CHAPTER - VI

WINDOW FINDING OF STRUCTURAL CHANGES IN PRICE LEVEL AND MONEY SUPPLY RELATION - SUB PERIOD ANALYSIS

6.1 INTRODUCTION :

The price money relationship studied in chapter IV, presents an overall relationship over the entire period 1950-92. However, the relationship cannot be expected to be static over such a long period. Lucas[1] has pointed out that econometric relationship under-goes changes over time. Lucas arrives at this dramatic conclusion by examining the nature of the equations used in typical econometric relationship. Current practices he argues, is to estimate an econometric relatioinship and then use this relationship to predict economic behaviour under alternative scenerios. An explicit assumption in this type of exercise is that the econometric relationship will remain stable under different scenerios. Lucas argues that dynamics of economic theory suggests that this assumption is false. The behavioural equation in this model undergoes changes as the scenerios change.

Changes in this behavioural relations in the equations of an econometric model arise because agents change their schemes to adapt themselves with changes in economic environment. If the environment can be characterized in some schematic manners, econometricians can hopefully use economic theory and estimate economic models to explain behaviour of economic agents.

However, if the agents find the economic environment to be random and chaotic, econometricians will not be able to say much about agents' behaviour. As the time proceeds, new shocks come into the economy. Economic environment become fluid. Economic relationship undergoes changes. No estimated relationship can therefore be taken as stable over time. Relationship obtained through the use of historical data set may, therefore, be expected to summarise such changes over time. Consequently, the price money relationship may be expected to undergo changes in different sub-periods over the past few decades (1950-92).

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1. Lucas, Robert E, Jr. 1976, "Econometric Policy Evaluation - A Critique" in The Phillips Curve and Labor Markets edited by Karl Brunner and Allan H. Meltzer, Amsterdam, North Holland.

6.1.1 This expectation is based on two economic observations. First, monetary policies regarding monetary expansion exhibit various degrees over this period. While money was let loose in the early sixties, controlled expansion policies were followed in the last part of the second Five Year Plan and subsequent plan periods. Second, prices reflected varying patterns of changes over the period concerned. Under these circumstances, price money relationship cannot be expected to exhibit uniform relationship over the historical data set used for the analysis in Chapter-IV.

Herein comes the problem of identifying such variation in price money relationship along with the sub-periods occurred in. These changes in relationship are 'Structural' by nature. It becomes, therefore, pertinent to identify such 'structural changes' alongwith the 'window' (the particular year) in which such a changed relationship remained undisturbed. Alternatively, it is our task to identify the particular year in which such a change in relationship occured and the period in which such a new relationship persisted.

6.2 Objective of Study :

The objective of study in the present chapter is to identify various sub-periods over which the price money relationship underwent changes. However, for the analytical purposes the task become difficult in view of the fact that the choice of sub-periods needs identification of the periods when the structural changes have just occurred. The study in this chapter further involves an analytical discussion of the relation over various sub-periods identified.

6.3 Identification of Sub-Periods :

Identification of sub-periods basically implies the finding of Windows where structural changes occurred. Usually two methods are used for this purpose.

First, the choice of sub-periods may be done with the help of graphical method. It involves the choice of sub-periods on the basis of graphical relationship of the variables concerned. The only periods where distinct changes in the association of concerned variable are discernible, may be taken as turning point of relationship.

The alternative method used for the identification of structural change is based on econometric technique which involves "Window Findings". Such Window Finding involves recursive estimation.

However, both the methods have some advantages and drawbacks of their own. Graphical method being subjective may entail bias on the part of researcher, on the other hand, though the econometric technique more objective and viable too, it is rather difficult to formulate and work with.

6.4 Graphical Method :

In order to identify the sub-periods we examine the time plots of stationary series of price level and money supply respectively. The rationality behind such choice lies in the fact that we seek to find the nature of the association of price changes with those of money supply.

It is observed that

(i) the price level exhibits discernible fluctuation over the period 1950-59. On the other hand, money supply series exhibit almost equal variation over the period. Consequently price level variation seems to be in a very feeble association with that in money supply.

(ii) the price level series exhibit an overall rising pattern (with singular exception at 1969) over the period 1960-1974. The rate of rise at different years, though different, does not exhibit big fluctuations.

