

An Empirical Analysis in Effect of Macroeconomic Factors on Inflation for Pakistan

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ABSTRACT

The current study is an effort to empirically assess the effect of various macroeconomic factors on inflation in Pakistan by utilizing ordinary least squares (OLS) method and Granger non-causality test in the time-series framework from 1973-Q3 to 2017-Q2. The empirical results confirm that real GDP, money supply, imports, government expenditure, and lagged inflation have a positive and considerable influence on inflation while interest rate has an adverse impact on inflation. Additionally, the findings demonstrate bidirectional causality between money supply and inflation, while the unidirectional causal relationship is found from government expenditure and imports to inflation. These results signify that inflation does not depend solely on monetary growth in Pakistan; however, imports and fiscal policy are also contributory factors that have a considerable impact on inflation. The study concludes that central authority would not accomplish the stabilize prices through changing the monetary policy until and unless the government will not fix the fiscal deficit.

JEL Classification: E31, E52, E62

Keywords: Inflation, Macroeconomic Factors, Pakistan

INTRODUCTION

Price stability and sustainable economic growth are considered essential macroeconomic goals of any economy. The nature and cost of inflation can have a considerable influence on the life of a common man, as well as on the economy. A look at Pakistani's inflation history shows a significant increase in inflation over the past decade. In the year of 2008, the inflation rate has crossed the double-digit. However, it reached its highest level, i.e., 20.77% in 2009 (Government of Pakistan, 2012). There are controversial views on sources, which are significantly contributing to the price hike in Pakistan during the last decade. Some people believed that the law and order situation was the worst in the past decade in Pakistan due to the war against terrorism in Afghanistan that started in 2001. However, Pakistan is the center of the global counterterrorism strategy and bears a high cost in terms of money for the war against terrorism. This puts some more pressure on Pakistan's economy and subsequently raise the price level in Pakistan. On the other hand, some people believed that high food prices in the country, high oil prices in the international market and imported inflation are the crucial factors for higher inflation in Pakistan in the last decade. In addition, several policy makers ascertained that a continually and rapidly rising price level is the result of the implementation of expansionary economic policies by the central bank during this period in Pakistan.

Economic literature has presented many theories that explicate the factors of inflation. The major theories are cost-push and demand-pull inflation that elucidate the causes of inflation. The demand-pull model suggests that inflation occurs when aggregate demand in the economy

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exceeds its productive capacity. On the contrary, the cost-push theory proposes that the price level rises by the increasing costs of production. Furthermore, monetarists believe that inflation largely depends on money growth in the economy. They asserted that the government can stabilize the prices by decreasing the money supply (Friedman, 1970; Schwartz, 1973). On the contrary, Keynesian economists emphasized that aggregate demand plays a vital role in determining inflation than changes in the money supply. Apart from this, structuralists asserted that the structure of the economy is the driving force behind the high rate of inflation (Canavese, 1982; Maynard, 1961). They argued that inflation is chiefly caused by evolution and bottlenecks on the real side of the economy (Bilquees, 1988). Moreover, several economists argued that for most countries, inflation also occurs from rising prices of imported goods and services, especially oil prices (Feldkircher & Siklos, 2019; Nell, 2004).

Most of the macroeconomists and policy makers have agreed that monetary policy is an effective instrument for stabilizing prices (Hussain, 2014; Qayyum, 2006; Yellen, 2017). However, several empirical studies concluded that inflation cannot be controlled only through changing the monetary policy without fixing the supply-side factors that may trigger inflation. They ascertained that higher wages, food prices, high prices of the imported goods, restrictions on imports, government expenditure as well as unstable growth process are the crucial sources of inflation (Adu & Marbuah, 2011; Bernanke, 2005). The success and failure of any policy to control inflation depends on a better knowledge of all these sources of inflation and responsiveness of the inflation to changes in the various factors specifically monetary and fiscal policy shocks. Therefore, understanding the magnitude and direction of the effects of all these factors of inflation is important for devising a comprehensive macroeconomic policy to control inflation. However, currently, a wide disagreement on the causes of inflation in Pakistan signifies that no single model of inflation, namely monetarists, Keynesian and structuralists, can alone explain the sources of inflation. Therefore, it is essential to combine all the major approaches of inflation in a single model to properly understand the sources of inflation in Pakistan. In this context, this study is designed in a way to empirically ascertain the effects of all major macroeconomic factors, including both monetary and fiscal policy variables, imports and output growth on inflation by using quarterly data in Pakistan's case.

