**Impact of Inflation and Interest Rate on Growth of Indian Economy:**

**A Study in Input- Output Framework**

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**Introduction**

The year on year growth of Indian economy has been constrained by high inflationary pressures since 2006-07, when agricultural output suffered a setback due to scanty rainfall. Incidentally, this is not the first time that the Indian economy has been straddled with the high inflationary pressures. At one time, Indian economy experienced even as high as 17% inflation and very high incidence of fiscal deficits. After the adoption of New Economic Policy, several reform measures were taken to address these twin problems. However, it is notable that inflation in India is not simply a monetary or fiscal phenomenon. India has been experiencing periodic bouts of inflationary pressures in the course of agricultural cycles.

Several steps have been taken by the government during the course of the latest phase of inflation in the economy to bring inflation under control. But money supply, including credit creation by banks, has been the major instrument for mitigating inflationary pressures in the Indian economy.RBI has increased CRR, Repo Rate and/or interest rates by 25 to 50 points basis. But these measures have not succeeded in mopping up excessive liquidity in the economy. Interestingly, the policy measures initiated by the government during the subsequent period are counter-productive, as such measures tend to neutralise the impact of policies implemented by RBI. Oil prices have been raised more than once which adds both directly and indirectly to prevailing inflationary pressures. Besides, indirect tax rates have been raised almost across the board substantially which escalates inflation. Railway freights and fares have also been raise in the recent railway budget. On the top of it, non-productive public expenditure has also been raised substantially. Thus, even if money supply could have been reduced by measures taken by RBI, these measures stand no chance of success. A careful evaluation of all the policies in the envelope indicates their paradoxical design. Has money supply declined, stagnant or?

RBI measures have made credit costlier than before, though the credit creation base of commercial banks has been reduced. Besides, demand pull inflation has also been transformed into cost push inflation to which interest cost push has also contributed its share. This has not contributed to contain demand pull inflation as agricultural prices did not rise due to rise in demand; these price rises were caused by supply falling short of demand. The government could have influenced the supply a great deal by releasing public stocks not only for public distribution but also to the market just as the government procures food-grains from the market. This was not the case.

Interestingly, Philips formulated the curve of positive relation between inflation and employment and rise in employment *ipso facto* accelerates growth. Actually, neither employment has increased nor growth has been accelerated despite high inflationary pressures as against the stipulation of Philips hypothesis. A look at employment in Indian economy does not lend strong support to the Philips hypothesis, since employment has either remained almost constant, or it has increased marginally and much less than what is warranted by the growth of GDP.

Year 2004 2005 2006 2007 2008

Employment 264.43 264.58 269.93 272.76 275.49

Employment remained almost constant from 2004 to 2005, while in three subsequent years employment increased marginally. These changes in employment are in contradistinction to each other even if marginal increase in employment is accepted as real increase. Thus, two interesting inferences may tentatively be drawn from this limited evidence: (i) Economic growth-less growth of employment; and (ii) employment-less growth of GDP. But as against the policy objectives of constraining inflation and promoting growth, investment has declined and growth has marginally decelerated in current prices since 2007-08 under the given policy regime, while the growth rate has declined from 9.7 in 2006-07 to 6.8 in 2008-09 in constant prices, which is a substantial decline..This compares very poorly with 16..4% growth in current prices in 2007-08. The difference of 8.4 percentage points between these two growth rates displays at least partly the impact of inflation on growth.

Process of growth operates through multiplier effect of consumption and accelerator effect of investment. The inflationary pressures, emanating from food-grain prices do not constrain consumption of food, which tends to be stable due to price inelasticity of its demand,though monetary expenditure on food rises due to inflation. This leaves less purchasing power in the hands of consumers for purchasing fix-price goods, leading to a decline in their demand. Thus, the demand for manufactured goods may be constrained from two directions: demand pull inflation effect through lower purchasing power being left in the hands of the consumers, and cost push driven inflation leading to the rise in prices of fix-price goods. Transformation of demand pull into coat push inflation raises prices in fix-price markets, leading to further squeezing of demand for fix-price goods. This dissipates multiplier effect on growth.

Inflation directly affects the disposable income of households, which, in turn, adversely affects savings/investment. In fact, savings have declined from 36.7% in 2006 to 33.6% of GDP in 2009. Inflation induced reduction in disposable income does not leave households with the same surplus income to save..Though higher interest rate is expected to stimulate savings through attracting more deposits, but lower savings leave households with less for deposits, but increased cost of credit discourages investment in multiple ways, including inflationary expectations and decline in real interest rate despite rise in monetary interest rate. Incidentally, interest on deposits in India unlike European countries, are not adjusted for inflation. In certain cases, smaller depositor earn even negative interest (Prakash, S., 2007 IMS journal)

This paper attempts to examine the inter-relations between interest rate hikes, inflation and growth in Indian economy in an input output framework, though the results derived from I-O model are supplemented by econometric models. Inter-relation between inflation, employment and growth may also be examined even though it is not among the important objectives of the study.

**Objectives**

1. The main objective is to determine the degree and direction of inter relations between inflation, interest rate and growth of total and sectoral output in the Indian economy.

