Chapter 5

INFLATIONARY EXPECTATION, VARIABILITY OF INFLATION AND DEMAND FOR MONEY IN INDIA
During the period under study there has been a tremendous increase in the prices of commodities in India. With 1960-61 as the base year, the wholesale price index was 79.9 in 1952-53 and it was 336.50 in 1977-78. The inflation rate in 1952-53, was -15.27 and in 1977-78, it was 5.33. Even though there has been almost a steeply rising price index, the rate of inflation has been fluctuating and hence we have the variability of inflation phenomenon too.

This chapter mainly is a study of the impact of inflationary expectation and the variability of inflation on the demand for money in India during the sample period, both from theoretical and empirical points of view. Bhattacharya (1975), Lahiri (1977), Trivedi (1979), Kamaish and Paul (1979) have examined the impact of inflationary expectation on the demand for money in India. These empirical evidences are conflicting with respect to significance of the inflationary expectation variable. The inflationary expectation as an opportunity cost variable is found to be insignificant by Lahiri (1977), and Bhattacharya (1975) for India. On the other hand, inflationary expectation is found to be statistically significant.
as an argument in Indian demand function of money by Trivedi (1979), and Kamaich and Paul (1979). As inflationary expectation variable is not directly observable, different researchers have approximated it through different empirical estimation schemes, and that may be perhaps the reason for ambiguous empirical conclusions regarding the statistical significance of the inflationary expectation variable in demand for money studies of India.

Again, Trivedi (1979) from the point of view of usual statistical criterion such as experiments with different sample periods, $R^2$, 't' test, D.W. etc., concludes that demand function of money in India is highly stable with permanent income as a scale variable and inflationary expectation as an opportunity cost variable. Kamaich and Paul (1979) by testing the stability of the parameters over time using the method suggested by Brown, Durbin and Evans (BDE procedure of Cusum of squares Error prediction) conclude that demand function of money with permanent income and inflationary expectation as the arguments, does not pass the stability test. To the best of our knowledge, in India no study* has come up examining

* The preliminary results of this chapter have been published in the Indian Economic Journal - July - September Monetary special issue "Demand for Money and Variability of Inflation in India - 1977-78" - Thomas Paul.
the impact of the variability of inflation on the demand for money both in its theoretical and empirical aspects. We make an attempt to examine such issues in this chapter.

More recently Kamesh and Ganti Subrahmanyan (1982) have examined the non-constancy of parameters in expectation formation in Indian demand for money function. They have concluded that income expectation parameter is constant, whereas inflationary expectation parameter is varying over time. They have postulated a non-constant model for inflationary expectation parameter is an increasing function of time. However, from an economic point of view their formulation does not throw any light on the phenomenon of inflationary expectation formation because there is not much economic logic in postulating that adaptive expectation parameter is an increasing linear function of time. Statistically, their parameter values when substituted with the variables including their independent variable time, yield the values of adaptive expectation parameter which are more than 1, which is a violation of the assumption of the adaptive expectation hypothesis that expectation parameter should get only values between zero and one.
SECTION - I

THEORETICAL UNDERPINNINGS OF INFLATIONARY EXPECTATION

Cagan (1956) used inflationary expectation as the only argument affecting demand for money during hyper inflationary countries. The obvious assumption was that real income and real interest rate did not undergo any changes during such times. From this it follows that in the nominal interest rates, if the real interest rate is held constant or on a weak hypothesis that if changes in nominal interest rates are dominated by changes in inflationary expectation, then instead of interest rates, inflationary expectation can be taken as an opportunity cost variable in the demand for money function.

This argument has been put forth by Trivedi (1979) while using inflationary expectation instead of interest rates, as the opportunity cost variable in demand for money studies for India. Obviously there is another reason too which is in some way contradictory to the first reason; for example suppose if inflationary expectation has also to be put as an opportunity cost variable, Indian government security markets are said to be captive
markets and their rates are considered to be administered rates; so they may not properly reflect the opportunity cost of holding of money. The opportunity cost of holding money, it is urged by some economists like Brehmende (1977), Kamata Prasad (1969) etc.- is the holding of commodities. The rate of return on commodities, it is argued, can be the price expectations. Also Chicago School's emphasis on the demand for money as one of the durable goods and the rate of return on other durables can be approximated by inflationary expectation. Considering all these aspects, there is enough reason for putting inflationary expectation as an argument in the demand for money function either in addition to interest rates or instead of interest rates, for a developing country like India. We have chosen the latter course i.e. casting inflationary expectation instead of interest rates as the opportunity cost variable in this chapter, mainly for empirical considerations. But this is also justified because of other reasons like the variability of inflation is also considered as an additional argument in the demand for money function, taken together, they may be taken as proxies for interest rates movements.