The rest of the paper is organized as follows. In section II, we present the existing findings on the determinants of inflation. In section III, we offer a detailed discussion on the specification of the inflation model and the analytical techniques used to assess the effects of macroeconomic factors on inflation. In section IV, we discuss and present the results. Finally, the last section provides the concluding remarks. The data sourced are given in Appendix, Table 4.

LITERATURE REVIEW

Several theories exist in the literature that explicate the dynamics of inflation. The most famous theory that explains the causes of inflation is the quantity theory of money. It states that an increase in the money supply leads to a rise in the price level in the country. On the contrary, the Keynesian economists explained the two types of inflation, namely demand-pull inflation and cost-push inflation. They argued that fiscal policy is an effective tool for controlling inflation. However, in the late 1960s, a new model was developed by monetarists and challenged the Keynesian view of inflation. Friedman (1968, 1970, & 1971) provides a theoretical foundation of the monetarist model. The monetarist model emphasizes the role of

monetary policy in curtailing inflation. Although, Schwartz (1973) has empirically tested monetarist's hypothesis and suggested that an increase in the price level chiefly depends on monetary growth. On the other hand, during the 1960s, the classical economists also presented a new model, called the structural model (Baumol, 1967; Maynard & Rijkeghem, 1976). The structuralists' model asserted that inflation chiefly depends on supply-side factors, including high food prices, volatile growth in output, prices of imported goods, indirect taxes and fluctuation in income and wages in the long-run.

The empirical literature identified various factors affecting the rate of inflation across the globe. For example, Scheibe and Vines (2005) explored the determinants of the general price level in China and stated that inflation is positively and considerably correlated with output growth, exchange rate, and expected inflation. Other studies, Khan, Bukhari, and Ahmed (2007), Leigh and Rossi (2002) also investigated the effect of various factors on inflation. These studies reported that monetary policy shocks, exchange rate, budget deficits, high prices of imported goods, supply-side shocks, fiscal policy variables, including direct and indirect taxes, and expected inflation have a substantial influence on inflation in respective countries. Abidemi and Malik (2010) argued that imports, GDP, monetary policy variables and price expectations have a positive and sizeable impact on inflation in Nigeria, whereas the exchange rate and fiscal deficit are negatively correlated with the rate of inflation. Kandil and Morsy (2011) documented that government spending and supply-side bottlenecks have a significant effect on inflation in the case of the Oil-rich Gulf Cooperation Council. Arif and Ali (2012) ascertained that the money supply, imports, and output growth a positive and considerable influence on inflation in Bangladesh. However, they argued that among all variables, the money growth has a larger influence on inflation in Bangladesh. Similarly, Evans (2019) documented that the growth rate of money supply has a substantial effect on inflation in both short- and long-run in South Africa and Nigeria. Alam and Alam (2016) investigated the determinants of inflation in India and reported that the growth rate of money supply, exchange rate and supply bottlenecks have a sizeable effect on inflation in the case of India. Furthermore, they suggested that monetary growth and supply bottlenecks have a larger influence on inflation compared to external factors in the long-run. Recently, Feldkircher and Siklos (2019) explored the influence of global factors on inflation and documented that global oil prices have a sizeable influence on inflation and its effects on inflation are long-lasting. Likewise, Okimoto (2019) suggested that the exchange rate and oil prices have positive and considerable effects on the trend inflation in Japan.