Money supply series, on the other hand, display a rising trend since 1960 until 1974. The rate of rise over the period is very insignificant.

It, therefore, appears that both the series delineate positive variation over the period and their association seems to be positive.

(iii) the price level series display a downward movement (with singular exception at 1977) over the period 1975-78. On the other hand, money supply proceeds with ups and downs between 1975-78. Over this period, there is overall declining trend is discernible. Consequently, the association between the variations of variables seems to be positive.

(iv) the price level again displays an overall upward inclination over the period 1978-92. With some occasional fall. As a result, this period is marked by spectacular fluctuation.

Money supply, on the other hand, displays an overall exponential rise since 1975 until 1985. Since then money supply grew at a greater rate with some jumps. Thus, the period 1986-92 is marked by some fluctuations.

It, therefore, appears that both the series exhibit upward movement implying positive association. However, the difference in the rates of growth and the nature of fluctuations make it difficult to assess the extent of such positive association.

The graphical approach for the identification of sub-periods, though simple has some limitations. First, the method is highly subjective in view of the fact that sub-periods may vary depending on the skill and choice of researchers. Second, the graphical method at best indicates the nature of the association between variables over any time period. However, it cannot give quantitative measure of such association . This calls for the use of alternative method which is objective by nature and can provide measured values of the association between variables concerned. The following section is an attempt in this direction.

6.5 "Window Finding" of Structual Changes : Methodology :

The choice of sub-periods objectively involves the identification of structural changes through "Window Finding" the basic procedure is described below.

6.5.1 Methodology :

Sometimes researcher seeks to investigate the stability of the co-efficient estimates as the sample size increase. Sometimes researcher also wants to find out whether the estimates will be different in enlarged samples and whether these will remain stable over time working with a sample, a researcher may produce a regression which is too closely tailored to his sample by experimenting with too many formulations of his model. In this case, if it is not contain that the estimated function will perform equally outside the sample of data which has been used for the estimation of co-efficients. Furthermore, there may have occurred events which change the structure of the relationship like changes in taxation laws introduction of birth control measures and so on. If such structural changes occur, the co-efficients may not be stable. They may be sensitive to the changes in the sample compositions.

Testing for structural stability calls for the use of additional observation besides the sample that is used to estimate a given model. Procedures for testing structural stability are treated in a work by Rao (1960)[2] and in Chow (1952)[3].

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2. Rao, C.R.(1952) "Advanced Statistical Methods in Biometric Research". New York, Wiley & Sons.

3. Chow, G. (1960) - "Tesf for Equality Between Sets of Co-efficients in two Linear Regressions". Econometrica, 28, 591-605 (July, 1960).
Huang | Regression and Econometric Method , 1970 Wiley Series in Probability and Mathematics Statistics.
A. Koutsoyiannis, Theory of Economics ; The Macmillan Press Ltd. 2nd Edition; Reprinted 1979, London and Basingstoke ; pp 164-168.
Adrian C. Darnell (EE) A Dictionary of Econometrics, Edward Elgar Publishing Ltd., Old Post Raod, Brookfield Vermont 05036, U.S.A., 1994, pp. 49-54.

6.5.2 The econometric method which involves "Window Finding" uses Chow test to identify the sub-periods. Here equality between two regression co-efficients concerning the relationship over two different periods is tested. This is done by F. test. Let us consider the two samples with n_1 and n_2 observations respectively and the general model for the pooled data set be -

$$Y = X\beta + u \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 6.1$$

where $Y \rightarrow n \times 1$
$X \rightarrow n \times k$
$\beta \rightarrow K \times 1$
$n \rightarrow n_1 + n_2$

Let us rewrite the models for these two individual samples such as

$$Y_1 = \begin{pmatrix} Z_1 , W_1 \end{pmatrix} \begin{pmatrix} \gamma_1 \\ \delta_1 \end{pmatrix} + u_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (6.2)$$

$$Y_2 = \begin{pmatrix} Z_2 , W_2 \end{pmatrix} \begin{pmatrix} \gamma_2 \\ \delta_2 \end{pmatrix} + u_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (6.3)$$

where $Y_1 \rightarrow n_1 \times 1$
$Y_2 \rightarrow n_2 \times 1$
$Z_1 \rightarrow n_1 \times 1$
$Z_2 \rightarrow n_2 \times 1$
$W_1 \rightarrow n_1 \times m$
$W_2 \rightarrow n_2 \times m$
$\gamma_1 \rightarrow l \times 1$
$\gamma_2 \rightarrow l \times 1$
$\delta_1 \rightarrow m \times 1$
$\delta_2 \rightarrow m \times 1$