* In our fifth chapter on Fisher effect and interest rates, we can observe that inflationary expectation and variability of inflation and related to nominal interest rates in India for long term rates, some times with partial adjustments.
However, it should be mentioned that there are further theoretical and empirical problems in studying the role of price expectations. We assume that the demand function for nominal money balances is homogeneous in degree one with respect to the current level of prices. If it is homogeneous only with respect to a "permanent level of prices", then the rate of change of "permanent level of prices" may be relevant for calculating price expectations. To tackle those issues empirically is difficult. Hence we conduct our study of the role of inflationary expectations on the assumption that the demand function for nominal balances is homogeneous in degree one with respect to current level of prices.*

* To quote Leidler (1971), "If the 'permanent price level' concept turns out to have important empirical content, need it be the case that the expected rate of inflation be measured by the rate of change of that variable? Does it make sense to talk about an expected rate of inflation without also dealing with a permanent price level, or is it possible to measure the latter variable merely by the current price level plus the expected rate of inflation over whatever may be the relevant time period? I do not pretend to have the answers to these questions, but until they are found, it is hard to see how much progress can be made in understanding the role that price expectations play in macro-economics."

Klein (1977) questions the implicit assumption in time series studies of the demand for money that the quality of real money balances remains the same over time or the assumption that a real dollar in 1870 is to be equivalent in terms of monetary services to a real dollar in 1970. He introduces a quality parameter per unit of each real dollar as a shift variable in demand for money function, approximated by the variability of the rate of inflation. Since the uncertainty of the anticipated real value of money is one major element of money's liquidity and hence can be expected to affect the relationship between the stock and the service flow, a correct estimation of the demand for money requires the inclusion of a variable which measures the predictability of prices and the variability of the rate of change of prices in an operational measure of price unpredictability. It will be a good approximation if the underlying stochastic structure is assumed to be one of a constant term plus some random disturbance. Klein (1977) on United States data for auto-correlation of annual rates of change of prices finds that the assumption of a constant (Zero) mean works reasonably well until 1955, and he measured the variability by five term moving standard deviation from the ten term moving mean of the annual rates of change of prices. Klein's empirical result shows that variability of the rate of price change is significant as an argument, and that the sign
of the regression coefficient of the variability of inflation is positive as against the negative sign of inflationary expectation coefficient.

Khan (1977) has used the level and the variability of the rate of inflation to model inflationary expectation itself, and thereby he has changed Cagan's (1956) adaptive expectation's assumption that the speed with which individuals revise their expectations, is constant.

Adaptive expectation model is widely used due to its simplicity and often good performance, notwithstanding its limitations. But it requires one strict assumption which may not be met under inflationary conditions, that expectations of inflation were formed by individuals looking only at the gap between the actual and the expected rates of inflation and revising their expectations according to a fixed multiple of the forecast error without any regard to the level of inflation. Instead Khan has postulated that the coefficient of inflationary expectations would be larger, the higher and more variable the rate of inflation. Khan's model becomes non-linear, as he specified it in such a way that the coefficient of inflationary expectations becomes a function of the level and variability of inflation.
The important part of Khan's criticism against Cagan's adaptive expectation model is that it led to over prediction of real cash balances holdings at the beginning of the sample period and under prediction towards the end and that a constant coefficient of expectations seems to result in an over estimation of inflation elasticity. But it follows from the logic of Khan's model that the individuals are only concerned with the variability of inflation of the current year. There is the possibility that the people may learn about the variability of the rate of inflation and thus form an expectation of variability or feel an actual experience of variability from the happenings of more than one year by studying the past behaviour of variability.

It is interesting to note that Blejer (1979) has used Cagan's adaptive expectation scheme itself to generate a series of expected variability of inflation.

According to him, the reason for choosing Cagan's scheme to make an expected series of variability is that, firstly, this takes care of first differences and secondly the average rate of inflation and its variability measured by the variance tend to be positively correlated. This problem of multicollinearity was pointed out by Logue and Willet (1976). The
noticeable point about Blejer's study is that he got a negative sign for the expected variability of inflation (it can be remembered that Klein got a positive sign).