In Pakistan's case, Hasan, Ashfaq, Hafiz and Rasheed (1995) and Naqvi, Ashfaq, Ahmed and Rehana (1994) explored the sources of inflation and documented that inflation is considerably affected by the support price of wheat. In addition, they argued that fluctuation in the exchange rate, government borrowings and expectation of prices have a substantial influence on inflation. Another attempt made by Chaudhary and Ahmed (1996), they examined the impact of the output growth on inflation and reported that real GDP growth has a considerable influence on inflation in Pakistan. Khan and Qasim (1996) investigated the influence of macroeconomic variable on inflation in Pakistan and reported that inflation is positively and significantly impacted by changing the money supply. Furthermore, the findings suggest that prices of import goods and output growth have made a considerable difference in the overall price level in Pakistan. Likewise, SPDC (2006) also documented that output growth has a positive and considerable influence on inflation. They argued that high

growth cannot be achieved without inflation when potential output is growing with the pace of increasing demand. In the same year, Chaudhry and Choudhary (2006) also examined the factors of inflation by utilizing an ARDL approach within a cointegration framework. Their findings indicate that the prices of imported goods are the crucial factors of inflation. Additionally, the results suggest that monetary policy variables do not have a considerable influence on inflation. They conclude that the prices of imported goods have played a considerable role in raising the price level in Pakistan. Qayyum (2006) documented that money supply has a positive and sizeable influence on inflation. The empirical findings of his study support the monetarist view that inflation largely depends on money growth in Pakistan. On the contrary, Khan and Gill (2010) suggested that the money supply (measured by M2) does not affect inflation in Pakistan. Recently, Shaikh, Siddiqui, and Wizarat (2014) examined the impacts of various factors on inflation. The empirical findings indicate that inflation is positively and substantially affected by money supply and exchange rate while interest rate and openness of the economy have an adverse effect on inflation. Finally, the study suggests that inflation in Pakistan is not only demand-pull, however, the supply side factors are also the causes of inflation in Pakistan. Similarly, Ghumro and Memon (2015) evaluated the factors of inflation and documented that inflation is considerably influenced by changing in both monetary and fiscal policy variables in Pakistan. To sum up, the extant literature showed that inflation does not only depend on money growth, as suggested by monetarists. However, several other factors including support price of wheat, output growth, exchange rate, import prices, openness of the economy, and fiscal policy variables also induce inflation across the globe as well as in Pakistan.

RESEARCH METHODOLOGY

Specification of Model

The extant literature has presented many theories to explain the mechanism of inflation. However, the empirical literature produced divergent conclusions on the causes of inflation. It signifies that there is no single model of inflation, namely monetarists, Keynesian and structuralists, which can alone explain the sources of inflation. Keeping in view the significance of all proposed theories, the current study integrates all the major approaches of inflation in a single model to ascertain the effect of various factors on inflation. First, the monetarist's model states that inflation largely depends on money growth. Following the quantity theory of money, this study hypothesized that money growth is associated with increases in the price level. Mathematically, the equation is specified as follows:

$$CPI_t = \alpha + \beta_1 MS_t \quad (1)$$

Furthermore, the general price level has also varied due to external shocks. The extant literature showed that the prices of imported goods put upward pressure on domestic prices (Nell, 2004). Therefore, a variable that represents the imported inflation (measured by the total imports) is included in the equation. In addition, several economists and researchers argued that an increase in prices creates price expectations. It can cause a further rise in the price level. People are expected a higher wage to compensate for expected rises in the prices and thus, this would lead to further price increases (Abidemi & Malik, 2010; Hasan et al., 1995; Khan & Gill, 2010). Therefore, the lagged variable for inflation" is included in the equation to capture the impact of expected prices on inflation. Now the equation (1) can be expressed as follows:

$$CPI_t = \alpha + \beta_1 MS_t + \beta_2 IMP_t + \beta_3 CPI_{t-1} \quad (2)$$

Many economists argued that high growth in output cannot be achieved without high inflation. The empirical studies have also confirmed that an increase in real GDP comes with a rise in the price level (Khan et al., 2007). To capture the influence of output growth on inflation, a real GDP is included in the inflation model (2) and now the equation (2) is specified as follows:

$$CPI_t = \alpha + \beta_1 MS_t + \beta_2 IMP_t + \beta_3 CPI_{t-1} + \beta_4 GDP_t \quad (3)$$

Moreover, several economists asserted that the general price level also varied due to fluctuation in the exchange rate. They argued that depreciation or appreciation of domestic currency has altered the general price level via imports channel. For instance, if the domestic currency depreciates, it means the more domestic currency per dollar and hence raises the number of rupees for same traded goods. Finally, it increases the cost of imports and eventually put pressure on domestic prices (Khan & Gill, 2010). Therefore, the current study hypothesized that the exchange rate is positively associated with the inflation rate. To capture the influence of fluctuation in the exchange rate, a variable which represents the exchange rate is included in the model and now the equation (3) is expressed as follows:

$$CPI_t = \alpha + \beta_1 MS_t + \beta_2 IMP_t + \beta_3 CPI_{t-1} + \beta_4 GDP_t + \beta_5 ER_t \quad (4)$$

The structuralist model posited that the government taxes “direct and indirect taxes” increases the prices of consumer goods, which eventually build the inflationary pressure on the economy (Khan et al., 2007). Therefore, a variable that represents the direct and indirect taxes (measured by the total government expenditure) is included in the inflation model to capture the effect of taxes on inflation in Pakistan. Now the equation (4) is written as follows:

$$CPI_t = \alpha + \beta_1 MS_t + \beta_2 IMP_t + \beta_3 CPI_{t-1} + \beta_4 GDP_t + \beta_5 ER_t + \beta_6 GEXP_t \quad (5)$$

The Keynesian economists postulated that monetary policy shocks also affected the inflation via interest rate channel by changing the aggregate demand. A rise in interest rates can lead to reduced aggregate demand, which translates into a gradual reduction in inflationary pressure that eventually decline the price level (Adu & Marbuah, 2011). Hence, a variable that represents the interest rate (measured by the money market rate) is added to the model to capture the effect of the monetary policy shocks on inflation. Finally, the equation is expressed as follows:

$$CPI_t = \alpha + \beta_1 MS_t + \beta_2 IMP_t + \beta_3 CPI_{t-1} + \beta_4 GDP_t + \beta_5 ER_t + \beta_6 GEXP_t + \beta_7 IR_t \quad (6)$$

In extant literature a huge debate on the selection of accurate function form. Several researchers and economists preferred the use of a log-log model because of ease interpretation and its superior fit. Therefore, the current study used a log-log model to estimate the results. All the variables in the equation (6) are transformed in the logarithm form and expressed it econometrically as follows:

$$\begin{aligned} \ln CPI_t = & \\ & \alpha + \ln \beta_1 MS_t + \ln \beta_2 IMP_t + \ln \beta_3 CPI_{t-1} + \ln \beta_4 GDP_t + \ln \beta_5 ER_t + \ln \beta_6 GEXP_t + \\ & \ln \beta_7 IR_t + \mu_t \quad (7) \end{aligned}$$

Where CPI stands for the consumer price index, MS stands for the money supply, IMP is total imports, CPLt-1 is one-year lagged of CPI, GDP stands for the gross domestic product, ER stands for the exchange rate, GEXP stands for government expenditure and IR stands for the interest rate. Ln is the natural log, β_1 to β_7 are the coefficients, α is an intercept, t is the time period, and μ is the error term.

