CHAPTER 6

CAUSALITY BETWEEN MONEY SUPPLY AND PRICES,
AND MONEY SUPPLY AND INCOME IN INDIA

6.1 Introduction

The precise nature of inter-relationship between money and prices and money and income has been an issue of controversy for long. Inflation is one of the major economic problems being faced by all countries of world since the Second World War.

Prices have not been only economic but political phenomenon in our country. Prices are supposed to be influenced by liberalization in two ways. As we have discussed earlier, liberalization has been influencing money supply and thus prices too. Another effect of liberalization on prices is from change in supply of goods and services. Money supply reflects demand side and total production reflects the supply side. Demand and supply, both forces determine price level.

As far as supply side is concerned, agriculture sector, industrial sector and service sector constitute total supply in economy. Agriculture has not been much affected by liberalization. Other factors, as weather conditions and expected prices affect agricultural production.

As far as industrial production is concerned, various liberal measures were adopted regarding industrial policy as abolition of industrial license, MRTP act amendment and free entry of foreign investment and technology. It was hoped that more competitive environment would induced higher growth rate in industrial sector. However, this expectation has been belied, as there was no evidence of positive impact on industrial production. In fact average rate of growth of industrial production fell from 7.8% annum during 1980-81 to 1991-92 to 6.6% during 1992-93 to 2001-02.

Impact of liberalization on prices has been discovered in this chapter by finding causal relationship between prices and national production.

One of many explanations for the continuous increase in the price level is the excessive growth of money supply. According to the monetarists, inflation is essentially a monetary phenomenon in the sense that a continuous increase in the general price level is
due to the rate of growth of expansion in money supply far in excess of the rate of growth of output.

It is accepted widely that there is uni-directional relationship from money to prices. But causality in the money price relationship can be bidirectional also as has been pointed out by Biswas and Saunders in the case of India. To put it another way, there can be a feedback relation between the supply of money and level of prices. Because of this feedback relationship, the stock of money supply cannot be considered to be exogenously determined.

The implication is that the stock of money becomes less effective as a control variable. In case of money income relationship, if there is a causal relationship, we can use monetary policy for growth of income. During the liberalization a lot of changes were made in monetary policy which we have discussed in chapter 4 “Impact of Liberalization on Money supply in India”. What type of effect of liberalization has been on prices through a cheap monetary policy depends on relationship between money supply and prices. Change in nature of relationship after liberalization is also important to find out. Other relationships which are to find out here are relationship between money supply and national income, and price and national product.

6.2 Methodology:

Granger test is used to find out the causality between money supply and prices and money supply and income. Growth rate of WPI for all commodities is taken as prices and growth rate of NNP at factor cost is taken as income. M1 is taken as money supply in case of money prices relationship while M1 and M3 both are taken in case of money income relationship. M1 is assumed to be very close to prices because it reflects the purchasing power of the public and intended to be used mostly in transactions. NNP at factor cost is taken as national income because our economy is not closed economy but a globalizing economy.

Annual data is taken from 1975-76 to 2004-05 and divided into to parts, from 1975-76 to 1989-90 is taken as pre-reforms period and from 1990-91 to 2004-05 as post-reforms period.

Four lags of time series data are taken here because in less than four years we can’t find out the actual influence of one variable, so at least four lags should be taken.
One observation is lost due to taking growth form of data and four observations are lost
due to taking four lags, here by taking four lags for each variable, co-efficient of total
eight explanatory variables are to estimate and 11 observations are left. Thus if we take
more than four lags, problem of degree of freedom can be arisen. Here it is important to
explain Granger test before explaining anything.

6.3 Granger test:

The Granger test procedure is based on the following premise: if forecasts of
some variable, say Y, obtained by using both the past values of Y and the past values of
another variable, say X, are better than the forecast obtained using past values of Y alone,
X is then said to cause Y. Granger test consists of estimating the following equations:

\[ X_t = \sum \alpha_i X_{t-i} + \sum \beta_i Y_{t-i} + \epsilon_t \quad (1) \]
\[ Y_t = \sum \alpha_i Y_{t-i} + \sum \beta_i X_{t-i} + \epsilon_t \quad (2) \]

On the basis of estimating equation (1) and (2), uni-directional causation from Y
to X implies, if the estimated co-efficient on the lagged Y variable in equation (1) are
statistically different from zero as a group and the set of estimated co-efficient on the
lagged X variable in equation (2) are not statistically different from zero. Conversely,
uni-directional relation causation from X to Y exists if estimated co-efficient on the
lagged X variable in equation (2) are statistically different from zero as a group and the
set of estimated co-efficient on the lagged Y variable in equation (1) are not statistically
different from zero. Bi-directional relationship exists if estimated co-efficient of lagged Y
variable in equation (1) and estimated co-efficient of lagged X variable in equation (2)
are statistically different from zero as a group as a whole.