Blegjer argues that the uncertainty of the rate of change of prices may affect the demand for money in opposite directions. On the one hand it will increase the precautionary demand and on the other hand by increasing the risk of holding assets whose value is not constant in real terms, it will induce changes in portfolio composition which tend to reduce the demand for money. So the ultimate net effect of variability of inflation on demand for money is open to empirical examination.

Harrod (1971) has given another hypothesis relating the uncertainty of inflation and the increase in the demand for money. He has questioned the theoretical rationale of the positive impact of Fisherian inflationary expectation on nominal interest rates like that of bond because, according to him, money does not provide any more a hedge against inflation than bonds and in the substitution between those two financial assets the problem of adjustment against inflationary expectation

* For this Harrod's arguments and the counter arguments from quantity theory sympathisers — see the "Fisher Effect" — 6th Chapter of the thesis.
does not arise. But according to Harrod the uncertainty of the inflation rate can have a positive effect on interest rate via the increase in the demand for money. The equities, even though the return may be less, are hedges against inflation and bonds are not inflation proof.

Suppose a man is uncertain about the future rate of inflation. He will need to stay liquid if he is able to go more deeply into equities without loss at a later date. Given the supply of bonds and cash if more people want to be free to be able to move out of all financial assets at a later date this will send up the rate of inflation rate, there will be a tendency for the substitution from other relatively less liquid financial assets into most liquid asset i.e. money. But this type of increase in the demand for money due to uncertainty of inflation may not have a negative welfare implication or their 'moneyness' does not decrease unlike in the argument of Klein (1977) mentioned earlier.

Finally an important theoretical underpinning regarding the effect of variability of inflation on the economy is that, until recently it has been only thought that inflation, especially the unanticipated inflation, will have only distribution and wealth effect, which has been built in
to stimulating factors into growth model*. But if the variability of inflation affects the demand for money, it has been recognised that this will have allocation effects which are not very much growth stimulating factors.

SECTION II

EMPIRICAL ESTIMATION SCHEMES EXPECTATION VARIABLES

(a) Inflationary Expectation

As it has already been stated inflationary expectation variable is not directly available, some economic hypotheses coupled with statistical estimation techniques are devised to construct inflationary expectation series. They are mainly extrapolative, adaptive and rational expectation hypotheses.

* One example can be Kaldor's (1960) model of the re-distributive effects of inflation and growth. Meltzer (1958), and Mundell (1971) recognize the possibility of wealth effect in the savings function as a result of the price rise. The obvious implication of their argument is that as a result of inflation, savings rise and real interest rate falls. Again in the New Classical Economy (Sargent (1973)) it has been argued, "only unexpected rises in price level....

boost aggregate supply because suppliers (of which suppliers of labour are one important category) mistakenly interpret surprise increases in the aggregate price level as increases in the relative prices of labour or goods they are supplying". 
We are here concentrating on adaptive - expectation hypothesis and the practical econometric methods for modeling price expectation. The simplest and most popular model of learning is the adaptive expectation hypothesis which postulates that expectations are revised in proportion to their current error. An implicit assumption is that the formula should not be applied to a variable which has a trend

\[ p_t - p_{t-1} = (1-\lambda) (p_{t-1} - p_{t-1}) \]

\[ p_t = (1-\lambda) p_t + \lambda p_{t-1} \quad \text{where} \quad 0 \leq \lambda \leq 1 \]

\( p_t \) = inflationary expectation i.e., the expectation at time (t) of the value of the variable P (rate of inflation) might have been taken at \( t + 1 \). \( \lambda \) is the weight given to previous years expectation \( p_{t-1} \) and \( (1-\lambda) \) is the weight given to current years rate of changes of prices when forecasting today's expectation of the \( t + 1 \) period rate of inflation.

\( \lambda \) lies between zero and one, if both \( p_t \) and \( p_{t-1} \) contribute to \( p_t \).