Estimating Techniques

The available literature has used several estimation techniques including simple OLS, VAR model, cointegration techniques, etc., to identify the determinants of inflation. Following the extant literature and according to the nature of data, this study used the ordinary least squares method (OLS) and Granger non-casualty test to obtain the required results. Furthermore, the obtained findings are verified and validated by using various diagnostic tests, namely LM test, White Heteroscedasticity tests and Ramsey RESET test for model specification.

Data and Sources

The study utilizes the time-series data ranges from 1973-Q3 to 2017-Q2. Data for the variables of imports, government expenditure, and real GDP are obtained from the study of Hanif, Iqbal, and Malik (2013). Data for the variables of CPI, interest rate and exchange rate are sourced from IFS-IMF data. Money supply (M2) is taken from the State Bank of Pakistan. All variables are transformed into a quarterly growth rate.

RESULT AND DISCUSSION

OLS method is invalid if the data-series of the included variables are non-stationary. To overcome this problem, the current study utilized the Augmented Dickey-Fuller (ADF) test to check the presence of a unit root in the individual time-series. The results, based on the ADF test reported in Table 1, demonstrate that data-series of all the concerned variables are stationary or integrated of order I(0). This is not surprising that data series of all variables are stationary in level because we have already converted all variables into the quarterly growth rate. For further analysis, all the corresponding variables are taken in the growth form.

Table 1:

Results of the ADF test

ADF in Level		
Variables in Percentage/Growth Form	ADF	Critical Value (5%)
Consumer Price Index	-3.443	-2.878
Imports	-5.106	-2.878
Interest Rate	-4.938	-2.878
Exchange Rate	-4.158	-2.878
Money Supply	-4.149	-2.878
Real GDP	-3.827	-2.878
Government Expenditure	-6.691	-2.878
Lagged Inflation Rate	-3.798	-2.878

Results are obtained by using the OLS technique. All the estimated results are summarized in Table 2. The findings of diagnostic tests in Table 2 show that the residual of the estimated equation satisfies the classical assumption. Moreover, the results indicated that all variables have expected signs. Furthermore, the findings in Table 2 confirm that imports have positively

and significantly contributed to the inflation rate as the estimated coefficient of imports (IMP) is positive and statistically significant. It implies that imports have a substantial influence on inflation. Pakistan mostly imported petroleum products, especially crude oil, etc. Since the last decade, oil prices have been increased globally, which can build inflationary pressure in Pakistan. These results support the hypothesis that for most countries, prices of imported goods put positive pressure on domestic prices. Similarly, the results show that real gross domestic product (GDP) has considerably contributed to inflation as the coefficient [0.134] of real GDP is positive and statistically significant. The findings support the view that the growth in output positively affects the general price level. Additionally, empirical findings in Table 2 show that the coefficient of the money supply is positive [0.083] and statistically significant. It signifies that growth in money supply is positively and substantially associated with the rate of inflation in Pakistan. These findings support the monetarist's hypothesis that inflation largely depends on money growth. Furthermore, the estimated results clarify that interest rate has an adverse and substantial impact on inflation as the coefficient [-0.008] of interest rate is negative and statistically significant. These findings suggest that contractionary monetary policy is the best option to reduce inflation in Pakistan.

Additionally, the empirical findings show that the coefficient of government expenditure has expected signs and highly significant. It implies that government expenditure has positively and noticeably contributed to the inflation rate in Pakistan. Likewise, the findings show that the coefficient of CPI_{t-1} (lagged inflation) is correctly signed with a reasonable magnitude [0.892] and statistically significant. It implies that price expectations (adaptive expectations) have a positive and considerable influence on inflation. Furthermore, the findings indicate that the coefficient of the exchange rate has an unexpected sign but statistically insignificant. To sum up, the results of the OLS technique suggest that imports, real gross domestic products, money supply, government expenditure, and lagged inflation have positively and considerably contributed to inflation in Pakistan.