By combining (6,2) and (6.3) we have

$$\begin{pmatrix} y_1 \\ y_2 \end{pmatrix} = \begin{bmatrix} Z_1 \, O \, W_1 \, O \\ O \, Z_2 \, O \, W_2 \end{bmatrix} \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \delta_1 \\ \delta_2 \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} \ldots\ldots\ldots \quad 6.4$$

and the null hypothesis of interest is

Ho : $\gamma_1 = \gamma_2$ (= B say)

Under the null hypothesis, the model is

$$\begin{pmatrix} y_1 \\ y_2 \end{pmatrix} = \begin{bmatrix} Z_1 \; W_1 \; O \\ Z_2 \; O \; W_2 \end{bmatrix} \begin{bmatrix} \beta \\ \delta_1 \\ \delta_2 \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} \quad \ldots\ldots\ldots \quad 6.5$$

The L.S estimate of the coeffieient vector in (6.5) is

$$\begin{pmatrix} \hat{\beta} \\ \hat{\delta}_1 \\ \hat{\delta}_2 \end{pmatrix} = \left[\begin{pmatrix} Z_1 \; W_1 \; O \\ Z_2 \; O \; W_2 \end{pmatrix}' \begin{pmatrix} Z_1 \; W_1 \; O \\ Z_2 \; O \; W_2 \end{pmatrix} \right]^{-1} \begin{bmatrix} Z_1 \; W_1 \; O \\ Z_2 \; O \; W_2 \end{bmatrix}' \begin{pmatrix} y_1 \\ y_2 \end{pmatrix} \quad \ldots\ldots 6.6$$

If we fit 6.2 and 6.3 individually their LS estimates of the coefficients will be

$$\begin{pmatrix} c_1 \\ d_1 \end{pmatrix} = \left[(z_1 w_1)' (z_1 w_1) \right]^{-1} (z_1 w_1)' \quad y_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6.7)$$

$$\begin{pmatrix} c_2 \\ d_2 \end{pmatrix} = \left[(z_2 w_2)' (z_2 w_2) \right]^{-1} (z_2 w_2)' \quad y_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6.8)$$

where C_i is the estimate of γ_i The sum of squares necessary for computing test statistics can then be obtained by using the results in (6.6) (6.7) and (6.8) The sum of squares that measures the distance of individual observations from the common regression plane is

$$Q_1 = \left[\begin{pmatrix} y_1 \\ y_2 \end{pmatrix} - \begin{pmatrix} Z_1 & W_1 & O \\ Z_2 & O & W_2 \end{pmatrix} \begin{pmatrix} b \\ \hat{\delta}_1 \\ \hat{\delta}_2 \end{pmatrix} \right]'$$

$$\left[\begin{pmatrix} y_1 \\ y_2 \end{pmatrix} - \begin{pmatrix} Z_1 & W_1 & O \\ Z_2 & O & W_2 \end{pmatrix} \begin{pmatrix} b \\ \hat{\delta}_1 \\ \hat{\delta}_2 \end{pmatrix} \right] \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7.9)$$

Here Q_1 / δ^2 has χ^2 distribution with (n - 2m - l) degrees of freedom where we assume that u_1 and u_2 have a commonvariance δ^2. Now Q_1 can be decomposed into two sums of squares Q_2 and Q_3. Q_2 will measure the distances of observations from the individual estionated regression planes, and Q_3 measures the distance of the individual estimated plane from the common regression plane. Thus,

$$Q_2 = \left[y_1 - (z_1 w_1) \begin{pmatrix} c_1 \\ \delta_1 \end{pmatrix} \right]' y_1 - (z_1 w_1) \begin{bmatrix} c_1 \\ \delta_1 \end{bmatrix}$$

$$+ \left[y_2 - (z_2 w_2) \begin{pmatrix} c_2 \\ \delta_2 \end{pmatrix} \right]' y_2 - (z_2 w_2) \begin{bmatrix} c_2 \\ \delta_2 \end{bmatrix} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6.10)$$

and $Q_3 = Q_1 - Q_2$. Here Q_2/δ_2 has a χ^2 distribution with (n-2m-2l) degrees of freedom.