Through Koyck transformation the coefficient of \( p_t \) can be estimated from the coefficient of the lagged endogenous
variable can be the demand for real money balance. However, if both adjustment lags and expectation lags are present in the model, it is difficult to separate out those lags in view of the over identification problem. And secondly when lagged endogenous variable is used, the normal test for autocorrelation like DW statistic is not very relevant and hence it is also difficult to know whether one is estimating the expectation lag or autocorrelation parameter. In view of such difficulties, we are adopting a simple empirical scheme which was proposed by Solow (1969) to arrive at the parameter estimates by considering an initial value, notwithstanding the fact that it is an arbitrary selection, for $P_t^e$ and a grid of values for $\lambda$ lying between 0 and 1. The optimum $\lambda$ and the corresponding parameter estimates are chosen by using the maximum likelihood criteria. This may also be treated as the Maximum Likelihood estimates of the money demand function for the parameters including that of the adaptive expectation. In order to minimise the effect of the arbitrariness of the chosen initial value of $P_t^e$, we have gone back up to 1938-39 and assumed the price expectation (rate of inflation %) which people would have formed in 1937-38 for 38-39 as zero. The optimum $\lambda$ value which has maximized in $R^2$ given money demand equation is 0.6. 
(b) **Permanent or expected real income.**

\[ ER_t - ER_{t-1} = (1-\phi) (R_t - ER_{t-1}) \]

\[ \therefore \ ER_t = (1-\phi) R_t + \phi (ER_{t-1}) \]

R1 is current real income; ER is permanent or expected real income.

where \( 0 \leq \phi \leq 1 \)

The initial value of \( ER_{t-1} \) is taken as the mean of the value of the real income of all years from 1947-48 to 1950-51. The \( \phi \) value maximises \( R^2 \) in respective money demand equation is 0.7. However, it should be admitted that our permanent income construction is different from Friedman’s in the sense that we did not correct for the trend elements in real income.

(c) **Variability of Inflation.**

\( V_t \) is the variability of inflation

\[ V_t = \frac{1}{n} \sum_{i=1}^{n} |P_{t-i} - P_{t-i-1}| \]

where \( P \) is the rate of change of wholesale price index and 'n' is the number of years considered. \( V_t^3 \) means 'n' is 3 years, \( V_t^4 \) 'n' 4 years etc. We have taken \( P_{t-i} \) because of the loss of degree of freedom when dividing by the mean. We have not
gone for a learning process of the variability of inflation because of the computational difficulties, which may be formulated as:

\[ v_t^e - v_{t-1}^e = (1 - \varepsilon) (v_t - v_{t-1}^e) \]

where \( v_t^e \) is the expected variability. Our construction of the variability of inflation has showed that for the Indian economy the variability of inflation has been an important phenomenon.

(d) **Varying Parameter Regressions.**

For the linear functional form only, we have estimated two models of varying parameter regression one where all parameters including constants are assumed to be varying and the other where only constant term of the linear regression is assumed to be varying. We have gone only for linear functional specifications because in inflationary expectation series, some values are negatives and they cannot be transformed into logarithms. Adding an integer and then transforming into logs may change the original relations in observations.

Model 4— \( \Xi_1 = \text{diag} (1,1,1,1) \) All parameters are assumed to be varying

* For details regarding the variance covariance Matrix, see fourth chapter the section on "Methods For Testing Stability of Parameters in A Regression Relation".
Model - B— diag (1,0,0,0) Only Constant term is assumed to be varying.

SECTION - III

LINEAR MONEY DEMAND MODELS

Firstly we shall take up models where parameters are assumed to be not varying. (Ordinary Least Squares Estimates.)

\[
\frac{M}{P_t} = \text{The currency plus demand deposits deflated by the whole-sale price index of 1960-61.}
\]

\[
\frac{M^*}{P_t} = \text{Currency plus demand deposits plus time deposits. (in real terms.)}
\]

\[
ER_t = \text{Expected real income}
\]

\[
R1_t = \text{Current real income}
\]

\[
V_t = \text{Variability of inflation.}
\]

\[
\frac{M}{P_t} = \alpha + \beta_1 R1_t + \beta_2 \dot{P}_t + e_t \quad (1)
\]

\[
\frac{M^*}{P_t} = \alpha + \beta_1 ER_t + \beta_2 \dot{P}_t + e_t \quad (2)
\]

