an economy to recover from any external or internal shock and to reach at long-run equilibrium. The short run coefficients show that inflation is positively affected by exports (DNX), government expenditure (DEX) and roads (DRDS) whereas it is negatively affected by Broad Money (DBM) and population (DPOP) in case of Pakistan. ECM (error correction term) is negative with statistically significant coefficient suggesting that economy will converge towards long run equilibrium by taking 0.33 or 0.52 percent adjustment annually.

Cost Push Inflation in the Short run

Table 8
ARDL Error Correction Supply Side

Regressors	Supply Side Models			
	Consumer Price Index		Wholesale Price Index	
	Coefficients	Probability	Coefficients	Probability
DIMP	0.01	0.25	0.02	0.29
DGR	0.02	0.12	0.05	0.03
DINDSE	0.00	0.99	-0.01	0.64
DELEC	-0.08	0.16	-0.04	0.58
DFDI	0.00	0.60	-0.02	0.28
DDEBT	0.05	0.51	0.02	0.83
ECM	-0.02	0.00	-0.04	0.00
R-square	0.65		0.63	
F-stat	8.45		6.14	
DW Stat	1.97		1.70	

Source: Using Microfit 4.1, Short run results are calculated

In the short run, imports of goods and services, government revenue and external debt are positive with inflation in Pakistan while industrial sector output, electricity generation and foreign direct

investment are reducing inflation. Error correction term is having meaningful interpretations that if there will be any disturbance in the short run, long run equilibrium will be restored after taking 0.02 and 0.04 percent annual adjustments on the average.

Conclusion and Policy Implications

The core objective of the study is to determine demand and supply side factors affecting inflation in Pakistan. The data of macroeconomic variables are collected from official websites i.e. Handbook of Statistics on Pakistan Economy 2010 and Economic Survey of Pakistan (2013-14) and World Development Indicators over a period of 1972 to 2014.

Ng and Perron unit root test finalizes Autoregressive and Distributed Lag model (ARDL) to be most suitable technique to estimate the long run and short run results of study. VAR lag order selection criterions choose '1' as an appropriate lag length for demand and supply side models. Bound test approach to co-integration confirms the existence of long-run relationship among variables included in demand and supply side models.

Long run estimates present that demand side factors such as Exports of goods and services, Government Expenditures, Roads and Broad Money are increasing inflation of Pakistan on the average while population is reducing inflation. Supply side factors such as Government Revenue, Industrial Sector Output, External Debt and Imports are increasing inflation of Pakistan on the average while Electricity Generation and Foreign Direct Investment are reducing inflation in the long run.

Considering log - log forms of the equation, the elasticities of price level with respect to population, roads, government expenditure, imports, government revenue, electricity generation and external debt are respectively -0.21, 0.20, 0.40, 0.07, 0.14, -0.30, and 0.54. Error correction term demonstrate that due to any disequilibrium in the short run, economy will be converged towards long run equilibrium. The significant factors that affect inflation through demand side are population, roads and government expenditure while factors that significantly affect inflation through supply side are imports, government revenue, electricity generation and external debt.

On the basis of results, it is recommended that inflation may be controlled by controlling exports, imports, broad money, roads, government revenue, electricity generation, foreign direct investment, external debt and government expenditure as these factors are under the control of government. Policies should be designed on requirement basis rather than desires so that desirable target of inflation may be achieved. Power generation should be enhanced as it is major input involved in any production process leading to lower inflation.