It may be noted that C_1 is the estimate of γ_1 obtained from the first regression and that $\bar{d}_2$ is the estimate of δ_2, obtained from pooled regression plane. So the ratio is

$$F = \frac{Q_3 / l}{Q_2 / (n-2m-2l)} \quad \ldots\ldots\ldots\ldots\ldots\ldots (6.11)$$

So, we have an F distribution with (l, n-2m-2l) degrees of freedom. Here Q_3 is the restricted sum of squates and that. Q_2 is the unrestricted sum of squares.

If, however, the new observations n_2 are fewer than the number of parameters in the function we may proceed as follows.Firstly, from the augmented sample we obtain the regression equation.

$$\hat{y} = \hat{\beta}_o + \hat{\beta}_1 + \ldots\ldots \hat{\beta}_k x_k \ldots\ldots\ldots\ldots\ldots\ldots (6.12)$$

from which we calculate the residual sum of squares

$$\Sigma e^2 = \Sigma y^2 - \Sigma \hat{y}^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (6.13)$$

with ($n_1 + n_2 - k$) degrees of freedom. Second from the original sample of size n_1 we have

$$\hat{y}_1 = \hat{\beta}_o + \hat{\beta}_1 + \ldots\ldots \hat{\beta}_k x_k \ldots\ldots\ldots\ldots\ldots\ldots (6.14)$$

from which the unexplained sum of square is

$$\Sigma e_1^2 = \Sigma y_1^2 - \Sigma \hat{y}_1^2 \ldots\ldots\ldots\ldots\ldots\ldots (6.15)$$

With $n_1 - k$ degrees of freedom.

Third, substructing the two sum of the residuals we find

$$\Sigma e^2 = \Sigma e_1^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (6.16)$$

with ($n_1 + n_2 - k$) - ($n - k$) = n_2 degrees of freedom, where n_2 are the additional observations. Further, we form F' ratio where

$$F' = \frac{(\Sigma e^v - \Sigma e_1^2) / n^2}{\Sigma e_1^2) / (n_1 - k)} \quad \ldots\ldots\ldots\ldots\ldots\ldots (6.17)$$

The null hypothses are

Ho : bi = βi (1 = o,1,2... k)

Ho : bi $\neq$ βi

The F* retio is compared with the theoretical value of F obtained from the F table with vi = n_2 and v_2 = (n-k) degrees of freedom.

If F* > F, we reject the null hypothesis i.e. we accept that the structural coefficients are unstable. This indicates that their values are changing in extended sample period.

6.6 Identification of sub-periods & structural changes : Results of chow test :

We have started with a sample of five years (1950 - 54). This sam. ple has been pooled with another sample of five years (1955-59). The estimated equations for each individual sample period have been estimated. Consequently the F* (estimated chow F value) have been obtained which is used for "Chow Test". Thus,we have proceeded with several samples. Each of these sample consists of five years observation on price level and money supply. We have thus eight sub - samples for the period 1950 - 54 1955 - 59, 1960 - 64, 1965 - 69, 1970 - 74, 1975 - 79, 1980 - 84, 1985 - 89. The 9th sample consists of three year observations viz. 1990 - 92. The results of the chow Tests are given in the Table 6.1

Table 6.1

RECURSIVE ESTIMATION RESURTS (CHOW TEST)
SUB - PERIOD IDENTIFICATION

Sl. No	Sample A with data for the years	Sample B with data for the years	F* (chow)	DF	Change / No change in the aeross two sample considered.	sub - period identified
1	1950 - 54	1955 -1959	3.51	2,6	No change	1950 - 59
2	1955 - 59	1960 - 64	43.37	2,6	change	.
3	1960 - 64	1965 - 69	0.96	2,6	No change	1960 - 74
4	1965 - 69	1970 - 74	1.41	2,6	No change	
5	1960 - 64	1970 - 74	2.32	2,6	No change	.
6	1950 - 59	1960 - 74	47.78	2,16	change	1960 - 74 Sub- period confirmed
7	1970 - 1974	1975 -1979	15.06	2,6	change	
8	1975 - 1979	1980 - 1984	13.7	2,6	change	1975 - 79.
9	1960 - 1974	1975 - 1979	12.67	2,16	change	
10.	1980 - 1989	1985 -1989	2.61	2,6	No change	
11.	1985 - 1989	1990 - 1992	1.89	2,4	No change	.
12.	1980 - 1984	1985 - 1992	2.97	2,7	No change	
13.	1975 - 1979	1980 - 1992	2.5	2,14	change	Sub-period 1980-92 confirmed.