Equations to be estimated:

Here eight equations are to be estimated in pre as well as post-reforms:

\[ M_1 t = \sum \alpha_i M_{1t-i} + \sum \beta_i WPI_{t-i} + \epsilon_t \quad (1.1) \]
\[ WPI_t = \sum \alpha_i WPI_{t-i} + \sum \beta_i M_{1t-i} + \epsilon_t \quad (1.2) \]
\[ M_1 t = \sum \alpha_1 M_1 t-i + \sum \beta_i NNP t-i + \epsilon_t \]  
(1.3)

\[ NNP t = \sum \alpha_1 NNP t-i + \sum \beta_i M_1 t-i + \epsilon_t \]  
(1.4)

\[ M_3 t = \sum \alpha_1 M_3 t-i + \sum \beta_i NNP t-i + \epsilon_t \]  
(1.5)

\[ NNP t = \sum \alpha_1 NNP t-i + \sum \beta_i M_3 t-i + \epsilon_t \]  
(1.6)

\[ WPI t = \sum \alpha_1 WPI t-i + \sum \beta_i NNP t-i + \epsilon_t \]  
(1.7)

\[ NNP t = \sum \alpha_1 NNP t-i + \sum \beta_i WPI t-i + \epsilon_t \]  
(1.8)

As stated earlier, four lag values are taken for each variable. In other worlds eight parameters are estimated in every equation $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \beta_1, \beta_2, \beta_3$ and $\beta_4$. Total of all $\alpha$'s and all the $\beta$'s shows total effect of its variable on dependent variable.

### 6.4 Problem of Multicollinearity:

When coefficient of variables were estimated, coefficient were not significant even at 10% level of significance but $R^2$ was very high, which is sign of Multicollinearity. When it becomes difficult to find out individual effect of variables on dependent variable due to high degree of correlation among explanatory variable, the problem is called Multicollinearity. One of the important reasons of this problem is use of lag values as explanatory variable. Thus it was obvious in the present case where we are using lag values of money supply, prices and NNP etc.

### 6.5 Solution of the Problem:

One of the widely used solutions is to exclude the variables which are highly correlated, but it is also another problem to detect the variables. To avoid the problem various sets of parameters are estimated by excluding variable having a low value of $t$, and one set with highest $F$ value is taken. $F$ value shows the overall significance of the estimation.
Results of Granger Test:

Pre-reforms

\[ M_1 t = \sum \alpha_i M_1 t-i + \sum \beta_i WPI t-i + et \] ........ (A)

\[ \sum \alpha_i = 1.345 \quad t= 6.493 \quad F=59.586 \]
\[ \sum \beta_i = -0.201 \quad t=-0.547 \]

\[ WPI t = \sum \alpha_i WPI t-i + \sum \beta_i M_1 t-i + et \] ........ (B)

\[ \sum \alpha_i = 0.478 \quad t= 4.365 \quad F=467.27 \]
\[ \sum \beta_i = 0.291 \quad t=4.716 \]

Post-reforms

\[ M_1 t = \sum \alpha_i M_1 t-i + \sum \beta_i WPI t-i + et \] ......(C)

\[ \sum \alpha_i = 1.458 \quad t = 1.701 \quad F = 10.671 \]
\[ \sum \beta_i = -1.337 \quad t = -0.639 \]

\[ WPI t = \sum \alpha_i WPI t-i + \sum \beta_i M_1 t-i + et \] ...... (D)

\[ \sum \alpha_i = 0.209 \quad t= 0.255 \quad F= 10.618 \]
\[ \sum \beta_i = 0.245 \quad t=0.661 \]

Pre-reforms

\[ M_1 t = \sum \alpha_i M_1 t-i + \sum \beta_i NNP t-i + et \] ........ (E)

\[ \sum \alpha_i = 2.07 \quad t= 7.575 \quad F=64.858 \]
\[ \sum \beta_i = -0.795 \quad t = -2.167 \]

\[ NNP t = \sum \alpha_i NNP t-i + \sum \beta_i M_1 t-i + et \] ........ (F)

\[ \sum \alpha_i = 0.579 \quad t= 1.223 \quad F=19.19 \]
\[ \sum \beta_i = 0.563 \quad t=1.499 \]

Post-reforms

\[ M_1 t = \sum \alpha_i M_1 t-i + \sum \beta_i NNP t-i + et \] ........ (G)

\[ \sum \alpha_i = 1.725 \quad t=2.824 \quad F=12.806 \]
\[ \sum \beta_i = -0.049 \quad t=-0.035 \]

\[ NNP t = \sum \alpha_i NNP t-i + \sum \beta_i M_1 t-i + et \] ........ (H)

\[ \sum \alpha_i = 0.247 \quad t= 0.505 \quad F=39.508 \]
\[ \sum \beta_i = 0.637 \quad t=2.077 \]
Pre-reforms

\[ M_3 t = \sum \alpha_i M_3 t-i + \sum \beta_i NNP t-i + et \] ........ (I)

\[ \sum \alpha_i = 1.412 \quad t=1.493 \quad F=101.38 \]

\[ \sum \beta_i = -0.517 \quad t=-1.106 \]

\[ NNP t = \sum \alpha_i NNP t-i + \sum \beta_i M_3 t-i + et \] ........ (J)

\[ \sum \alpha_i = -1.557 \quad t=-1.954 \quad F=35.292 \]

\[ \sum \beta_i = 2.003 \quad t=1.076 \]