It may be noted that inter relations among the above variables are postulated to be bi-directional and sequential rather than simultaneous;

1. Since, Interest rate is a policy variable,interest rate is treated as an administered price. The changes in interest rate emerge as a consequence of change in policy. RBI announces policy twice a year each for peak and offseason of the year. The main objective is to examine direct and indirect impact of change in Interest rate on Inflation and growth;
2. The nature, magnitude and direction of inter-relations between inflation, employment and growth of output will also be examined.

**Sources of data**

1. Econometric modelling part of the study uses 21 year time series data. These data are taken from Economic Survey- Annual Publications of Ministry of Finance, Government of India, RBI’s website, and National Income Accounts of CSO. Input Output tables are taken from the web site of CSO. Since the Inverse of the IO table of 2006-07 is not available on CSO’s website, we ourselves inverted the matrix. The Leontief Inverse of 2003-04 is taken from CSO’s website.

**Methods and Models**

We have not relied upon any one single method or model. But the models and methods used are complementary rather than substitutes. The models and methods used in the study are briefly described hereunder.

**Test of Stationary Nature of Time Series**

One problem with time series data is probable non-stationary nature of the series. In order to preclude this probability, we used multiple sets of models and methods. Stability of the mean and variance of the series is the crudest test of non-stationary nature of the time series. Two factors ANOVA without Replication is used for the evaluation of statistical significance of the variances of the paired time series as well as three series taken together.

This is followed up by the evaluation of three versions of Random Walk Model:

∆Yt = δ Yt-1 +Ut

=(ρ-1)Yt-1 +Ut  (1)

where Y depicts the variable under consideration, ∆ shows change, ρ is the root of the equation 1, U displays random errors, and t is time.

∆Yt = β0 +δ Yt-1 +Ut (2)

∆Yt = β0 +δ Yt-1+β1T +Ut (3)

T is time in equation 3. (ρ-1= δ. If ρ<1, the series is stationary according to Dickey-Fuller test of root. The Dickey-Fuller test is further supplemented by Engel-Granger test of the first order differences of the random errors of the chosen regression model of the variables.

If the variance of each error, Ut , differs from the variance of other errors, estimate OLS becomes unreliable as the problem of heteroskedasticity emerges. Results of ANOVA will be a rough indicator of the probability of the presence of this problem. So, ANOVA may also serve this purpose.

**Regression Functions of Core Variables**

**Inflation, interest rate and investment are the key variables of the study. Inflation rate is also considered in its two component** parts: demand pull, represented by agricultural prices in India and cost push, which is embodied in prices of manufactured goods. Both step wise and multiple regression models have been used. As per Klein’s criterion, the pattern and magnitude of multi-collinearity in a multiple regression function can be detected easily by the step wise regression analysis.

**Inter-Relation between Core Variables**

The following models are used to evaluate the relationship between the demand pull and cost push inflation and inflation and interest rate:

**WPIt= a + bWPIc-1 + Ut  (4)**

**INTt =α0 + α1 WPIt + Ut  (5)**

**Relations between Investment, Interest Rate and Inflation**

**System of Sequential Regression Models**

A multiple regression function is used to evaluate the impact of inflation and interest rate on investment. Two Stage Least Squares is used to estimate the investment function under the conditions of rising inflation and interest rate. .Regression model is also used to estimate the impact of inflation on savings/investment.

The relations, postulated in the study, between investment, interest rate and inflation are outlined hereunder

**INVSTt =β0+ β1 INTt +Ut …… (6)**

**INVSTt =γ0+ γ1 INTt + γ2 WPIt +Ut (7)**

**INVSTt =ε0+ ε1 INTt^ + ε2 WPIt +Ut  (8)**

INT depicts interest rate, INVST shows investment, WHI displays wholesale price index, WHIa and WHIc are agricultural and manufactures’ price indices respectively, t is time, and ^ stands for estimated value of INT from equation 4.

All the models, except 8, listed above, are estimated by OLS. Equation 8 is estimated by two stage least squares.

**Input Output Model**s

Two input output models are used in this study for determining the output effect of investment.. The conventional input output model of prices treats all prices as fix, and hence, it is assumed that the long term equilibrium prices are determined by the long run cost of production as shown in the following model:

P=WL(I-A-rB)-1 (9)

We have modified this model in order to introduce the differential character of flex and fix prices in the model. It is assumed that flex prices are exogenously determined outside the IO model but these prices enter into the system as determinants of fix prices. Therefore, the fix-prices in the economy are determined as shown by model equation 10:

Pmt = [WtL (I – Am- rtAms)-1]+{( Pat (Aa + rtAas) \* (I- Am- rtAms)-1}..........(10)

In equation 10, Pmt denotes prices of manufactured goods(fix-prices) at time t, W is uniform wage rate, L is row vector of labour coefficients, I is an identity matrix, Am and Ams are matrices of flow and stock inputs of fix-price goods used in the production of fix-price goods, r is uniform interest rate,, Pat is the vector of flex price goods, Aa and Aas are matrices of flow and stock input coefficients of flex price goods used in the production of fix price goods, subscript s refers to stock inputs in the matrix. At this stage of the investigation, the equation 10 is transformed into macro regression equation of whole sale prices of manufactured goods as a function of whole sale agricultural prices of agricultural goods. This represents the transformation of demand pull into cost push inflation in the economy.