Table 2:
Results of the OLS (Ordinary Least Squares)

Dependent Variable: CPI			
Variable	Coefficient	t-Statistic	Prob.
C	-0.205	-1.047	0.296
IMP	0.020	1.857	0.065
RGDP	0.134	1.701	0.091
MS	0.083	2.259	0.025
IR	-0.008	-1.825	0.070
ER	-0.041	-1.269	0.205
GEXP	0.019	3.253	0.001
CPI _{t-1}	0.892	29.469	0.000
Goodness of Fit		Model Diagnostics Tests	
R-squared	0.880	LM test	1.161 [0.329]
Adjusted R-squared	0.874	White Heteroscedasticity Test	1.841 [0.152]
Akaike info criterion	-4.898		
F-statistic	174.52		
Prob (F-statistic)	0.000	Durbin-Watson stat	1.586

Note: The values in parentheses [] are the F-statistics probability value of specified tests.

Granger Non-Causality Analysis

To establish a causal relationship between inflation and other concerned variables, this study employed the Granger non-causality tests based on the VAR model. The results in Table 3 suggest bidirectional causality between money supply and inflation, while unidirectional causality holds from government expenditure and imports to inflation, and from inflation to interest rate. In addition, the results suggest that there is no causal link between real GDP and inflation, and exchange rate and inflation in either direction. These results signify that inflation does not depend solely on monetary growth in Pakistan, however, imports and fiscal policy have also a considerable influence on inflation.

Table 3:
Results of Granger Non-Causality test

Equation	Excluded	chi2	Prob	Equation	Excluded	chi2	Prob
CPI	IMP	10.70	0.030	IMP	CPI	6.325	0.176
CPI	MS	12.86	0.011	MS	CPI	21.62	0.000
CPI	RGDP	4.98	0.289	RGDP	CPI	6.179	0.186
CPI	ER	2.56	0.633	ER	CPI	2.92	0.560
CPI	IR	5.72	0.221	IR	CPI	21.32	0.000
CPI	GEXP	10.56	0.032	GEXP	CPI	3.11	0.461

Sample: 1973-Q3 to 2017-Q2 DF=4 include observation= 172
Lag Length is 4 based on Akaike information criterion (AIC)

CONCLUSION

This study seeks to ascertain the effect of various macroeconomic factors on inflation in Pakistan by using ordinary least squares and Granger non-causality tests in the time-series framework from 1973-Q3 to 2017-Q2. Real GDP, government expenditure, imports, exchange rate, lagged inflation rate, money supply, and interest are taken explanatory variables in the specified model, whereas inflation (measured by CPI) is used as a dependent variable. The estimated results, based on OLS, suggested that that real GDP, money supply, imports, government expenditure, and price expectations have a significant and positive impact on inflation (measured by CPI) while interest rate has an adverse impact on inflation. In addition, the findings of the Granger non-causality test showed a bidirectional causality between money supply and inflation. Moreover, the study found a unidirectional causal link from government expenditure and imports to inflation, and from inflation to interest rate. Additionally, the finding suggests that there is no causal link from the exchange rate and real GDP to inflation and vice versa. These results signify that inflation is not only a monetary phenomenon in Pakistan, however, imports and fiscal policy have also a considerable effect on inflation. The study concludes that central authority would not accomplish the stabilize prices through changing the monetary policy until and unless the government will not fix the fiscal deficit.

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Appendix

Table 4:
Detail of Abbreviation and Data Source

Variables	Abbreviation	Data Source
RGDP	Real Gross Domestic Product (Constant price = 2005-06)	Hanif, Iqbal, and Malik (2013)
IR	Interest Rate (Money Market rate)	International Financial Statistics: IMF-Data
CPI	Consumer Price Index (100=2005-06)	
ER	Exchange Rate	
IMP	Total Imports	Hanif, Iqbal, and Malik (2013)
GEXP	Government Expenditure	
MS	Money Supply	State Bank of Pakistan (Handbook of Statistics)