Post-reforms

\[ M_3 t = \sum \alpha_i M_3 t-i + \sum \beta_i NNP t-i + et \] .......(K)

\[ \sum \alpha_i = 0.338 \quad t=0.671 \quad F=41.589 \]

\[ \sum \beta_i = 0.688 \quad t=0.702 \]

\[ NNP t = \sum \alpha_i NNP t-i + \sum \beta_i M_3 t-i + et \] ........ (L)

\[ \sum \alpha_i = 0.593 \quad t=0.853 \quad F=25.488 \]

\[ \sum \beta_i = 0.273 \quad t=0.420 \]

Pre-reforms

\[ WPI t = \sum \alpha_i WPI t-i + \sum \beta_i NNP t-i + et \] ........ (M)

\[ \sum \alpha_i = 0.903 \quad t=1.801 \quad F=29.205 \]

\[ \sum \beta_i = 0.307 \quad t=0.531 \]

\[ NNP t = \sum \alpha_i NNP t-i + \sum \beta_i WPI t-i + et \] ............ (N)

\[ \sum \alpha_i = 0.389 \quad t=1.336 \quad F=29.685 \]

\[ \sum \beta_i = 0.327 \quad t=1.265 \]

Post-reforms

\[ WPI t = \sum \alpha_i WPI t-i + \sum \beta_i NNP t-i + et \] .......(O)

\[ \sum \alpha_i = 0.771 \quad t=1.500 \quad F=17.705 \]

\[ \sum \beta_i = 0.131 \quad t=0.265 \]

\[ NNP t = \sum \alpha_i NNP t-i + \sum \beta_i WPI t-i + et \] ......... (P)

\[ \sum \alpha_i = 0.089 \quad t=0.140 \quad F=44.019 \]

\[ \sum \beta_i = 1.481 \quad t=2.212 \]
Here we can see all the results of granger test. Equation A shows that money supply (narrow money) had been affecting prices positively during pre-reforms period. Coefficient of money supply (narrow money) is 0.291 which is statistically significant at 5% level of significance but prices' negative effect on money supply (-0.201) is not statistically significant (t= -0.547) during pre-reforms period (equation B). During post-reforms period neither money supply’s positive effect on prices and nor prices’ negative effect on money supply is statistically significant at 5% level of significance (equation C and D).

Equation E and F show, NNP had been affecting money supply (narrow money) negatively. Coefficient of NNP is -0.795, which is statistically significant at 5% level of significant (t= -2.167). Money supply had also been affecting NNP positively during pre-reforms period but its coefficient 0.563 is significant only at 10% level of significant, though its effect on NNP is more clear in post-reforms period (equation H), where its coefficient 0.637 is significant at 5% level of significant (t= 2.077). Here negative effect of NNP on money supply (narrow money) is not statistically significant so we can’t accept it (equation G).

Equation I and J show that there had not been any kind of relationship between broad money and prices, because relationship is not statistically significant during pre-reforms period and same happened during post-reforms period (equation K and L).

Here in this study we found positive relationship between narrow money supply and prices, but not proportional during the pre-reforms period. Same is not true for post-reforms period. It means other variables affecting prices had been dominating during post-reforms period and we should not relay only on monetary policy to control inflation in a highly open economy.

Relationship between narrow money and NNP, provided by this study are really mind boggling. It shows narrow money had been affecting NNP positively (though statistically significant at 10%) and NNP had been effecting narrow money supply negatively.

Positive effect of output on money supply is widely accepted but results of this study in this regard are strange. It is assumed that increase in output results in decrease in prices and thus purchasing power of money and velocity of money increases and last effect on money supply is always positive.
But another possibility can also be there: there can be time lag between payment to factor of production and output actually comes into the market. We make payments to the factor of production at the time of hiring them, which increases the demand in the economy and thus the prices too. On the other hand, output takes time to be produced. Increase in prices instead of decrease, may had been cause of this opposite relationship. Whatever had been the cause but we can’t ignore the relationship which is opposite to our beliefs. As far as post-reforms period is concerned only positive effect of narrow money supply on NNP is statistically significant, there had not been evidences of reverse effect.

Relationship between broad money and NNP had been statistically significant, neither during pre-reforms period nor during post-reforms period.

As far as relationship between NNP and prices is concerned, only effect of prices on NNP is statistically significant for post-liberalization period. It means impact from supply side had been absent.

As far as impact of liberalization on prices is concerned, prices had been monetary determined phenomenon during pre-reforms period and became an important determinant of national income.