**In the later stage of the study, input output model shall be used. There is data problem at this time, which we are not able to tackle due to insufficient information about the two sets of prices of individual goods.**

**I-O Model of Output Effect of Investment**

Input-output model is used to determine the effect of interest rate and inflation induced investment on the output of different sectors of the Indian economy. This output vector will be denoted by X^1. Another solution vector of gross output, X1 is estimated from the observed sector wise investment in the economy. Estimate of total investment, derived from regression model, is used as the base of determining the final demand for IO model. Total investment, estimated from regression model, is distributed among the 130 sectors of the economy on the principle of proportionality. The column of IO table containing investment component of final demand of different sectors is used for distributing estimated investment into sectors on the principle of proportionality. Thus, gross output vector, X^1 is determined from this estimated investment vector of final demand, while the other gross output vector, X1 is determined from the actual investment reported in the IO table. The main difference between these two gross output vectors is that the output vectorX^1 reflects the impact of only interest rate induced investment, while the other gross output vector X1carries the influence of all relevant determinants of investment in the economy. The difference between these two gross output vectors depicts output net of the impact of interest rate on investment. The output vector X^1 represents the overall output effect of interest rate induced investment under the conditions of inflation. The subscript 1 represents the year 2006-07 for which we have the latest input output matrix.

The IO model has two versions, which are outlined below:

X1= (I-A)-1f (11)

and

X1\*= (I-A)-1f\*  (12)

In the above models, X is gross output vector, (I-A)-1 is Leontief inverse, **f is observed final demand vector with investment as the only non zero elements**, and **f\* is final demand vector having estimates of investment from the multiple regression function.**

Input-output model 12 is used to determine the **effect of interest rate induced investment** on the **output of different sectors of the Indian economy**, whereas the model 11 shows the influence of investment which embodies the impact of all determinants of investment in the economy. Obviously, these models abstract from the output effect of private and government consumption expenditure, and the foreign trade. Therefore, output effect, captured by models 11 and 12, are independent of components of growth due to multiplier and trade effects.

The sector wise differences of two solution vectors of gross output X and X\* alsoindicate the output effect of investment independent of all determinants of investment except interest rate and inflation. X embodies the influences of all determinants of investment in the economy, including interest rate and inflation.

Estimate of total investment, derived from multiple regression model 8, is used as the base of determining the final demand vector, f\* of IO model 12. Total investment, estimated from the regression model 8, is distributed among the 130 sectors of the economy on the principle of proportionality. The column of IO table, containing observed investment component of final demand of different sectors is used for distributing estimated investment into sectors according to the shares of sectors in the total observed investment in the economy. Thus, estimate of gross output vector, X\*^embodies the impact of interest rate on the sector wise gross output of the economy. The main difference between these two gross output vectors is that the output vector X1\*^reflects the impact of interest rate on output through induced investment, while the other gross output vector, X1 carries the influence of all relevant determinants of investment. The difference between these two gross output vectors depicts output net of the impact of interest rate on investment.

The output vector, X1\*represents the overall output effect of interest rate under the conditions of inflation. The subscript 1 represents the year 2006-07 for which we have the latest input output matrix. Output vectors

X2 and X2\* are determined similarly on the basis of input output table of 2003-04.

A similar exercise is performed for 2003-04 under different set of inflationary conditions. Two output vectors for this year are represented by X2 andX^2.

Leontief Inverse of I-O tables of 2003-04 and 2006-07 are used as one of the data bases.

**Empirical Analysis**

The results of two factors ANOVA are discussed first to highlight the Inter-temporal and intra-temporal variability of Investment and Inflation.

**Investment and Inflation**

The following table shows the results of ANOVA of investment and inflation.

**Two Factors ANOVA without Replication of Inflation and Investment:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **WPI and Investment** | |  |  |  |  |  |
| ANOVA |  |  |  |  |  |  |
| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
| Rows | 1.83E+10 | 20 | 9.13E+08 | 1.004746 | 0.495829 | 2.124155 |
| Columns | 6.87E+10 | 1 | 6.87E+10 | 75.67296 | 3.12E-08 | 4.351243 |
| Error | 1.82E+10 | 20 | 9.08E+08 |  |  |  |
|  |  |  |  |  |  |  |
| Total | 1.05E+11 | 41 |  |  |  |  |

The results highlight an interesting feature of the temporal movements in inflation and investment. The variation of investment and inflation, taken together, is not statistically significant. It suggests that these two series changed together over the years. Though their joint variation is not significant, yet each series may individually show significant variation between the years. This indicates possible interrelation between these two variables. However, the variation of inflation differs significantly from the variation of interest rate during the entire period, taken as a whole.

Thus, inter-temporal variation does not appear to suggest that these time series data are non stationary. The results may also reflect the constancy of error variances.If, however, we consider the variances of the two individual’ series over the entire period, then it is inferred that the difference of the variance of inflation and the variance of Investment separately is highly significant statistically. It is probable that the significant variance of one variable is not mapped on to the variance of the other variable in this case. But the variation of two series taken separately differs significantly from each other. One series shows greater degree of variation between the years than the other series.

