The Long Run Determinants of Inflation in India: A Co integration Approach

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Abstract

Inflation is considered as the regressive taxation against the poor. The most visible effect of inflation is on relative prices, real output, taxation, exchange rate, relative income and interest rates. This paper aims to analyze demand side and supply side long run determinants of inflation in India by employing johansen – juselius co integration methodology using annual data for the period from 1970-2012. The findings of the study suggests that in the long run inflation has found directly influenced by money supply, government expenditure and exchange rate. On the other hand gross domestic product and government revenue is negatively influence the inflation rate in India. The Long run elasticities of inflation with respect to Gross domestic product, broad money supply, government expenditure, government revenue and exchange rate are 0.78, -1.249, -1.653, 2.40, and -0.35 respectively.

KEYWORDS:- Inflation, Johansen co integration technique, Money supply, long run elasticities, GDP, exchange rate.

Introduction

Inflation is one of the most debated topics in current affairs owing to its direct impression on the monetary policies of the countries and day to day life of common man. In economical term, inflation is known as sustaining increase in price of various utility goods and services over a particular span of time. With increase in inflation, the value of currency unit decreases remarkably which implies less good and services can be purchased with specific amount of money. From the economics perspective, the inflation rate directly influence the GDP, relative prices, exchange rate, export, import, money supply, interest rates, fiscal deficit etc.

Increase in aggregate demand or decrease in aggregate supply may result in rise in general price level. An inflation generating from rise in aggregate demand is called demand pull inflation. Demand pull inflation arises due to many factors like excessive monetary growth, increase in net export, increase in government expenditure etc. cost push inflation can be defined as the persistently rising in general price level brought about by rising input costs. Cost push inflation arises because of higher import prices, budget deficit, increases wages, rising taxes etc.

Review of Literature

Shams, parveen and Ramzan (2013) investigates the long run relationship between inflation and fiscal determinants of inflation in Pakistan by employing Johansen co integration approach for the period from 1975-2008. In their study they found the long run relationship between macro economic variables local credit, GDP, Exchange rate, and inflation and concluded that local credit and exchange rate have positive relation with inflation in long run where as GDP have negative relationship with inflation.

Arif and Ali (2012) have shed light on the determinants of inflation in Bangladesh by using data for the period 1978 to 2010. The study employed johansen-juselius co integration methodology and found existence of long run relationship between inflation and its determinants namely, GDP, Government expenditure, government revenue, export, import and money supply. This study concludes that government expenditure and money supply are the most important long run determinants of inflation in Bangladesh.

Kumar (2013) examines the inflation dynamics after following new economic policy in Indian economy by employing Restricted Vector Autoregressive technique and found that inflation variables has co-integrating relationship with other macro economic variables with money supply turned out to be most important variable in explaining the variation in inflation overtime followed by import index variable.

Srinivasan et. al. (2006) estimated an augmented Phillips curve to examine the effect of supply shock on inflation in India by employing ordinary least square framework. The study found that supply shock have only a transitory effect on both headline inflation and core inflation. Moreover, the study concludes that monetary policy in India is more focused towards the core inflation.

Sahaduden I (2012) studied the determinants of inflation in India by employing the co integration and vector error correction model for the period from 1996Q1 to 2009Q3. The study concluded that GDP and broad money have positive effects on inflation and exchange rate and interest rate negatively influence the inflation rate.

Data, Model and Methodological framework

Data

Annual data from 1971 to 2013 is used to investigate the relationship between inflation and its long run sources. The data of all variables have been collected from Handbook of statistics on Indian Economy from the Reserve Bank of India.

Econometric Model of Sources of Inflation

This paper focuses the long run determinants of inflation and form Econometrics model as-

$$Log(INF_t) = \alpha + \beta_1 Log(BM_t) + \beta_2 Log(GDP_t) + \beta_3 Log(GE_t) + \beta_4 Log(GR) + \beta_5 Log(EX_t) + \varepsilon_t$$

Dependent Variable

Log(INF)= Log of whole sale price index(base year 2004-05)

Explanatory Variables

Log(BM)= Log of broad money.