6.7 Analysis of the Table-6.1 and identification of sub-periods.

It is observed from the Table 6.1 that the estimated relation ship between price level and money supply.

(i) Over the period 1950 - 54 and 1955 - 59 do not differ significantly and the relationship estimated for the pooled data set (over the period 1950 - 59) represents a stable relation ship over the period concerned.

(ii) Over the period 1955 - 59 and 1960 - 64 differ significantly. The estimated relation ship over the period 1955 - 64 exhibit instability (since $F^* > F^{2,6}$) in the sense that the relation ship between the variation in price level and that in money supply was not found to be prevailing in the period 1960 - 64. This finding has two implications First, it indicates that one stable sub - period ends in 1959, second, it further indicates that anothersub - period begins with the end of the period 1950 - 59. Consequently, we have identified the first sub period 1950 - 59.

(iii) Over the period 1960 - 64 and 1965 - 69 and 1970 - 74 do not differ significantly and the relation ship estimated over the pooled data sets (over the period1960 - 74) represents a stable relationship over the period concerned (since $F^* < F^{2,6}_{0.05}$)

It, therefore, appears that the relationship estimated over the period 1960 - 74 is stable and it is sharply different from the one estimated over the period 1950 - 59. Consequently, the second sub - period identified in our study. consists of the period 1960 - 1974.

(iv) Over the period 1950 - 59 and 1960 - 74 differ significantly. Again the estimated relationship estimated over the period 1950 - 74 indicate instability in the estimation (Since $F^* > F^{2,16}_{0.05}$).

(v) Over the period 1970 - 1974 and 1975 - 1979 differ significantly. Again the estmated relationship over the pooled period 1970 - 1979 exhibit instability since $F^* > F^{2,6}_{0.05}$ .It, therefore, appears that a change in the relationship Occurred in the period beginning with 1975.

(vi) Over the period 1975 - 79 and 1980 - 1984 are different and the relationship estimated over the pooled period 1975 - 84 exhibit instability since $F^* > F^{2,6}_{0.05}$

It, therefore indicates that further change inthe relation occurred in the period beginning with 1980.

Moreover, the findings in V and VI confirm that the relationship estimated over the period 1975 - 79 is stable and sharply different from that of the period 1960 - 74 and 1980 - 1984.

(vii) Over the period 1960 - 74 and 1975 - 79 are significantly different and the relation estimated over the pooled data set period 1960 - 1979 exhibit instability since $F^* > F^{2,16}_{0.05}$

It, therefore, appears from (V), (VI) & (VII) that the estimated relationship over the period 1975 - 79 is stable and it is sharply distinct from those estimated over the period 1960 - 74 and 1980 - 84. Consequently,the third sub-period identified covers the period1975-79.

(viii) Over the period 1980 - 84 and 1985 - 89 are not different since $F^* < F^{2,6}_{0.05}$.

(ix) Over the period 1985-89 and 1990 - 92 are not significantly different since $F^* < F^{2,4}_{0.05}$.

(x) Over the period 1980 - 89 and 1985 - 92 are not significantly different. Again the relationship estimated over the period 1980 - 92 exhibit stability since $F^* < F^{2,9}_{0.05}$.

(xi) Over the period 1975 - 79 and 1980 - 1992 are significantly different. Again the relationship estimated over the period 1975 - 1992 exhibit instability since $F^* > F^{2,14}_{0.05}$. It, therefore, follows from (viii) (ix) (x) and (xi) that the last sub - period identified covers the period 1980 - 1992. The relationship estimated over the period is stable and it is in sharp contrast with that extimated over the period 1975 - 79.