Similar results are replicated for investment and interest rate.

Analysis of all three variables, taken together, also displays similar results.

**Two Factors ANOVA without Replication of Inflation and Interest Rate**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Inflatoion and Int Rate** |  |  |  |  |  |  |
| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
| Rows | 21089.72 | 19 | 1109.985 | 0.836221 | 0.649687 | 2.168252 |
| Columns | 198321.1 | 1 | 198321.1 | 149.4076 | 1.9E-10 | 4.38075 |
| Error | 25220.27 | 19 | 1327.383 |  |  |  |
|  |  |  |  |  |  |  |
| Total | 244631.1 | 39 |  |  |  |  |

The results of ANOVA of inflation and interest rate are similar to those obtained for inflation and investment. The inter-temporal changes in inflation and investment, taken together, are not significant, which suggests that these two series changed together over the years. But each series may individually show significant variation between the years, which will indicate possible interrelation between these two variables. However, the variation of inflation differs significantly from the variation of interest rate during the entire period, taken as a whole.

However, the variances of two series over the entire period show that the variance of inflation differs significantly from the variance of interest rate. It is probable that the significant variance of one variable is not mapped on to the variance of the other variable in this case. One series shows greater degree of variation between the years than the other series.

**Two Factors ANOVA without Replication of Investment and Interest Rate :**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Capital Vs Interest** |  |  |  |  |  |  |
| ANOVA: Two- Factor Without Repilcation | | | |  |  |  |
| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
| Rows | 1.15E+10 | 19 | 6.03E+08 | 0.999772 | 0.500196 | 2.168252 |
| Columns | 5.68E+10 | 1 | 5.68E+10 | 94.23245 | 8.47E-09 | 4.38075 |
| Error | 1.15E+10 | 19 | 6.03E+08 |  |  |  |
|  |  |  |  |  |  |  |
| Total | 7.97E+10 | 39 |  |  |  |  |

These results are also similar to the earlier results. Therefore, these need no further explanation.

**Two Factors ANOVA without Replication of Investment , Inflation and Interest Rate :**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Capital Vs Int rate Vs WPI** | |  |  |  |  |  |
| ANOVA |  |  |  |  |  |  |
| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
| Rows | 7.66E+09 | 19 | 4.03E+08 | 1.00384 | 0.478489 | 1.867332 |
| Columns | 7.56E+10 | 2 | 3.78E+10 | 94.18768 | 1.88E-15 | 3.244818 |
| Error | 1.53E+10 | 38 | 4.01E+08 |  |  |  |
|  |  |  |  |  |  |  |
| Total | 9.85E+10 | 59 |  |  |  |  |

These results are also the replica of earlier results despite the fact that all three series are taken together.

**Empirical Analysis**

The above results are based on crude test of stationarity and the test may not be conclusive, therefore, we move to subject each of the three series to more rigorous test associated with alternative versions of Random Walk Model.

**Direct Test of Staionarity-Dickey Fuller Test**

Application of Dickey-Fuller Test to all three series separately is discussed here.

**Stationarity of Investment**

OLS estimates of all three versions of RWM are reported below:

∆INVSTt = 0.113029 INVSTt-1 , R2 =0.2529, F=8.36 (13)

t: (2.89)

∆INVSTt = -3285.12+0.149 INVSTt-1 , R2 =0, 0.115 F=2.34 (14)

t: (-0.41) (1.53)

∆INVSTt = --2861.48-0.104INVSTt-1+1620.57T, R2 =0, 0.1785, F=1.8534 (15)

t: (--0.35 (-0.43) (1.15)

Equation 13 suggests that the its root is significantly greater than unit, so the series of investment is explosively non-stationary on this count. As against this, relation 14 shows the its root to be statistically unit, while the equation 15 points towards the possibility of its root to be less than unit with non-significant stochastic trend. Therefore, the series may be taken to be stationary.

**Stationarity of Inflation**

∆INFt =0.0597 INFt-1 , R2 =0.8917, F=156.37 (16)

t: (12.51)

∆INFt = 3.0772+0.0415 INFt-1 , R2 =0.2761, F=6.87 (17)

t: (1.20) (2.62)

∆INFt =-7.944 +0.233 INFt-1-1.6033T,R2 =0.3378., F=4.34  (18)

t: (-0.872) (1.52) (-1.26)

All three versions of RWM of inflation suggest the time series of the variable to be non-stationary. It is not possible to explain or forecast the emergence or dis-appearance of inflation from the Indian economy so far as the results of these models are concerned.

**Stationarity of Interest Rate**

∆INTt = -0.0288 INTt-1 , R2 = 0.063, F=1.21 (19)

t: (-1.10)

∆INTt =2.07441-0.1799∆INTt -1 , R2 =0, 0.0891, F=1.66 (20)

t: (1.10) (-1.29)

∆INTt =-11.674-0.6815INTt-1-T,R2 =0. 0.342, F=4.15  (21)

t: (2.77) (-2.88) (-2.48)

Results of all above models indicate the time series of interest rates to be stationary. Since interest rate is an administered price, its stationary feature is as expected.