Log(GDP)= Log of Gross Domestic Product (base year 2004-05).

Log(GE)= Log of government Expenditure.

Log(GR)= Log of government revenue.

Log(EX)= Log of exchange rate.

α = intercept term.

$\beta's$ = slope coefficients

ε = error term.

Log model has been employed to have elasticities of prices with respect to money supply, GDP, government expenditure, government revenue and exchange rate.

Methodological Discussion

Stationarity Test

An analysis of the time series properties of variables used in the macroeconomic research is particularly important when examining the casual relationship between variables that exhibit a common trend (Clive W.J. Granger 1986; Robert Engle and Clive granger 1987; SorenJohansen(1991). Our initial step would be to check the order of variables used in this study by conducting stationarity or unit root test. The Phillips –perron test is employed for this purpose. Unit root test is the first step in this study because it is prerequisite for co integration test.

Co integration Test

In order to have a valid inflation function, there must be at least one co integrating equation in the system. Co-integration test is used to find if there exist stable long run relationship between inflation and its determinants, and therefore predictable over long period. For this we employ the (johansen, 1991, 1995) multivariate co integration technique. The johansen co integration a VAR based test.

Test Results

The empirical results of the test are encouraging. They are discussed as below. Before conducting tests for co integration , the stationarity properties of the variables have been checked by using Phillips-Perron unit root test. To determine the order of integration of time series, unit root test is applied on level as well as on first difference. The table-2 shows the results of Phillips-perron unit root test.

Table 1 Phillips- perron test results for unit

Variables	At Level		First Difference	
	With intercept but no trend	With intercept and trend	With intercept but no trend	With intercept and trend
Log(INF)	-2.30(p=0.1758)	-1.88(P=0.6457)	-4.40^*(p=0.00)	-4.46^*(p=0.00)
Log(BM)	-0.4129 (p=0.89)	-2.763(p=0.2183)	-5.55^*(p=0.00)	-5.50^*(p=0.00)
Log(GDP)	-1.93 (p=0.15)	-1.50 (p=0.81)	-6.43^*(p=0.00)	-9.38^*(p=0.00)
Log(GE)	1.080(p=0.71)	-1.78(p=0.69)	-5.76^*(p=0.00)	-5.83^*(p=0.00)
Log(GR)	-1.79(p=0.37)	-2.32(p=0.41)	-7.00 (p=0.00)	-7.55 (p=0.00)
Log(EX)	-0.55(p=0.86)	-1.46(0.82)	-4.38^*(p=0.001)	-4.63^* (p=0.007)

Note: - * shows the coefficient is significantly different from zero at 0.05 probability level
The Phillips perrorn statistic are -2.888932 and -3.452764 for models 'with Intercept but no Trend', and 'with Intercept &Trend' respectively at 0.05 probability level.

The Phillips perrorn unit root test results showed that all six series were non-stationary at levels for both models after first difference all the series were stationary with both models.

Lag Length Selection Process

Second step of Johansen Co-integration technique involves the selection of appropriate lag length using proper information criterions. The author used Akaike information criterion. Favorable lag length that is selected in current analysis is assumed to be 3 at which the values of information criterions are minimum.

No. of Co-integrated Vectors

Given that all the variables are non stationary at their level but stationary at their first difference, we proceeds to examine whether there exist any long run equilibrium relationship among these variables. The trace statistics reveals that there exist five co-integration vector and Max-eigenvalue test indicates two cointegration vector at the 0.05 level between Log(INF) and its determinants. The results shows in table 2.

Table 2: *Results of Cointegration Test.*

	Based on Maximal Eigenvalue Statistic			Based on Trace value statistic		
Null	Eigenvalue	Eigen Statistic	95% critical value	90% critical value	Trace statistic	95% critical value	90% critical value
None	0.9342	103.40*	40.95	38.15	225.61*	103.84	99.01
At most one	0.7709	56.012*	34.80	32.16	122.20*	76.97	72.77

At most two	0.4500	22.724	28.58	26.12	66.19*	54.07	50.52
At most three	0.4245	20.995	22.29	20.05	43.46*	35.19	32.26
At most four	0.3264	15.015	15.89	13.90	22.47*	20.26	17.98
At most five	0.1781	7.457	9.16	7.55	7.45	9.16	7.55

*Indicates that the coefficient is significantly different from zero at 0.05 probability level.

