

**P-STAR MODEL: A LEADING INDICATOR
OF INFLATION IN PAKISTAN**

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ABSTRACT

Inflation perform a vital role in formulation of economic Growth rate. The goal of this paper is to outlook the P-Star Model: A leading indicator of Inflation in Pakistan. In this study we show the impact of inflation on Pakistan's economy. As it is a biggest indicator. In this study the selected variables of this study are Inflation (INF), Gross Domestic Product (GDP), Exchange rate (ER), Money Supply (MS), Consumer Price Index (CPI) and Credit (CRDT). Time duration of this research consists on time series annual data from period 1973 to 2014. To check stationary we employed Augmented Dickey Fuller (ADF) and Philips Perron (PP) test. All the variables are stationery at 1st Difference or I(1) then, the suitable technique for the result is Granger Causality test or simply Johnson's Co-integration Test to check causation among variables. It was clearly predicted that rising price is good for economic stability rather than the falling. This study endures a policy allegation for economic experts in Pakistan to implement a abundant policy to check and to control over it.

Keywords: Consumer Price Index, Gross domestic product, Exchange Rate, Inflation, Money Supply

INTRODUCTION

Inflation is actually an endless enlargement in overall worth of goods. It is an increase in the value of commodities and facilities in the economy ended an epoch of interval when universal price level of goods increases than we purchase less of that commodity. In the result, we can say that due to enlargement in price level income, wage and others upset in real term. Internationally its impacts are so longer and bad that the interchange will become expensive.

Economists usually settled that the extraordinary increase in the charges of goods also known as Hyper Inflation. Which was initiated by over plentiful development in money supply? Nowadays, most economists favor a small and stable degree of price increases because inflation is near to the ground. Inflation may shrink the rigourness of

monetary recession via permitting the labor market to regulate extra swiftly and it flux off the danger of trap which indirectly effect the economic growth.

The contract of lowering the price level was a big problem for the financial authorities. Commonly, those ruling classes like Central Bank, controls the magnitude of currency over the place location of concern rate and many more other factors. Inflation causes through many ways. Like, it happens when central authority face budget deficit, when spare currency is supplied, it will booster up the power of buying of some specific groups in the economy. Subsequently, the prices finale increasing at an extreme fast speed.

The major causes of inflation are, it is the nature of humans that their wants are unlimited so they desired more and more, due to this higher demands the deficiencies were formed and suppliers faces unstable business. This situation is called "Demand pull-inflation" in which charges against products were involuntary rising due to higher demand. One more reason of price increases is the increase in the cost of production, which leads to increase the price of final product. For example, if any factor of production price increased, it results in the increase in the price of product. This is called "cost-push-Inflation". Moreover, when the labor demands to increase the wage level, if the firm did so than only money wage increases not real because the price level also rises, this sort of inflation is called "wage-pull Inflation".

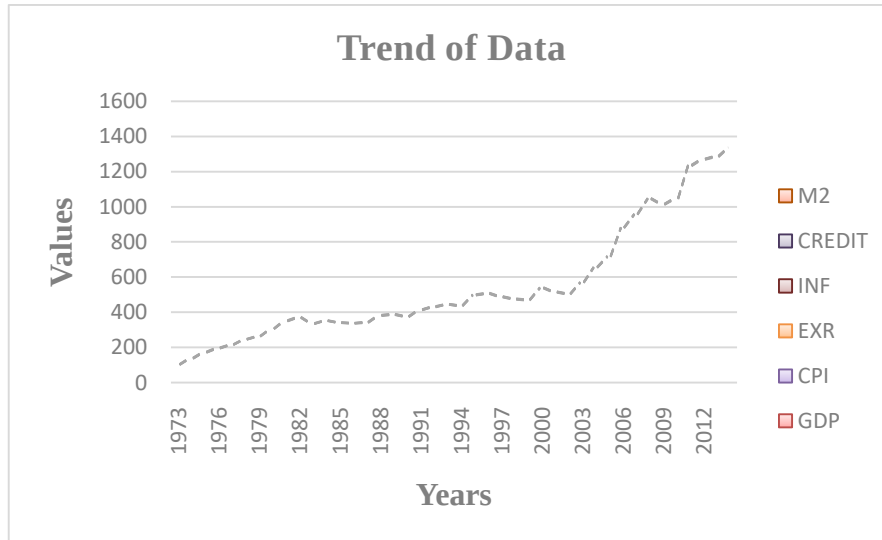
Other measures of inflation are national debts, ('as the nation borrows money they have to deal with high interest rate which causes price level to rise'). A profound droplet of interchange rate can also result in increased Inflation ('as government will have to deal with differences in the import/export level'). It also caused by the taxes put by central authorities.