These results pave the way to move forward to take up the analysis of the results of regression models, non-stationary nature of inflation series being non-stationary. A linear combination of these variables in multiple and bivariate regression models may not be affected by the non-stationary nature of inflation provided that the Engel-Granger test of stationarity of first order differences of these functions are stationary.

**Analysis of Regression Models**

The OLS estimates of step wise regression models are discussed as a preliminary step.

Relation between flex and fix prices:

Pm= 35.17+ 0.6548 Pa, R2= 0.96, F=465.9

t: (6.59) (21.58)

This is obvious that prices of manufactures are significantly affected by change in flex prices.

Invstt =-37711.8+746.2219 INFt, R2 =0.8832, F=143.7(22)

(-3.61) (11.9)

The model equation 22 shows that inflation significantly affects investment positively. In fact, as much as 88.33 percent of total change in investment is explained by the above function, leaving only less than 12 per cent to be explained by the residual factors. Besides, the first order differences of the regression model are statistically significant negatively, displaying that the residuals are stationary. The regression model may be accepted as genuine.

Invstt =236210.1-11978.1INTt, R2 = 0.54117 F=22.4 (23)

(7.07) (-4.73)

Engel-Granger test reveals the regression to be genuine. The results of the model lend credence to our hypothesis that interest rate hikes significantly reduce investment in the economy by raising the cost of loan capital on the one hand, and reducing demand for credit in the financial market. Thus, interest rate hikes prove growth constraining.

**Interest Rate and Inflation**

Next model in the series examines the degree and direction of relationship between interest rate and inflation. The OLS estimates are reported hereunder:

INFt =363.61 --16.014 INTt, R2 = 0.7162, F= 45.42 (24)

t: (11.47) (-6.74)

The above results furnish substantial empirical evidence in support of the hypothesis that interest rate significantly affects negatively in the Indian econmy, notwithstanding the contribution of interest rate to raise the cost of production of fix-price goods in the market. It is probable that the loan capital does not account for substantial part of the capital cost on the one hand, and escalation of production cost as a consequence of inflation induced increase in wage and material cost of production.

**Multiple Regression Equation**

Above results lead us to examine the OLS estimate of multiple regression function. OLS estimate of the function is reported here:

INVSTt =-101102+879.982 INFt +3250.29INTt, R2 =0.8947, F=76.46... (25)

t: (-2.12) (7.77) (1.40)

The function fits the data well and it explains 89.5 per cent of the total variation of investment. The signs of both the regression coefficients are positive but the coefficient attached to interest rate is not significant. This is directly accounted by the presence of multi-collinearity. The coefficient of determination between inflation and interest rates is statistically significant and has a value of 71.6. Neither of the two variables is superfluous as the introduction of interest rate in function 22 raises the value of coefficient of determination by 1.15 which is not negligible. But the introduction of inflation in relation 24 raises explanatory power of the function by 34.2 percent.

The results of Engel-Granger of the function are also reported here   
∆ Ut=-0.722Ut-1,

t: (-3.363)

The above results of Engel-Granger test confirm that the multiple regression function is genuine.

**Output Effect of inflation and Interest Induce Investment in Indian Economy**

The following table reports the sector wise output effect of inflation and interest induced investment in Indian economy. The output effect inflation and interest rate affected investment in 2003-04 and 2007-07 is analysed. The year 2006-07 is the latest year for which input output table is available. We have inverted the commodity by commodity technology based table of 130 sectors of 2006-07. The estimated results are reported in the table below.

|  |  |  |
| --- | --- | --- |
|  | **ACTUAL** | **PREDICTED** |
|  | **2003-04** | **2003-04** |
| **Range** | **No. Of Sectors** | **No. Of Sectors** |
| less than 0 | 24 | 24 |
| 0-48000 | 60 | 105 |
| 48000-96000 | 17 | 1 |
| 96000-144000 | 10 | 0 |
| 144000-192000 | 6 |  |
| 192000-240000 | 3 |  |
| 240000-288000 | 4 |  |
| 288000-336000 | 0 |  |
| More than 336000 | 6 |  |
| **TOTAL** | **130** | **130** |

Table:

|  |  |  |
| --- | --- | --- |
|  | **ACTUAL** | **PREDICTED** |
|  | **2006-07** | **2006-07** |
| **Range** | **No. Of Sectors** | **No. Of Sectors** |
| less than 0 | 23 | 23 |
| 0-187000 | 63 | 107 |
| 187000-374000 | 18 |  |
| 374000-561000 | 8 |  |
| 561000-748000 | 6 |  |
| 748000-935000 | 3 |  |
| 935000-1122000 | 2 |  |
| 1122000-1309000 |  |  |
| more than 1309000 | 7 |  |
| **TOTAL** | **130** | **130** |

Table:

A perusal of the table reveals that actual, and hence, estimated investment was negative in 24 and 23 sectors respectively in 2003-04 and 2006-07. Consequently, these sectors also show the substantial negative output effect of negative investment. The remaining 106 and 107 sectors of the economy depict positive output effect of both actual and estimated investment in these years. But the output effect of actual investment is far in excess of the output effect associated with the inflation and interest induced investment in both the years. This is because actual investment is far in excess of the estimated investment.