Thus, four sub-periods with distinct and stable relationship between price level and money supply in each individual period have been identified. These sub- periods are 1950 - 59, 1960 - 74, 1975 - 79 and 1980 - 92 respectively.

6.8 Price - money Relationship over different sub- periods :

The estimated[4] relationships in different sub - periods have been presented in the Table 6.2.

Table 6.2

No.of Sub-periods	Sub-periods (Year covered)	$\hat{L}i$ (i = 1,2,3,4)	$\hat{B}i$ (i = 1,2,3,4)	R^2	F^2	DW
1.	1950-59	-0.2453 (0.8303) [-0.2954]	0.00162 (0.00273) [0.5921]	0.0477	0.4007	1.72
2.	1960-74	0.8509 (1.0617) [0.8014]	0. 1762 (0. 086914) [2.0273]	0.3403	6.7059	1.67
3.	1975-79	4.0679 (3.3687) [12.075]	0.036532 (0.00324) [35.385]	0.6556	5.71	1.83
4.	1980-92	5.5663 (0.12884) [43.202]	0.039996 (0.0072359) [55.273]	0.7258	29.1167	1.715

It is observed from the Table 6.2 that (i) $\hat{\beta}_1 = 0.00162$ is not statistically significant at 5% level. This indicates that variation in money supply over the period 1950 - 59 fails to explain the variation in price-level significantly.This indicates that variation in price level over the period 1950 - 59 is not found to bear any association with that in money supply.

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4. The equatioins have been estimated through the GLS method.

(ii) $\hat{\beta}_2$, $\hat{\beta}_3$ and $\hat{\beta}_4$ are found to be statistically significant at 5% level. It, therefore, appears that variation in , money supply could explain variation in price level over the sub-period 1960 - 74, 1975 - 79 and 1980 - 92. Howcver, extent of the variations in pricelevel explained by variation in money supply varied across different sub- periods . An idea about such differing extent could better be understood from the Transition t.- matrix, presented in Table 6.3

TABLE 6.3

Transition t - matrix for β_s

	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_3$	$\hat{\beta}_4$
$\hat{\beta}_1$	-	1.7998	11.486	13.56
$\hat{\beta}_2$	1.7998	-	2.15	2.66
$\hat{\beta}_3$	11.486	2.15	-	2.096
$\hat{\beta}_4$	13.56	2.66	2.296	-

6.9 Price Miney Relation ship over differenrt sub - period - Further Explanation:

The transition t-matrix in the Table 6.3 represents the dynamic change of β_i[5] where differences between β_s are tested through t-test at 5% level[6].

It appears from the Table 6.3 that (i) there exist significant difference between $\hat{\beta}_1$ and $\hat{\beta}_2$, $\hat{\beta}_2$ and $\hat{\beta}_3$, and $\hat{\beta}_3$ and $\hat{\beta}_4$. & (ii)

$$\hat{\beta}_1 \angle \hat{\beta}_2 \angle \hat{\beta}_3 \angle \hat{\beta}_4$$

5. Any entry in the ith row and jth column of the t- Matrix represents the estimated t statistic for the difference between β_i β_j.

6. In the t- test at I = 0.05
Ho, $\beta_i = \beta_j$ Against HA $\beta_i > \beta_j$ or $\beta_i \angle \beta_j$
The actual form of HA depends on the respective absolute values of β_i and β_j.

Here $t^* = \frac{\hat{\beta}_i - \hat{\beta}_j}{\sqrt{s(\hat{\beta}_i + \hat{\beta}_j)}} = \frac{\beta_i - \beta_j}{\sqrt{(s\hat{\beta}_i)^2 + (s\hat{\beta}_j)^2}}$

This is a one tail test.

1t, therefore, appears that associations of the price level variation with money supply variation (though not significant in the sub - period 1950 - 59) appears to be positive and growing across higher sub-periods. A variation in price level have been found to be in growing association with that in money supply. This findings tacitly indicate that money supply affected price level more and more with the passage of time.

6.9.1 : Price Money Relationship in the Sub-Period 1950-59.

This period covers almost the entire First Five Year Plan period alongwith a significant part of the Second Five Year Plan period. There was a spurt of development expenditure followed by cheap money policy in the First Five Year Plan followed by a policy of controlled Expansion of money supply in the Second Five Year Plan period.