The greatest and apparent properties of Inflation is the devaluation of money. Individuals Therefore, spending power decreases each month in the economy. The Individuals spends on bonds and other speculative motives to minimize their cost. Finally, it is also caused by unequal distribution of income level. The indicators of Inflation in the economy are different such as CPI (Consumer Price Index) which measures Inflation faced by consumers.

Another is PPI (Producer Price Index) which examines the average change in selling price received by domestic producers of goods & services. The GDP deflator, WPI (Wholesale price Index) and

SPI (Sensitive Price Index) are other indicators which measures the Inflation keeping different things in the view.

FIGURE-1
TREND OF INDEPENDENT AND DEPENDENT VARIABLES



LITERATURE REVIEW

Qayyum and Bilquees (2005) examined P-Star Model a Leading Indicator of Inflation and its Performance in Pakistan. They used P price level, M monetary aggregate income velocity, and Y output as variables and HODRICK-PRESCORT filter approach to calculate equilibrium velocity and output. They used time series data in their study with DICKY-FULLER test statistics. Their research covers period from 1960 to 2003. This paper concluded that the suggested policy was valuable in decision making.

Khan and Schimmelpfennig (2006) worked on P-Star Model a Leading Indicator of Inflation and its Performance in Pakistan. They used time series data in their study with money supply, the interest rate, the exchange rate as variables, and applied DICKY-FULLER test on the data. They used VECM to recognize the short term relationships between the variables and estimated the variables using CPI (consumer price index) their study covers the period from 1998 to 2005 according to them the prevailing situation shows the impact of inflation yearly.

Bukhari and Khan (2008) studied the P-Star Model a Leading Indicator of Inflation and its Performance in Pakistan. Their work covered the period from 1992 to 2007 their used price level P, govt. expenditure and taxes, GD_GD-1, GBg, Mg as variables they used time series data along with technique GARCH (General Auto Regressive Conditional Heteroscedasticity) they used autoregressive distributed lagged model test their study supports the financial supremacy in powerful rise in prices of our own country.

Tufail and Batool worked on P-Star Model: A Leading Indicator of Inflation and its Performance in Pakistan and uses variables as inflation, exchange rate, output and they used time series data and to identify the variables they used WECM (Vector Error Correlation Model) and they used OLS (Ordinary Least Square) technique to estimate variables their work covered the period from 1960 to 2010.

Rehan et.al., (2011) observed P-Star Model; A Leading Indicator of Inflation and its Performance in Pakistan. They used time series data and they used TECH: STAR MODEL to identify the relationships between variables and used OLS to estimate variables their work covered the time period from 1992 to 2011. Chaudhry et.al., (2012) examined P-Star Model: A Leading Indicator of Inflation and its Performance in Pakistan. They used time series data and to estimate the variables. They used JOHANSEN-JUSELIUS technique and to identify the relationship of variables. They used VECM model their work covered the time period from 1972 to 2010.

Moses C.Kiptui (2013) examined P-Star Model: A Leading Indicator of Inflation and its Performance in Pakistan. He used price level P, output Y, velocity of money V, money stock as variables. He used HODRICK-PRESCOTT filter approach for calculation and data source is time series the test statistics he used is DICKY-FULLER test his work covers time period from 1960 to 2011 according to him the exchange rate liberalization of 1993 had significant positive effect on inflation.

