CHAPTER –VII

Output-Money Supply Relationship in Different Sub- Periods

7.1 Introduction

Lucas (1976a) has pointed out that econometric relationship among variables may change over time. So the relationship obtained from a historical dataset may not represent the dynamic relationship among variables concerned. More specifically, he argues that any dataset may contain several structural breaks in it and the economic relationships among variables may undergo changes in those periods. In such case the estimated relationship may not remain stable over the period concerned.

It is, therefore, pertinent upon over parts to consider if such structural breaks occurred in our dataset. After identifying the relationship between output level and money supply for the study period (1959-2003) according to Rational Expectations proposition, it is necessary to identify several structural breaks based on stability test. The stability test presents the idea of structural breaks of the series, on the basis of which several sub periods can be identified. Chow Breakpoint test, Chow Forecast test, Ramsey RESET tests and Recursive Least Squares Estimates are some of the methods for stability test. But only Chow Breakpoint Test has been used to identify structural breaks in the present study.

7.2 Window Finding on the Basis of Chow Break Point Test: Methodology

The idea of Chow Breakpoint Test is to fit the equation separately for each sub sample and to see whether there are significant differences in the estimated equations. A significant difference indicates a structural change in the relationship. This test can be used with least squares and two- stage least squares regressions also. In order to carry out this test, the data should be partitioned into two or more sub samples. Each sub sample must contain more observations than the number of coefficients in the equation so that the equation can be estimated.

The Chow Breakpoint test compares the sum of squared residuals obtained when separate equations are fitted to each sub sample of the data. Two test statistics i.e. F-statistic and log likelihood ratio statistic are relevant for the Chow Breakpoint Test. The F-statistic is based on comparison of the restricted and unrestricted sum of squared residuals and in the simplest case involving a single breakpoint is computed as;

$$F = \frac{[u'u-(u_1'u_1+u_2'u_2)]/k}{(u_1'u_1+u_2'u_2)/T-2k} \quad (7.1)$$

Where,

$u'u$ = the restricted sum of squared residuals.

$u_i'u_i$ = the squared residuals from sub sample i.

T = the total number of observations.

k = the number of parameters in the equation.

The formula from equation (7.1) can be generalized normally to more than one breakpoint. The F-statistic has an exact finite sample F-distribution if errors are independent and identically distributed normal random variables.

7.3 Structural Breaks in Nepalese Economy

The structural breaks of the Nepalese economy have been identified on the basis of the following equations:

$$\Delta \ln Y_t = \gamma_1 + \gamma_2 \Delta \ln M1_t + z_t \tag{7.2}$$

$$\Delta \ln Y_t = \gamma_1 + \gamma_2 \Delta \ln M2_t + z_t \tag{7.3}$$

The findings of Chow Break Point Test based on equation (7.2) are being presented through the Table 7.1.

Table 7.1: Chow Break Point Test on Equation

($\Delta \ln Y_t = \gamma_1 + \gamma_2 \Delta \ln M1_t + z_t$)

year	F-statistic	Probability	year	F-statistic	probability
1962	2.950003	0.063818	1982	3.301397	0.047093
1963	1.936622	0.157473	1983	3.154393	0.053448
1964	3.337275	0.045666	1984	5.456637*	0.008027
1965	3.149697	0.053665	1985	3.648420	0.035039
1966	2.974834	0.062453	1986	3.040833	0.058971
1967	3.255711	0.048979	1987	2.597257	0.086993
1968	2.988600	0.061709	1988	3.266955	0.048508
1969	3.568794	0.037485	1989	2.636285	0.084042
1970	2.513371	0.093711	1990	2.114993	0.133926
1971	2.492143	0.095496	1991	1.787623	0.180469
1972	3.494605	0.039924	1992	1.032955	0.365253
1973	3.444294	0.041673	1993	0.897865	0.415491
1974	5.012411*	0.011415	1994	1.149365	0.327080
1975	3.654317	0.016169	1995	0.410810	0.665879
1976	3.843565	0.029729	1996	0.420738	0.659434
1977	3.243019	0.049516	1997	0.661914	0.521421
1978	3.221204	0.050455	1998	0.920367	0.406644
1979	2.894032	0.067012	1999	1.056660	0.357117
1980	3.077765	0.057112	2000	1.555817	0.223517
1981	4.698475	0.014696	2001	1.201244	0.311439
			2002	3.709741	0.033271

* indicates highly significant F-statistic.