The long run-relationship identified by Johansen co-integration technique depicted Inflation function as obtained in below equation.

$$Log(INF_t) = 5.36 + 1.2457 Log(BM_t) - 0.785 Log(GDP_t) + 1.65 Log(GE_t) - 2.40 Log(GR) + 0.35 Log(EX_t$$

$$(0.41) \quad (0.085) \quad\quad (0.061) \quad\quad (0.211) \quad\quad (0.288) \quad (0.028)$$

The results reveal that money supply is found to be directly related to the price level in case of India. The coefficient having positive sign and is significant at 5 percent level of significance suggesting that 1 percent increase in money supply leads to 1.2457 percent increase in inflation on the average in the long run. Price elasticity with respect to broad money or money supply is 1.2457. The result is according to macroeconomic phenomenon of classical economists given in quantity theory of money as increase in money supply leads to higher price levels. Due to higher money supply, more funds will be available to invest in the economy, investment will be taken place, more employment will be generated, aggregate demand will increase, and finally there will be increase in inflation. It affects price level through demand side.

Gross domestic product is influence inflation at 5 percent level of significance implying that inflation will decrease by 0.785 percent due to 1 percent increase in gross domestic product on the average in the long run. The Price elasticity with respect to gross domestic product is 0.785. The rationale may be that rise in real Gross domestic product results in more supply of goods and services in the economy that results in fall in the prices. Therefore gross domestic product influences inflation through supply side.

Government expenditures are tended to raise inflation in India. This variable is significant at 5 percent level of significant with positive coefficient value. On the average in the long run, it proposes 1.65 percent enhancement in inflation due to one more percent increase in government expenditures. Elasticity of Price with respect to government expenditure is 1.65. Government expenditures also affects through demand side, as due to more expenditure, aggregate demand of goods and services will increase and it would lead to higher prices overall in the economy.

With regards to government revenue, it is having inverse effects on inflation. The sign of coefficient is negative and significant at 5 percent level of significance as well. One

percent rise in tax collection would be cause of 2.40 percent lower price level in the long run on the average. Price elasticity with respect to government revenues is -2.40. It may be interpreted as due to one more percent increase in tax collection of government, the disposable income will decrease, due to lower income available to purchase goods and services, demand of goods and services will decline, and it will eventually lead to surplus supply and hence lower inflation. It has influence on inflation through supply side.

In the same manner, the study also includes exchange rate. As expected, it gives positive impression on inflation. If exchange rate will be raised by 1 percent, price level will increase by 0.35 percent on the average in the long run. Price elasticity with respect to exchange rate is 0.35. This may be justified as due to depreciation of domestic currency results in increases in export and decrease in import. As a result there is increase in net export. This increase in net export due to increase in exchange rate results in higher aggregate demand and it would lead to higher prices overall in the economy.

Conclusion

In this paper, we have examined the long run determinants of inflation in India by means of co integration methods using annual data for a period of 43 years. The results of the analysis reveal that in the long run money supply, government expenditures and exchange rate are contributed in raising inflation while inflation index is bound to decrease due to higher government revenues, and gross domestic product. The government expenditure coefficient is 1.65 and the money supply coefficient is 1.24, implying a one percent increase in government expenditure and one percent increase in money supply trigger 1.65% and 1.24% increase in inflation respectively. On the basis of the findings of the study, it does conclude that inflation in India is triggered by both demand side factors as well as supply side factors but government expenditure and money supply are critical. The policy implication is that in India to lessen inflation momentum the government will have to pursue a monetary and fiscal policy which matches with the actual scenario of real sectors and monetary sectors.

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