\[
\frac{M^*}{P_t} = \alpha + \beta_1 R1_t + \beta_2 \dot{P}_t + e_t \quad (3)
\]
\[
\frac{M^*}{P_t} = \alpha + \beta_1 \text{ER}_t + \beta_2 \frac{p_e}{P_t} + \beta_3 \frac{v_t}{v} + e_t \tag{4}
\]
\[
\frac{M}{P_t} = \alpha + \beta_1 \text{R}_t + \beta_2 \frac{p_e}{P_t} + \beta_3 \frac{v_t}{v} + e_t \tag{5}
\]
\[
\frac{M}{P_t} = \alpha + \beta_1 \text{R}_t + \beta_2 \frac{p_e}{P_t} + \beta_3 \frac{v_t}{v} + e_t \tag{6}
\]
\[
\frac{M}{P_t} = \alpha + \beta_1 \text{R}_t + \beta_2 \frac{p_e}{P_t} + \beta_3 \frac{v_t}{v} + e_t \tag{7}
\]
\[
\frac{M}{P_t} = \alpha + \beta_1 \text{R}_t + \beta_2 \frac{p_e}{P_t} + \beta_3 \frac{v_t}{v} + e_t \tag{8}
\]
\[
\frac{M}{P_t} = \alpha + \beta_1 \text{R}_t + \beta_2 \frac{p_e}{P_t} + \beta_3 \frac{v_t}{v} + e_t \tag{9}
\]
\[
\frac{M}{P_t} = \alpha + \beta_1 \text{R}_t + \beta_2 \frac{p_e}{P_t} + \beta_3 \frac{v_t}{v} + e_t \tag{10}
\]
\[
\frac{M}{P_t} = \alpha + \beta_1 \text{R}_t + \beta_2 \frac{p_e}{P_t} + \beta_3 \frac{v_t}{v} + e_t \tag{11}
\]
\[
\frac{M}{P_t} = \alpha + \beta_1 \text{R}_t + \beta_2 \frac{p_e}{P_t} + \beta_3 \frac{v_t}{v} + e_t \tag{12}
\]

As from equation (5) to (12) for \(\frac{M}{P_t}\), the same models in the same order are for \(\frac{M^*}{P_t}\) from equation (13) to (20) (These equations are not written here as the independent variables are the same and only dependent variable has changed).
IV. Interpretations of results (See Table):

In equation (1) narrow definition of money \( M_1 \), as the dependent variable performs very badly in terms of the 't' value of price expectation coefficient and D.W. statistics. Apart from the fact that the sign of price expectation \( P_t^e \) coefficient is positive as against the theoretical postulation of a negative sign in equation (2), only encouraging factor is that the sign of \( P_t^e \) has become negative, with the introduction of permanent income \( E_{t-1} \) but in terms of the 't' value of \( P_t^e \) and D.W. value it is quite disappointing. In equations (3) and (4) even with the introduction of broad definition of money, in terms of 't' value of \( P_t^e \) and D.W. Statistics there is nothing encouraging. In equations (5), (6), (7) and (8) the variability of the rate of inflation is introduced as an explanatory variable, and even though 't' value of \( P_t^e \) remains insignificant as before, one encouraging point is that D.W. Statistic has considerably improved, compared to earlier equations. From that it can be reasonably inferred that in earlier equations, where the variability of inflation was excluded, the low D.W. statistic can be due to the fact that an important explanatory variable (variability) was left out and hence the distribution of error terms in earlier equations can be systematically explained by the variability of inflation which is a violation of the assumption of Ordinary Least squares. In equations (9) (10) (11) and (12) with the
### Results Table

* 't' values are given in parentheses and * indicate that the coefficient is significant at 5% level

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<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>$R^2$</th>
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<td>(1.71)*</td>
<td>(5.21)*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
introduction of permanent income (instead of current real income) even the 't' value of $P_t^e$ has become significant, with the improvement of D.W. statistic too. From this one can interpret that the permanent income is a better scale variable than current real income for Indian demand function of money ($M$), the variability of inflation has been consistently shown as no less important an explanatory variable.

Coming to the results of the broader definition of the money, one can discern the same trend in results. In equation (13) (14) (15) and (16) with the current real income as an explanatory variable, the 't' value of $P_t^e$ are insignificant, In equation (17) (18) (19) and (20) with the introduction of permanent real income the 't' values of price expectation became significant and D.W. Statistic also improved, in all equations permanent income and the variability of inflation are consistently found to be significant. And the coefficient of the variability of inflation in our results is positive in all equations, and this supports Klein (1977) and not Blejer (1979).

About the issue of choosing the particular definition of money as far as our results are concerned, there is nothing to choose between narrow definition of money and broader definition of money, as they display the same trend in results.
As our equations are in linear forms, we have calculated the mean elasticities, separately for equations which had comparatively performed well.