7.3.1 Findings

From the Table (7.1), it appeared that,

(i) The significant F-statistic is appeared at the year 1974 and 1984.

(ii) Structural breaks, therefore, are found to occur at 1974 and 1984. Consequently, the series has been divided into three sub-periods viz. 1959-1973, 1974-1983 and 1984-2003.

7.3.2 Window Findings with Broad Money Supply (M2):

The findings from Chow Break Point Test on equation (7.3) are being presented through the Table 7.2.

Table 7.2: Chow Break Point Test on Equation

($\Delta \ln Y_t = \gamma_1 + \gamma_2 \Delta \ln M2_t + z_t$)

year	F-statistic	Probability	year	F-statistic	probability
1962	3.112136	0.055437	1982	3.654303	0.034866
1963	2.177345	0.126593	1983	3.497533	0.039825
1964	3.584623	0.036985	1984	6.064398*	0.005008
1965	3.480489	0.040407	1985	4.976243	0.011751
1966	3.265001	0.048589	1986	4.055509	0.024906
1967	3.733498	0.032611	1987	3.723098	0.032898
1968	3.448876	0.041511	1988	4.501608	0.017247
1969	4.259612	0.021034	1989	3.304359	0.046974
1970	2.798105	0.072883	1990	2.756304	0.075608
1971	2.769318	0.074748	1991	2.502867	0.094590
1972	3.979145	0.026542	1992	1.757261	0.185573
1973	3.839184	0.029838	1993	1.593240	0.215896
1974	5.730793*	0.006479	1994	2.035707	0.143900
1975	4.580791	0.016169	1995	1.445086	0.247767
1976	4.771320	0.013855	1996	1.490969	0.237400
1977	3.953770	0.027110	1997	1.646106	0.205591
1978	3.966869	0.026815	1998	1.598144	0.214917
1979	3.558228	0.037822	1999	2.244367	0.119179
1980	3.703235	0.033454	2000	2.935430	0.064634
1981	5.401293*	0.008385	2001	3.955935	0.027061
			2002	4.072332	0.024560

* indicates more significant F-statistic.

7.3.3 Findings

It is observed from the Table (7.2) that,

(i) F- statistics are significant at 1974, 1981 and 1984.

(ii) The structural break at 1981 has been neglected in the present study.

(iii) The virtual significant structural changes occurred on 1974 and 1984. Consequently, the series has been divided into three sub-periods i.e., 1959-1973, 1974- 1983 and 1984-2003.

7.4 The ARIMA structure for the first sub-period (1959-1973) of M1

In order to find anticipated and unanticipated parts of narrow money supply (M1) for the sub-period (1959-1973), ARIMA structure narrow money supply (M1) for this sub-period has been identified and estimated. The model is based on the correlogram of the series. Figure 7.1 depicts the correlogram for this sub-period.

Figure 7.1: Correlogram of the series (M1) for the first sub-period (1959-1973)

Included observations: 14

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.010	-0.010	0.0016	0.969
		2	-0.149	-0.150	0.4187	0.811
		3	-0.153	-0.160	0.8961	0.826
		4	0.369	0.356	3.9440	0.414
		5	0.089	0.057	4.1419	0.529
		6	-0.229	-0.199	5.6141	0.468
		7	-0.428	-0.380	11.480	0.119
		8	0.137	-0.016	12.181	0.143
		9	0.043	-0.128	12.263	0.199
		10	-0.085	-0.053	12.665	0.243
		11	-0.148	0.195	14.307	0.216
		12	-0.043	-0.111	14.518	0.269

The following table (Table 7.3) presents the estimated ARIMA structure. The appropriate lag for this model has been selected according to Akaike info criterion and Schwartz criterion.