The number of sectors in each range of output effect differs between the output effect of estimated and actual investment.

In 2003-04, number of sectors in two lowest ranges of output effect of actual and estimated investment are 84 and 129 respectively.

In 2006-07, there is only one sector in the third lowest category according to the estimated investment.

Output effect of actual and estimated investment differs between the actual and estimated investment on the one hand, and between the two years.

It is noteworthy that the output effect differs between the sectors largely due to the sptength and spread of forward and backward linkages of the sectors (See, Prakash and Panigrahi,)

**Conclusions:**

1. Test of stationarity shows that time series of Inflation alone is non- stationary but its linear multiple regression function is found to be genuine.
2. Inflation is inversely affected by Interest rate but Inflation directly affects investment
3. Our hypothesis that inflation in Indian Economy is largely driven by Flex prices which are represented by wholesale prices of agricultural goods. A change in Flex prices leads to significant rise in the prices of Manufacture. Thus, Cost push inflation depends on Demand pull inflation.
4. Interest rate inversely affects Investments whereas Investment is directly affected by Inflation
5. Investment in Indian Economy, among other factors is significantly affected by Interest rate and Inflation.
6. Both actual and estimated Investment affects output greatly but the output affect varies between actual and estimated Investment. Most of the sectors in both the years are concentrated in the lowest categories.
7. However the second lowest category of 2007-08 is many times greater than the ranges of 2003-04.
8. The differentials of output affect are basically explained by the strength and spread of forward and backward linkages. (Results of analysis of backward and forward linkages of the sectors are available with the Authors)