### Mean Elasticities:

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>For Narrow Definition of Money</th>
<th>For Broad Definition of Money</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$E_{t}$</td>
<td>$P_{e_{t}}$</td>
</tr>
<tr>
<td>(9)</td>
<td>1.08</td>
<td>-0.05</td>
</tr>
<tr>
<td>(10)</td>
<td>1.07</td>
<td>-0.04</td>
</tr>
<tr>
<td>(11)</td>
<td>1.08</td>
<td>-0.04</td>
</tr>
<tr>
<td>(12)</td>
<td>1.12</td>
<td>-0.02</td>
</tr>
</tbody>
</table>

The results in case of mean elasticities support the theoretical hunch that for narrow definition of money the
elasticity with respect to permanent income is near unity, whereas for broader definition including time deposits, it supports the luxury good hypothesis of money by Friedman (1959), as the elasticity is more than 1.5. As far as the elasticity of inflationary expectation is concerned the order of magnitude is more, for broader definition of money. It supports the hunch that people are likely to shift from time deposits to commodities more than from currency and demand deposits to commodities. But it shows that Khetan and Waghmare's (1971) elasticity coefficient of \( M_1 \) and \( M_2 \) with respect to price expectation, is likely to be an over estimation, because of their adding of the integer to rates of inflation and then transforming into logarithms.

Results relating to Varying Parameters regression and their Implications.

Because of computational limitations two type of variabilities of inflation \( V_t^3 \) and \( V_t^4 \) only are considered for varying parameter regression. Equation No. 21.1, 21.2, 22.1 and 22.2 deal with narrow definition of money without postulating a partial adjustment model. In model A where all parameters are postulated as varying, it is found from \( \hat{\gamma}/\hat{\sigma}_r \) that there is no stability and hence parameters are not stable. On the contrary model B where it is only postulated that the constant term in the equation is varying,
\begin{table}
\centering
\begin{tabular}{|l|l|l|l|l|l|l|l|l|}
\hline
Dependent variable & Cov span & Constant & $\beta_1$ Permanent income & $\beta_2$ Inflationary expectation & $\gamma$ & $s_\gamma$ & Equation No. \\
\hline
$M/P_t$ & (A) & $-416.91$ & 0.2523 & -10.71 & 31.98 & 0.4 & 0.0090 & 21.1 \\
$M/P_t$ & (B) & $-310.67$ & 0.2440 & -21.66 & 37.23 & 0.0 & 144.72 & 21.2 \\
$M/P_t$ & (A) & $-478.57$ & 0.2535 & -9.696 & 35.88 & 0.3 & 0.010 & 22.1 \\
$M/P_t$ & (B) & $-413.54$ & 0.2462 & -17.80 & 43.50 & 0.0 & 145.10 & 22.2 \\
$M/P_t$ & (A) & $-2864.286$ & 0.5369 & -33.10 & 75.85 & 0.4 & 0.025 & 23.1 \\
$M/P_t$ & (B) & $-3009.256$ & 0.5311 & -67.53 & 93.76 & 0.0 & 422.53 & 23.2 \\
$M/P_t$ & (A) & $-2983.17$ & 0.5330 & -31.39 & 84.79 & 0.2 & 0.030 & 24.1 \\
$M/P_t$ & (B) & $-3318.52$ & 0.5382 & -57.70 & 117.09 & 0.0 & 406.50 & 24.2 \\
\hline
\end{tabular}
\caption{Equilibrium Money Demand Function for India - Permanent Income, Price Expectation. 't' Values given in Parenthesis}
\end{table}
## Results relating to varying parameter regression of money demand functions