Soomro and Memon (2015) studied and worked on P-Star Model: A Leading Indicator of Inflation and its Performance in Pakistan. They used time series data along with methodology OLS (ordinary least square) they used, log of consumer price index no LCPIN, log of budget deficit to GDP ratio LBDGR, log of real gross domestic product LGDPR, log of import price in PKR LIMPP, log of reserve money LRESM as variables their study covered period to 1973

to 2006 their worked showed that decrease in imports and budget deficits can mitigate inflation significantly.

DATA AND METHODOLOGY

DATA

The present study used the annual time series data from period 1973 to 2014. It takes the data of 42 years. We take annual time series data collected by different sources like State Bank Of Pakistan (SBP), World development indicator (WDI) and International Monetary Fund (IMF) etc. This data is collected to analyze our study and specially to achieve our goals. First of all we should explain the nature and source of data.

TABLE- 1
NATURE AND SOURCES OF DATA

Variables	Description of Variables	Sources
GDP	Gross domestic product	IMF
CPI	Consumer price Index	SBP
EXR	Exchange rate	SBP
INF	Inflation	SBP
CREDIT	Domestic credit to private sector	IMF
M2	Money Supply	IMF

Source: Researcher's calculation from MS WORD

MODEL

Our present data study has a model which is as:

$$\text{GDP} = \beta_0(\text{CPI}) + \beta_1(\text{EXR}) + \beta_2(\text{INF}) + \beta_3(\text{CREDIT}) + \beta_4(\text{M2}) + \varepsilon$$

Where GDP is a dependent variable and CPI, EXR, INF, CREDIT and M2 are dependent variables.

DESCRIPTION OF VARIABLES

There are specific variables that effects Gross domestic product such as consumer price index, inflation, exchange rate and money supply.

GROSS DOMESTIC PRODUCT

The notion GDP shows the all final goods & services production in an entity over the period of time say 1 year. Per capita GDP is the good indicator of the growth of an economy. Through this we should

have to calculate the overall stability of the economy. It is calculated as: $GDP = C + I + G + (X - M)$

EXCHANGE RATE

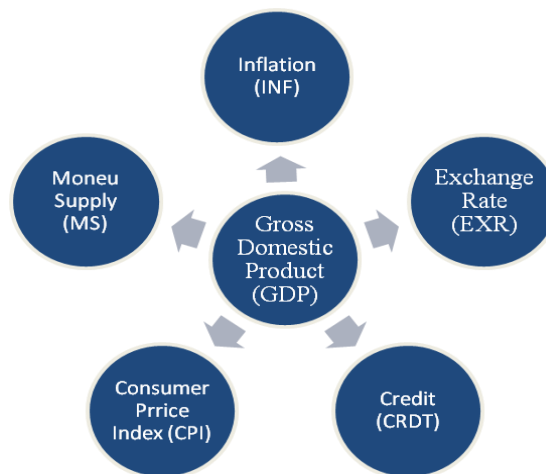
EXR means the price of currency of a country which can be exchange with the currency of another country. It explain the difference between the currency of country that any one must pay attention that how much money you have before exchange and what I the value after exchanging.

INFLATION

The notion Inflation shows continuous increase in price level (general) in an economy over the specified time period. The measure of inflation is the source by Inflation rate with annual percentage.it is the main variable which determine the economic stability.

MONEY SUPPLY

Money supply includes currency circulation and demand deposit (M1) plus saving and time deposit and also used to forecasting the inflation.



ISSUES REGARDING STATIONARY

If given data set is time variant then it means that their variance is may vary with amendment (change) in time. Situation like that is referred as UNIT ROOT. Because of this examined variables become non-stationar. In order to resolve this difficulty researcher usually examine some statistical tests on their data set to make sure that the

ADF, DF, PP etc.