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**Books:**

1. Johnson, Macroeconomic Analysis
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**Appendix:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **2003-04** |  |  | **2006-07** |  |  |
| **Sno.** | **ACTUAL** | **PREDICTED** | **Difference** | **ACTUAL** | **PREDICTED** | **Difference** |
| 1 | 87371.68 | 3355.89133 | 84015.787 | 156527.6729 | 1974.375887 | 154553.3 |
| 2 | -115239 | -4426.2491 | -110812.5 | -122114.4894 | -1540.3021 | -120574.2 |
| 3 | 5542.493 | 212.883662 | 5329.6089 | 20540.8344 | 259.093663 | 20281.741 |
| 4 | 303.7611 | 11.6672732 | 292.09383 | 2415.105374 | 30.46314895 | 2384.6422 |
| 5 | 5512.213 | 211.720657 | 5300.4927 | 17259.8694 | 217.7089157 | 17042.16 |
| 6 | 12248 | 470.438108 | 11777.565 | 105263.3059 | 1327.748181 | 103935.56 |
| 7 | 15531.17 | 596.542457 | 14934.627 | 49881.7836 | 629.1883659 | 49252.595 |
| 8 | 132307 | 5081.82814 | 127225.15 | 325037.2778 | 4099.886951 | 320937.39 |
| 9 | 3899.443 | 149.775162 | 3749.6679 | -58862.78754 | -742.4710672 | -58120.32 |
| 10 | -5621.86 | -215.93204 | -5405.926 | -11054.78688 | -139.4405491 | -10915.35 |
| 11 | 508016.6 | 19512.597 | 488503.96 | 613018.7164 | 7732.366739 | 605286.35 |
| 12 | 4596.992 | 176.567566 | 4420.4241 | -15981.16303 | -201.5798379 | -15779.58 |
| 13 | -162931 | -6258.0831 | -156673.1 | 332490.2272 | 4193.895399 | 328296.33 |
| 14 | 39057.5 | 1500.17402 | 37557.325 | 112455.8742 | 1418.472288 | 111037.4 |
| 15 | 4234.484 | 162.643877 | 4071.8402 | 8391.65631 | 105.848912 | 8285.8074 |
| 16 | 17198.32 | 660.576562 | 16537.74 | 95809.66425 | 1208.503821 | 94601.16 |
| 17 | -5326.62 | -204.59208 | -5122.027 | -10502.71049 | -132.4768838 | -10370.23 |
| 18 | 14996.61 | 576.010528 | 14420.603 | 56319.0698 | 710.3856546 | 55608.684 |
| 19 | 1498.089 | 57.5406506 | 1440.5481 | 5048.646078 | 63.68155159 | 4984.9645 |
| 20 | 156603.3 | 6015.03261 | 150588.22 | 604547.4379 | 7625.513506 | 596921.92 |
| 21 | 24754.41 | 950.801187 | 23803.605 | 50036.92531 | 631.1452598 | 49405.78 |
| 22 | 39377.27 | 1512.45633 | 37864.816 | 91363.40719 | 1152.420558 | 90210.987 |
| 23 | 736.129 | 28.2742529 | 707.85475 | 3012.834728 | 38.00266195 | 2974.8321 |
| 24 | 126332 | 4852.33295 | 121479.67 | 281272.2017 | 3547.852225 | 277724.35 |
| 25 | -60712.3 | -2331.923 | -58380.42 | -144036.096 | -1816.812257 | -142219.3 |
| 26 | 6990.261 | 268.491534 | 6721.7694 | 22569.1065 | 284.6774556 | 22284.429 |
| 27 | 11404.21 | 438.028687 | 10966.185 | 24367.93223 | 307.3671058 | 24060.565 |
| 28 | 50399.12 | 1935.7985 | 48463.32 | 69207.30136 | 872.9525231 | 68334.349 |
| 29 | -728484 | -27980.598 | -700503 | -1234707.174 | -15574.09004 | -1219133 |
| 30 | 2111.138 | 81.0874971 | 2030.0508 | 17054.72886 | 215.1213571 | 16839.608 |
| 31 | -6175.91 | -237.21291 | -5938.699 | -12445.83462 | -156.9866549 | -12288.85 |
| 32 | 2455.88 | 94.3288248 | 2361.5516 | 17551.14871 | 221.3829936 | 17329.766 |
| 33 | 5156.125 | 198.043521 | 4958.0814 | 32881.36194 | 414.7520176 | 32466.61 |
| 34 | 31515.9 | 1210.5059 | 30305.393 | 67101.2962 | 846.3882375 | 66254.908 |
| 35 | -7166.81 | -275.27271 | -6891.538 | -16903.55224 | -213.2144772 | -16690.34 |
| 36 | -8507 | -326.74853 | -8180.251 | -13324.03283 | -168.0638871 | -13155.97 |
| 37 | -34187.6 | -1313.1233 | -32874.45 | -45983.18962 | -580.0130999 | -45403.18 |
| 38 | 242776 | 9324.87391 | 233451.13 | 605243.7463 | 7634.296455 | 597609.45 |
| 39 | 7226.006 | 277.546336 | 6948.4592 | 31330.1062 | 395.1851137 | 30934.921 |
| 40 | 24948.65 | 958.262115 | 23990.391 | 35586.91323 | 448.8787323 | 35138.035 |
| 41 | 76561.83 | 2940.69167 | 73621.134 | 178327.5055 | 2249.350036 | 176078.16 |
| 42 | 161164.1 | 6190.21149 | 154973.88 | 395282.1363 | 4985.926795 | 390296.21 |
| 43 | 87636.26 | 3366.05386 | 84270.209 | 359718.932 | 4537.347117 | 355181.58 |
| 44 | 39612.18 | 1521.47913 | 38090.705 | 207190.2778 | 2613.413213 | 204576.86 |
| 45 | -61222.9 | -2351.5339 | -58871.38 | -144937.8321 | -1828.186386 | -143109.6 |
| 46 | 133881.1 | 5142.29059 | 128738.85 | 54589.68177 | 688.5718631 | 53901.11 |
| 47 | 27238 | 1046.19433 | 26191.802 | 168231.4015 | 2122.001921 | 166109.4 |
| 48 | 11963.22 | 459.499733 | 11503.719 | 20297.67547 | 256.026556 | 20041.649 |
| 49 | 8817.902 | 338.690082 | 8479.2119 | 35078.94905 | 442.4714803 | 34636.478 |
| 50 | 61106.74 | 2347.07154 | 58759.669 | 178994.6879 | 2257.765602 | 176736.92 |
| 51 | 19375.29 | 744.192706 | 18631.097 | 61096.01543 | 770.6400881 | 60325.375 |
| 52 | -439.793 | -16.892188 | -422.9012 | -1945.096389 | -24.53464833 | -1920.562 |
| 53 | 94805.35 | 3641.41382 | 91163.932 | 245608.1941 | 3098.001056 | 242510.19 |