References

- Ahmed, F., Raza, H., Hussain, A., & Lal, I. (2013). Determinant of Inflation in Pakistan: An Econometrics Analysis, Using Johansen Co Integration Approach. *European Journal of Business and Management*, 5(30), 115–122.
- Altowaijri, H. A. (2011). Determinants of Inflation In Saudi Arabia. *World Review of Business Research*, 1(4), 109–114.
- Asghar, N., Jaffri, A. A., & Asjed, R. (2013). An empirical investigation of domestic and external determinants of inflation in Pakistan. *Pakistan Economic and Social Review*, 51(1), 55–70.
- Aurangzeb, A. U. H. (2012). Determinants of Inflation in Pakistan. *Universal Journal of Management and Social Sciences*, 2(1), 89–91.
- Bashir, F., Nawaz, S., Yasin, K., Khursheed, U., Khan, J., & Qureshi, M. J. (2011). Determinants of inflation in Pakistan: An econometric analysis using Johansen co-integration approach. *Australian Journal of Business and Management Research*, 1(5), 71–82.
- Bhargava, A. (1986). On the theory of testing for unit roots in observed time series. *The Review of Economic Studies*, 53(3), 369–384.
- Brooman, F. S., & Jacoby, H. D. (1970). *Macroeconomics: An Introduction to Theory and Policy*. Aldine Publishing Company.
- Catao, L. A., & Terrones, M. E. (2005). Fiscal deficits and inflation. *Journal of Monetary Economics*, 52(3), 529–554.
- Cottarelli, C., Griffiths, M. E., & Moghadam, R. (1998). The Nonmonetary determinants of inflation: A panel data study. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=882254
- Edwards, S., & Tabellini, G. (1991). Explaining fiscal policies and inflation in developing countries. *Journal of International Money and Finance*, 10, 16–48.
- Fatukasi, B. (2003). Determinants of inflation in Nigeria: An empirical analysis. *International Journal of Humanities and Social Science*, 1(18), 262–271.
- Fisher, I. (2006). *The Purchasing Power of Money: Its' Determination And Relation to Credit Interest And Crises*. Cosimo, Inc.
- Kandil, M., & Morsy, H. (2011). Determinants of Inflation in GCC. *Middle East Development Journal*, 3(02), 141–158.
- Khan, A. A., Ahmed, Q. M., & Hyder, K. (2007). Determinants of recent inflation in Pakistan. Retrieved from <https://mpira.ub.uni-muenchen.de/16254/>
- Khan, M. S., & Schimmelpfenning, A. (2006). Inflation in Pakistan. *Pakistan Development Review*, 45(2), 185–202.
- Khan, R. E. A., & Gill, A. R. (2010). Determinants of inflation: A case of Pakistan (1970–2007). *Journal of Economics*, 1(1), 45–51.
- Kuijs, L. (1998). Determinants of inflation, exchange rate, and output in Nigeria. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=882745
- Liu, O., & Adedeji, O. (2000). Determinants of inflation in the Islamic Republic of Iran: A macroeconomic analysis. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=879891

- Moser, G. G. (1995). The main determinants of inflation in Nigeria. *Staff Papers-International Monetary Fund*, 42(2), 270–289.
- Ng, S., & Perron, P. (2001). Lag length selection and the construction of unit root tests with good size and power. *Econometrica*, 69(6), 1519–1554.
- Olatunji, G., Omotosho, O., Ayinde, O. E., Ayinde, K., et al. (2010). Determinants of Inflation in Nigeria: A Co-integration approach. In *Joint 3rd africa association of agricultural economists (aaae) and 48 th agricultural economists association of south africa (aeasa) conference, cape town, south africa, september 19* (Vol. 23).
- Papi, L., & Lim, C. H. (1997). An econometric analysis of the determinants of inflation in Turkey. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=883293
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289–326.
- Ramady, M. (2009). External and Internal Determinants of Inflation: A Case Study of Saudi Arabia. *Middle East Journal of Economics and Finance*, 2(1), 25–38.
- Raza, S. A. (2015). Foreign direct investment, workers' remittances and private saving in Pakistan: an ARDL bound testing approach. *Journal of Business Economics and Management*, 16(6), 1216–1234.
- Raza, S. A., Shahbaz, M., & Nguyen, D. K. (2015). Energy conservation policies, growth and trade performance: evidence of feedback hypothesis in Pakistan. *Energy Policy*, 80, 1–10.
- Raza, S. A., Shahbaz, M., & Paramati, S. R. (2016). Dynamics of Military Expenditure and Income Inequality in Pakistan. *Social Indicators Research*, 1–21. doi: 10.1007/s11205-016-1284-7
- Sahadudheen, I. (2012). A cointegration and error correction approach to the determinants of inflation in India. *International Journal of Economic Research*, 3(1), 105–112.
- Saleem, F., Haider, Z., Shoukat, S., Shafiq, S., Zahid, A., Shahzad, A., & Hassan, W. (2013). Determinants of inflation in Pakistan. *Interdisciplinary Journal of Contemporary Research in Business*, 4(9), 245.
- Shams, A., Parveen, S., & Ramzan, M. (2013). Fiscal determinants of inflation in Pakistan. *Interdisciplinary Journal of Contemporary Research in Business*, 5(5), 241–249.
- Shapiro, E. (1972). The Surtax, Labor Supply Reaction, and the Rate of Inflation. *Nebraska Journal of Economics and Business*, 11(3), 49–56.
- Sumaila, U. R., & Laryea, S. A. (2001). Determinants of inflation in Tanzania. *CMI Working Paper*. Retrieved from <http://www.cmi.no/publications/publication/?934=determinants-of-inflation-in-tanzania>