Table 7.3: Estimation of ARIMA (1, 1, 1) Model for M1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	0.091010	0.055866	1.629074	0.1344
AR(1)	0.457857	0.166979	2.741996	0.0208
MA(1)	-2.490160	0.885643	-2.811698	0.0184
Akaike info criterion :- -2.982930			R^2 :- 0.820512	
Schwarz criterion :- -2.852557			Adj. R^2:- 0.784614	
Durbin-Watson stat:- 2.072056			RSS :- 0.024297	

The estimated ARIMA model for M1 (1959-1973) is as follows:

$$\hat{m}_{1t} = 0.091010 + 0.457857M1_{t-1} - 2.490160\epsilon_{t-1} \quad (7.4)$$

Based on the fitted part of the above estimations, the anticipated part of money supply can be obtained while the unanticipated part of money supply for this sub-period will be obtained from residuals. The anticipated and unanticipated parts of M1 for this sub- period are being presented through the following table (Table 7.4).

Table 7.4: Actual, Anticipated and Unanticipated Parts of M1 (1959-1973)

Sample (adjusted): 1961- 1973

Year	Actual M1	Anticipated. M1	Unanticipated. M1
1961	0.20475	0.19311	0.01164
1962	0.01905	0.11409	-0.09504
1963	0.25467	0.29474	-0.04006
1964	0.25316	0.26571	-0.01254
1965	0.23996	0.19649	0.04347
1966	0.05043	0.05096	-0.00053
1967	0.04895	0.07376	-0.02481
1968	0.11383	0.13353	-0.01971
1969	0.21593	0.15053	0.06541
1970	-0.05590	-0.01466	-0.04124
1971	0.11485	0.12643	-0.01158
1972	0.07063	0.13076	-0.06013
1973	0.25869	0.23142	0.02727

7.5 Output-Money supply (M1) relationship for the first sub period (1959-1973)

The following table depicts the relationship between output level and money supply of this sub-period based on the regression equation where output level is regressed on the first lag of anticipated ($M1^{e}_{t-1}$) and unanticipated ($UM1^{e}_{t-1}$) part of money supply. The appropriate lags of the model are determined on the basis of AIC and SC. The estimations are being presented through the following table (Table 7.5).

Table 7.5: Output – Money supply (M1) relationship for the first sub-period[a]

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	0.000926	0.010729	0.086333	0.9331
$AntM1_{(-1)}$	0.131913	0.062214	2.120309	0.0630
$UnantM1_{(-1)}$	0.274279	0.124574	2.201731	0.0552
Akaike info criterion =		-5.030338	R^2 =	0.561927
Schwarz criterion =		-4.909111	Adj. R^2=	0.464577
Durbin-Watson stat=		2.724245	RSS =	0.002786
F- statistic=	5.772252	Prob.(F- statistic)=		0.024376
($\Delta Yt = \alpha + \beta_1 AntM1_{(-1)}$)				
Constant(α)	-0.007040	0.011885	-0.592354	0.5668
$AntM1_{(-1)}$	0.158043	0.071866	2.199119	0.0525
R^2 :- 0.325970		RSS :- 0.004286	Adj. R^2:-	0.258567
($\Delta Yt = \alpha + \beta_1 UnantM1_{(-1)}$)				
Constant(α)	0.020561	0.006294	3.266896	0.0085
$UnantM1_{(-1)}$	0.324665	0.142062	2.285386	0.0454
R^2 :- 0.343099		RSS :- 0.004177	Adj. R^2:-	0.277409

[a]($\Delta Yt = \alpha + \beta_1 AntM1_{(-1)} + \beta_2 UnantM1_{(-1)} + \varepsilon_t$) Sample (adjusted):- 1962 1973

The estimated equation is,

$$\hat{y}_t = 0.000926 + 0.131913\ M1^{e}_{t-1} + 0.274279\ UM1^{e}_{t-1} \qquad (7.5)$$
$$(0.010729)\ (0.062214) \qquad (0.124574)$$
$$[0.086333]\ [2.120309] \qquad [2.201731]$$