CO-INTEGRATION TEST

The Co-integration test concept was firstly developed by 'GRANGER' (1981) and then examined by several other Economists. It is a test examined when OLS (ordinary least square) is not possible to examine. In simple words we say that if all examined variables are stationary at I(1).

VECTOR ERROR CORRECTION MODEL

This test is examined to find out the short run associations. It is the easiest way to check the short run association among the selected variables.

EMPIRICAL ANALYSIS

This study used the Granger causality test with the specification of 2 lags. Then arranges the H_0 that refers CPI does not Granger Causality GDP and H_1 that refers CPI does Granger Causality with GDP. If the f-statistics value is higher than 2 and Probability value is less than 0.05 than we accept H_0 but if it does not fulfills than we accept H_1 . If the first variable cause to second variable but second variable does not cause to first variable the

DESCRIPTIVE ANALYSIS

TABLE- 2
SELECTED VARIABLES ANALYSIS

Variables	Mean	Min	Max	Std.dev	Skewness	Kurtosis	Jarque-Bera	Pro
GDP	543.3285	100.2960	1334.147	334.9443	1.076384	3.064845	8.117581	0.017270
CPI	1.399962	0.593306	2.151377	0.429168	0.018740	1.958287	1.901499	0.386451
EXR	1.461240	0.995635	2.007017	0.353427	-0.00822	1.546356	3.698364	0.157366
INF	0.963184	0.391481	1.405463	0.228833	-0.04000	2.999241	0.011206	0.994413
CREDIT	1.373225	1.187521	1.474013	0.065871	-1.06908	4.042111	9.901159	0.007079
M2	1.624236	1.527216	1.691846	0.037647	-0.16169	2.587912	0.480184	0.786556

Source: Author's calculation from Eview's 7.0

The analytic descriptive table characterizes the summary of all examined variables. Average value of GDP is 543.3285. GDP is skewed positively and the kurtosis value of GDP clarifies that it's leptokurtic because it is higher than three and the Jarque - Bera value exhibits that GDP is normal distributed. CPI is positively skewed and

platykurtic. It is normally distributed. EXR is also negatively skewed with respect to GDP as dependent variable.

INF is also negatively skewed and its kurtosis value shows that it is platykurtic. Jarque-Bera value shows that it's normal distribution. The kurtosis CREDIT value indicates that it's leptokurtic because it's bigger than three (3) and the Jarque-Bera value indicates that it's distributed normally. M2 skewed negatively and its kurtosis value is lower than 3 so it is mesokurtic.

CORRELATION MATRIX

TABLE-3
CORRELATION AMONG VARIABLES

	GDP	CPI	EXR	INF	CREDIT	M2
GDP	1					
CPI	0.918416	1				
EXR	0.871214	0.983406	1			
INF	0.028506	-0.071600	-0.048499	1		
CREDIT	-0.443273	-0.300940	-0.275173	-0.219638	1	
M2	0.076813	0.256077	0.283812	-0.380442	0.589142	1

Source: Researcher's calculation from Eview's 7.0

INTERPRETATION

In this model, we present is the correlation matrix for Gross domestic product, domestic credit provided to private sector, money supply, inflation, exchange rate and CPI. The result of correlation is testified in above table. The correlation matrix displays that here is positive correlation between CPI and GDP. Which is 0.918416 means strong association. There is weak and negative relationship between GDP and CREDIT is -0.443273.

STATIONARITY OF VARIABLES

To check the stationarity of variables we employ ADF and PP test. Both are used to check that there exist unit root or not. ADF test is the extension of DF test presented by Dickey and Fuller. According to this we check our variables one by one on level I(0), 1st difference I(1) and 2nd difference I(2). But we only take I(0) and I(1) results and ignores the I(2). The values are checked with intercept, trend & intercept and none at 1%, 5% and 10% level of significance. The results shown in the given table.