| 54 | 50716.82 | 1948.00112 | 48768.816 | 158346.7431 | 1997.320892 | 156349.42 |
| 55 | 97537.51 | 3746.35437 | 93791.151 | 326432.8072 | 4117.489586 | 322315.32 |
| 56 | -436445 | -16763.575 | -419681.3 | -915726.0889 | -11550.59342 | -904175.5 |
| 57 | 118559.6 | 4553.80116 | 114005.83 | 421449.2232 | 5315.9877 | 416133.24 |
| 58 | 185269.2 | 7116.07198 | 178153.08 | 501074.1646 | 6320.344062 | 494753.82 |
| 59 | -13155.9 | -505.30962 | -12650.58 | -56529.77916 | -713.0434561 | -55816.74 |
| 60 | 21008.31 | 806.915817 | 20201.389 | 99979.68793 | 1261.10279 | 98718.585 |
| 61 | 65435.1 | 2513.32108 | 62921.778 | 303203.6865 | 3824.486983 | 299379.2 |
| 62 | 251935 | 9676.66654 | 242258.37 | 785695.9165 | 9910.446141 | 775785.47 |
| 63 | -1086443 | -41729.605 | -1044714 | -1814272.776 | -22884.49291 | -1791388 |
| 64 | -223353 | -8578.8471 | -214774.1 | -477333.8728 | -6020.893756 | -471313 |
| 65 | 724057.1 | 27810.5777 | 696246.5 | 1538060.894 | 19400.46949 | 1518660.4 |
| 66 | 161347.6 | 6197.26008 | 155150.34 | 525606.2292 | 6629.781467 | 518976.45 |
| 67 | 232818.8 | 8942.42343 | 223876.36 | 43050.39111 | 543.019982 | 42507.371 |
| 68 | 41245.55 | 1584.21568 | 39661.334 | 114930.0531 | 1449.680566 | 113480.37 |
| 69 | 282589.5 | 10854.0842 | 271735.39 | 613226.8813 | 7734.992446 | 605491.89 |
| 70 | 1425104 | 54737.3582 | 1370366.8 | 3121156.353 | 39368.9865 | 3081787.4 |
| 71 | 30766.49 | 1181.72139 | 29584.764 | 120372.492 | 1518.32926 | 118854.16 |
| 72 | 8854.434 | 340.093268 | 8514.3411 | 271845.1338 | 3428.943056 | 268416.19 |
| 73 | 59856.48 | 2299.04988 | 57557.431 | 306639.9364 | 3867.83043 | 302772.11 |
| 74 | -150515 | -5781.196 | -144734 | -361070.0705 | -4554.389824 | -356515.7 |
| 75 | -135315 | -5197.3518 | -130117.3 | -306225.0876 | -3862.597697 | -302362.5 |
| 76 | 202030.5 | 7759.86336 | 194270.6 | 496324.7287 | 6260.436626 | 490064.29 |
| 77 | 19821.76 | 761.341419 | 19060.42 | 437064.7254 | 5512.955241 | 431551.77 |
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| 79 | 80601.25 | 3095.84355 | 77505.41 | 307996.7057 | 3884.944161 | 304111.76 |
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| 91 | 58616.38 | 2251.41817 | 56364.957 | 282586.9893 | 3564.436418 | 279022.55 |
| 92 | 224975.1 | 8641.15205 | 216333.94 | 1248352.448 | 15746.20593 | 1232606.2 |
| 93 | 132134.1 | 5075.18972 | 127058.96 | 2350575.643 | 29649.19738 | 2320926.4 |
| 94 | 508114.4 | 19516.3559 | 488598.06 | 1385931.485 | 17481.57149 | 1368449.9 |
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| 103 | 10354.61 | 397.713922 | 9956.8922 | 134280.8365 | 1693.763414 | 132587.07 |
| 104 | 385.257 | 14.7974796 | 370.45952 | 5080.120261 | 64.07855403 | 5016.0417 |
| 105 | 71689.94 | 2753.56573 | 68936.378 | 1258270.675 | 15871.31038 | 1242399.4 |
| 106 | 39114.49 | 1502.36312 | 37612.13 | 330829.6333 | 4172.949348 | 326656.68 |
| 107 | 180743.7 | 6942.25107 | 173801.42 | 611438.7851 | 7712.438134 | 603726.35 |
| 108 | 2236.432 | 85.8999418 | 2150.5319 | 12668.11002 | 159.7903457 | 12508.32 |
| 109 | 8153.329 | 313.164234 | 7840.1644 | 90370.5505 | 1139.89707 | 89230.653 |
| 110 | 251241.4 | 9650.02616 | 241591.42 | 949535.8853 | 11977.05633 | 937558.83 |
| 111 | 3480.651 | 133.689636 | 3346.9618 | 13959.67121 | 176.0815689 | 13783.59 |
| 112 | 15854.01 | 608.942401 | 15245.063 | 31601.75902 | 398.6116309 | 31203.147 |
| 113 | 26523.54 | 1018.75271 | 25504.792 | 87231.3727 | 1100.300769 | 86131.072 |
| 114 | 2686.388 | 103.182489 | 2583.2058 | 8660.587834 | 109.2411039 | 8551.3467 |
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| 116 | 421173.8 | 16177.0206 | 404996.76 | 1336735.948 | 16861.03916 | 1319874.9 |
| 117 | 14761.78 | 566.99077 | 14194.791 | 52251.60357 | 659.0803033 | 51592.523 |
| 118 | 132667.6 | 5095.67967 | 127571.93 | 589192.4514 | 7431.832003 | 581760.62 |
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| 120 | 0 | 0 | 0 | 0 | 0 | 0 |
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| 123 | 42324.42 | 1625.65451 | 40698.768 | 164712.3085 | 2077.613525 | 162634.7 |
| 124 | 18507.88 | 710.876189 | 17797.007 | 90208.95027 | 1137.858711 | 89071.092 |
| 125 | 3519.056 | 135.16474 | 3383.8915 | 18608.521 | 234.720254 | 18373.801 |
| 126 | 516.4715 | 19.8373462 | 496.63415 | 999.5582039 | 12.60801735 | 986.95019 |
| 127 | 1612.991 | 61.9539643 | 1551.0368 | 5533.46987 | 69.79692012 | 5463.6729 |
| 128 | 38892.15 | 1493.82312 | 37398.328 | 149310.8426 | 1883.345749 | 147427.5 |
| 129 | 16191.93 | 204.238379 | 15987.693 | 16191.93104 | 204.2383791 | 15987.693 |
| 130 | 0 | 0 | 0 | 0 | 0 | 0 |

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