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Constant</th>
<th>( \beta_1 )</th>
<th>( \beta_2 )</th>
<th>( \beta_3 )</th>
<th>( \beta_4 )</th>
<th>Lagged endogenous variable</th>
<th>( R^2 )</th>
<th>Equation No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>( z_1 )</td>
<td>-396.56</td>
<td>0.183</td>
<td>-2.154</td>
<td>32.82</td>
<td>0.274</td>
<td>0.3</td>
<td>0.008</td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>(A)</td>
<td>(0.962)</td>
<td>(3.46)</td>
<td>(1.811)</td>
<td>(4.41)</td>
<td>(1.422)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>( z_2 )</td>
<td>-320.24</td>
<td>0.148</td>
<td>-8.901</td>
<td>32.92</td>
<td>0.417</td>
<td>0.0</td>
<td>129.360</td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>(B)</td>
<td>(2.282)</td>
<td>(3.784)</td>
<td>(0.787)</td>
<td>(5.648)</td>
<td>(2.558)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>( z_1 )</td>
<td>-424.97</td>
<td>0.231</td>
<td>0.9219</td>
<td>34.06</td>
<td>0.090</td>
<td>0.2</td>
<td>0.010</td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>(A)</td>
<td>(1.01)</td>
<td>(3.962)</td>
<td>(0.696)</td>
<td></td>
<td>(2.840)</td>
<td>(0.387)</td>
<td></td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>( z_2 )</td>
<td>-395.01</td>
<td>0.1775</td>
<td>-0.997</td>
<td>38.25</td>
<td>0.298</td>
<td>0.0</td>
<td>138.27</td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>(B)</td>
<td>(2.508)</td>
<td>(4.002)</td>
<td>(0.742)</td>
<td></td>
<td>(4.968)</td>
<td>(1.619)</td>
<td></td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>( z_1 )</td>
<td>-2090.33</td>
<td>0.323</td>
<td>-0.6966</td>
<td>80.16</td>
<td>0.397</td>
<td>0.2</td>
<td>0.023</td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>(A)</td>
<td>(2.083)</td>
<td>(2.742)</td>
<td>(0.028)</td>
<td>(4.02)</td>
<td>(1.918)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>( z_2 )</td>
<td>-1944.16</td>
<td>0.281</td>
<td>-19.47</td>
<td>82.75</td>
<td>0.506</td>
<td>0.0</td>
<td>368.890</td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>(B)</td>
<td>(3.55)</td>
<td>(2.973)</td>
<td>(0.581)</td>
<td>(4.970)</td>
<td>(2.840)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>( z_1 )</td>
<td>-2613</td>
<td>0.455</td>
<td>-20.71</td>
<td>31.54</td>
<td>0.149</td>
<td>0.2</td>
<td>0.026</td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>(A)</td>
<td>(2.139)</td>
<td>(3.45)</td>
<td>(0.584)</td>
<td></td>
<td>(2.545)</td>
<td>(0.635)</td>
<td></td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>( z_2 )</td>
<td>-2484.30</td>
<td>0.3617</td>
<td>-25.05</td>
<td>19.42</td>
<td>0.353</td>
<td>0.0</td>
<td>383.87</td>
</tr>
<tr>
<td>( \frac{M}{P_t} )</td>
<td>(B)</td>
<td>(3.87)</td>
<td>(3.42)</td>
<td>(0.71)</td>
<td></td>
<td>(4.98)</td>
<td>(1.77)</td>
<td></td>
</tr>
</tbody>
</table>
it is found that is passes the stability and hence constant term is not much varying. And from this we can infer that the parameters excluding the constant term are almost unstable coefficients. And more or less the same trend of results are seen, in \( \frac{M^*}{P_t} \) broad definition of money (In equation No. 23 and 24). If we look carefully into the results we can notice that among the parameters, the inflationary expectation coefficient, even though significant statistically at 10% levels in equilibrium models and with correct negative theoretical signs, are much varying across models in orders of magnitudes. The economic implication may be that the adaptive expectation parameter may not be constant especially when forecasting the rate of inflation. As far as the coefficients of permanent income and variability of inflation are concerned, on the contrary, they are not much varying across models. As the same trend of results are seen for both narrow and broad money definitions, there is nothing to choose between two definitions of money on the basis of the stability of the demand for money results.

When coming to the results with partial adjustment models and varying parameter regression, there also the same trend of results is noticeable. In \( \Sigma_1 \) models-\( \Lambda \) where all parameters are postulated as varying, the test statistic \( S^2 \).
shows that there is no stability of the parameters as a whole. However a careful look will reveal that this instability may be only due to the inflationary expectation coefficient. And another interesting finding is that in partial adjustment models, the inflationary expectation coefficient, even though with correct theoretical signs, is not statistically significant even at the 10% level of confidence. Apart from that, even the orders of magnitude of inflationary expectation coefficient are reduced. This may be due to the fact that a part of the partial adjustment of the money demand function may be due to the inflationary expectation itself, and there may even long lag in adjusting inflationary expectation to nominal rates of interest, especially long term rates. These results may be contrasted with the results in the 4th chapter, where the stability result was found with partial adjustment models for both definitions of money - narrow and broader with long term interest rate as the opportunity cost variable instead of inflationary expectation.

In all type of specifications the variability of inflation is found to be statistically significant. Another interesting finding is that in majority of our variability constructions, the elasticity of demand for narrow money (m1) is found to be higher than that of broader (m2) money, with
respect to the variability of inflation (see the earlier Table on mean elasticities). This may be partly supporting, Harrod's (1971) hypothesis that whenever there is high variability of inflation, there may be substitution from less liquid financial assets to more liquid financial assets. But needless to tell that our results are not sufficient to judge the cross-elasticity of substitution from less liquid to more liquid financial assets; it needs analysis in terms of a systems framework.