TABLE-4
RESULT OF ADF TEST

Variables	Level			1 st difference			Conclusion
	Intercept	T&I	None	Intercept	T&I	None	
GDP	-	-	-	-4.85*	-5.30*	-3.76*	I(1)
CPI	-	-	-	-4.67*	-4.54*	-2.44*	I(1)
EXR	-	-	-	-4.36*	-4.27*	-2.74*	I(1)
INF	-	-	-	-7.42*	-7.38*	-7.46*	I(1)
CREDIT	-	-	-	-5.90*	-6.28*	-5.96*	I(1)
M2	-	-	-	-6.78*	-6.71*	-6.88*	I(1)

Note: (*shows stationary at 1%, ** shows stationary at 5%, *** shows stationary at 10% significance level)

TABLE-5
RESULT OF PP TEST

Variables	Level			1 st difference			Conclusion
	Intercept	T&I	None	Intercept	T&I	None	
GDP	-	-	-	-4.82*	-5.36*	-3.73*	I(1)
CPI	-	-	-	-4.67*	-4.55*	-2.44*	I(1)
EXR	-	-	-	-4.36*	-4.27*	-2.63*	I(1)
INF	-	-	-	-10.14*	-10.1*	-10.2*	I(1)
CREDIT	-	-	-	-5.9*	-6.28*	-5.96*	I(1)
M2	-	-	-	-8.24*	-11.8*	-8.34*	I(1)

Note: (* shows stationary at 1%, ** shows stationary at 5%, *** shows stationary at 10% level of significance)

Unit root test explained in above table. According to the Null hypothesis, data set contains unit root as it's Non-stationar data. In above displayed table, the value of I(0) exhibits that variable is stationar at Level. While the term I(1) exhibits that variable is stationar at 1st difference. A comparison is supposed via comparing approximated value with critical value in 'ADF' and 'PP' test. A variable's stationary might be examined when estimated value is lower than the value tabulated. The above table concluded that all the variables are stationar at First Difference.

TABLE-6
CO-INTEGRATION ANALYSIS

Hypothesized No. of CE (S)	Eigen value	Trace Statistics	0.05 Critical value	Prob.**
None*	0.85	155.73	83.94	0.000
At most 1*	0.62	80.21	60.06	0.000
At most 2*	0.45	41.65	40.17	0.03
At most 3	0.27	18.44	24.28	0.22
At most 4	0.14	6.07	12.32	0.42
At most 5	0.00	0.08	4.13	0.81

(*) shows that variables are at the 5 % level of significance

TABLE- 7
MAXIMUM EIGEN VALUES

(*) shows that variables are at the 5% significance level

Hypothesized No. of CE (S)	Eigen value	Max Eigen Statistic	0.05 Critical value	Prob.**
None*	0.85	74.25	40.07	0.000
At most 1*	0.60	35.93	33.87	0.02
At most 2*	0.53	29.34	27.58	0.02
At most 3	0.41	20.84	21.13	0.05
At most 4	0.14	6.08	14.23	0.16
At most 5	0.00	0.28	3.84	0.59

Co-integration results shows that there are three possible equations for our analysis and our variables are significant at 5% level of significance, it is shown by* values. And finally the estimates suggested that there exist a long run association among variables.

CONCLUSION

This study based on the study regarding inflation. The primal objective of this research was to highlight the inflation impact on growth of the economy. As we know that prices are an important factor in stabilizing the economy. For that purpose we use some variables as discussed in the literature. These variables will determine the impact of inflation on overall growth of country's well being. To prove this empirically we used annual time series data from 1973 to 2014.

And the variables used for this purpose are GDP, INF, EXR, CPI, CREDIT & M2. In this list the GDP is taken as regress and while all others as predictors according to them. This study highlights that all the variables are stationary at first difference. To check stationarity we employ the ADF and PP test. The results are discussed earlier. Now the suitable technique which we have to use was Granger Causality test.

The results of this study show that variables are co-integrated. CRDT, EXR and M2 have negative impact on the dependent variable while others have positive impact. Whenever any change occurs in the regressors some of them directly while some indirectly affect the regress and. This study concludes that the policy makers should adopt the neutral policy to control the inflation and to stabilize the economy.

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