This period is also marked by a process of transition of a vast non-monetized part of the economy into monetization. This growing monetization was made possible through large scale financing for development purposes and thereby through large scale money supply. Consequently, the barter economy was growing into the monetized economy. Money supply, therefore, might have gone to affect income. Price variation,therefore seem to be less related to that in money supply.It seems to be supported by insignificant (at 5% level of significance) Bi in the period 1950-59.

Statistically insignificant (at 5%) Bi indicates that variation in price level is not related to that in money supply. There might be other non-monetary factors explaining the variation in price level.

6.9.2 Price Money Relationship in the sub-period 1960-74.

This period covers a very large period which is marked by several notable events like Indo-Pak War, Nationalization of Banks and the launching of 12 point Economic Programme for quick economic development by the then Union Govt. All these events involve introduction of large scale money supply into the economy in order to cope with developmental and emergency needs.

The large scale introduction of money supply and the cheap money policy followed by the Reserve Bank of India during this period immediately stimulates the nominal income of the people more than the real income. Consequently, there was large variation in price level. This variation is, therefore, concomitant with the variation in money supply in the period. Consequently, variation of price level is being observed to be in significant association with that in money supply. This is being indicated by the observed value of $\hat{\beta}_2$ which is significant stastically (at 5% level).

6.9.3 Price Money Supply Relationship in the Sub-period 1975-79.

This sub-period 1975-79, though small, is marked with several important national events like proclamation of Emergency and introduction of various 'Poverty Alleviation Schemes. All these schemes involve large scale expenditure for the uplift of the poor people. The initiation of the schemes opened the flood gate of several other schemes in the following years in different names. These schemes have later become the instrument of the govt. to pour in money into the rural economy for the outright rise in nominal income of the poor mass of the country.

Consequently, these schemes and the proclamation of emergency brought in a structural change in the eco-political environment of the country. Price control was not the main objective of the measure while the prime concern was to insure quick rise in the nominal income of the people.

This led to further variation in price level. As a result thereof, price variation was found to be in stronger association with that in money supply. This is exhibited through significant value of $\hat{\beta}_3$ while the transit t-matrix indicates that $\hat{\beta}_3 > \hat{\beta}_2 > \hat{\beta}_1$.

6. 9.4 Price Money Relationship in the sub-period 1980-92.

This sub period also covers a very long period which is marked with several changes in economic policy programmes followed by different union govts. The country during this period, saw political changes just after the end of emergency. This was further marked by the comeback of the eartwhile political party (Congress) to power. Again, this party lost the marginality and political instability followed alongwith the govt. of erstwhile opposition parties. All these govt. by and large, aimed at poverty alleviation and quick generation of income opportunities for the

poor mass of the country. The economic policies which have been followed for the last few decades were on the wane . The economy saw growing money supply with variation in price level. Consequently, price variations exhibit even stronger association with variations in money supply. Thus, $\hat{\beta}_4$ appeared significant along with $\hat{\beta}_4 > \hat{\beta}_3 > \hat{\beta}_2 > \hat{\beta}_1$.

6.10 Summary and Conclusion :

We have sought to verify the association of the variation of price level and that of money supply through the evaluation of time plots of price level, 1950-92. Thus, an idea though tentative (Section 6.4) about the sub-period was formed.

A search for windows of structural changes was carried through the chow tests. Consequently, four sub - periods were identified. These periods cover 1950-59, 1960-74, 1975-79 and 1980-92 (Section 6.6).

The price money relationship over different sub-periods have been estimated. The results are being presented in the Table 6.2. Moreover, the transition t-matrix of $\hat{\beta}_s$ has been presented in the Table 6.3.

It has been observed that price variations failed to exhibit any association with that in money supply over the sub period 1950-59.

However, variation in price level has been found to be in association with that in money supply in other sub periods. This association has been found to be greater in subsequent sub periods (since $\hat{\beta}_4 > \hat{\beta}_3 > \hat{\beta}_2 > \hat{\beta}_1$).

This dynamic movement of the price money relationship in different sub periods also tacitly implies the possibility of existence of dynamic movement of relationship between income and money supply over different sub-periods. We seek to enquire into such possibility. Our study in the next chapter is devoted to this direction.