CONCLUSIONS.

(1) For the sample period 1951-52 to 1977-78 the variability of inflation has been no less important a phenomenon. The variability of the rate of price rise, taken as a proxy for the uncertainty of prices, is an important explanatory variable in Indian demand for money function, which had been hitherto too ignored in all studies about India. The coefficient of the variability of inflation is found to be positive as against the negative coefficient of the inflationary expectation. Some theoretical implications are:—The common theorising has been that unanticipated price rise has only distribution and wealth effects. But as the unanticipated price changes affect the demand for money, this can have allocation effects too in the economy. Even though it will be too sweeping to conclude that society will be better off or worse off, as Klein (1977)
concludes because of the "quality changes" in real money balances, one can reasonably conclude that the task of stabilization policy will be made difficult as a result of the uncertainty of the rate of change of prices and its impact on the demand for money.

(2) As the varying parameters regression results with different model specifications show that the coefficient of inflationary expectation, though with correct theoretical signs, has got almost random behaviour, and may be due to that when the inflationary expectation through an adaptive expectation modelling is included as an argument in the Indian demand for money function, the function and parameters do not have the statistical stability property. This differs from Trivedi (1980)'s conclusion that in India instead of interest rates, when inflationary expectation is taken as the opportunity cost variable, it yields econometrically stable demand for money functions. On the other hand we have seen in the fourth chapter that with partial adjustment postulations long term interest rate as the opportunity cost variable, they yield econometrically stable demand for money functions for both narrow and broad definitions of money in India. We have two probable explanations for this - (1) It may not be that inflationary expectation is an unimportant explanatory variable in the demand for money functions; but because of the inherent
limitations in properly modeling an unobservable variable like inflationary expectation, for example with the assumption that the adaptive expectation parameter is a constant which may not sometimes meet the rational expectation criteria that the forecasting error should be purely random. (2) Instead of interest rates when the inflationary expectation is taken as the opportunity cost variable, one implicit assumption which is made is that the real interest is constant and adjusts to the inflationary expectation, or at least on a 'weak hypothesis' that, the movements in nominal interest rates are dominated by the movements in the inflationary expectation. But our sixth chapter results will show that though nominal interest rates adjust with inflationary expectation on the one hand there is some time lag for such adjustments for long term interest rates and on the other hand there are other important factors which also affect the interest rate movements; and hence the simple assumption that the real interest rate is constant may not be right. So it may also be that the inflationary expectation may not alone be able to capture the opportunity cost of holding money as far as India is concerned. In this context it may be pointed out that in the previous chapter, we have seen that long term interest rates perform better than short term interest rates as the relevant opportunity cost variable for Indian demand for money function; so a first stage decision between money and other non-financial
assets itself is being made. Instead of that if short
term interest rates were found to be more appropriate oppor-
tunity cost variable for India, then perhaps inflationary
expectation alone as the opportunity cost variable (instead
of interest rates) would have yielded a more stable econometric
relationship. However, these are all tentative explanations
for the fact that when inflationary expectation instead of
interest rate is cast as the opportunity cost variable, the
parameters were not found to be stable. In any case they
deserve further investigations.

(3) Instead of equilibrium models, when partial adjustment
models are postulated the orders of magnitudes of inflationary
expectation coefficients are reduced, and their 't' values
have become insignificant even at ten percent level. So when
inflationary expectation is cast as the opportunity cost
variable, the partial adjustment model has become not much
relevant; even the coefficient of the lagged endogenous
variable is not often statistically significant. This is also
in contrast with the partial adjustment models when interest
rate was used as the opportunity cost variable. From this
one may tentatively suggest that one of the reasons for the
partial adjustment in the previous chapter itself may be due
to the lag effect in adjusting

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nominal interest rates, especially the long term rates. That seems to be a plausible explanation for the adjustment lag when interest rate is cast as the opportunity cost variable instead of inflationary expectation because in India, after all, interest rates are partly administered rates; but they respond to market forces like inflationary expectation — though with a lag effect.

(4) The specifications of demand for money employed with permanent income, inflationary expectation, and variability of inflation as arguments and their empirical results also, like the results in previous chapter, are insensitive to particular definition of money like narrow or broader money. And hence the stability criterion of the demand for money does not enable us here also to choose a particular definition of money.