R^2 = 0.561927 Adj. R^2 = 0.464577

F- stat = 5.772252 D-W stat = 2.724245

The estimations based on the first part of the above table present the findings that both explanatory variables (anticipated and unanticipated parts of M1) have influenced real output at 10% level of significance. Again for assessing the significance of anticipated and unanticipated parts of narrow money supply (M1) on output level, restricted regression equations have also been estimated. The second part of the Table 7.5 presents the regression equation where unanticipated part is restricted. Similarly, the third part of the table presents the regression equation where anticipated part of narrow money supply (M1) is subject to restriction. It has been observed from the table that the anticipated and unanticipated parts are significant at 10% and 5% level respectively.

It is also found that-

$F^* = 4.845$ when unanticipated part of M1 is restricted.

$F^* = 4.49$ when anticipated part of M1 is restricted.

It is further observed that both estimated F^* statistics are less than the critical value for $F_{(1,9)} = 5.12$ (at 5% level) but greater than $F_{(1,9)} = 3.36$ (at 10% level).

The F-statistic of both cases shows that both parts of money supply do not affect the output level in this sub-period at 5 % level of significance. This indicates that-

(i) Both anticipated and unanticipated parts of narrow money supply (M1) have insignificant effects (at 5%) on real output but significant effects at 10% level.

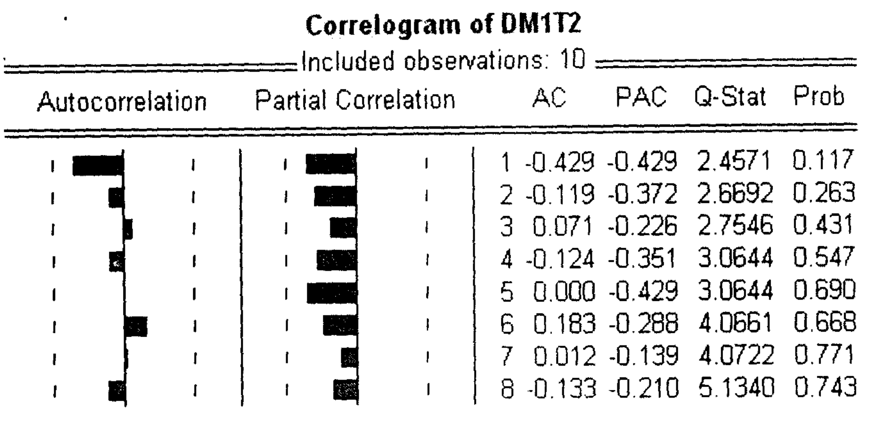
(ii) Monetary policy as well as 'Invariance Proposition' has insignificant impact (at 5%) on real output level but significant impact at 10% level of significance.

(iii) Surprise in money supply (unanticipated part of narrow money supply) has comparatively greater influence to affect real output level in this sub-period.

7.6 The ARIMA structure for second sub-period of M1 (1974-1983)

The ARIMA structure of M1, which is used to identify anticipated and unanticipated part of money supply, has also been estimated for the sub-period (1974-1983). The estimation is based on the correlogram of M1 for this period. Figure 7.2 depicts the correlogram for this purpose, on the basis of which ARIMA (2, 1, 2) has been identified. However, in order to check its appropriateness, the AIC and SC has also been used.

Figure 7.2: Correlogram of the series for the second sub-period of M1



7.6.1 Estimation of the ARIMA (2, 1, 2) Structure of M1 (1974- 1983)

The following table presents the findings of the ARIMA (2, 1, 2) model for M1 of this sub-period.

Table 7.6: Estimation of ARIMA (2, 1, 2) Model for M1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	0.149324	0.014774	10.10754	0.0021
AR(1)	-0.438463	0.239573	-1.830185	0.1646
AR(2)	-0.125499	0.429431	-0.292245	0.7891
MA(1)	4.721212	4.191919	1.126265	0.3420
MA(2)	2.003681	2.980606	0.672239	0.5496
Akaike info criterion =		-6.747948	R^2 =	0.974193
Schwarz criterion =		-6.698297	Adj. R^2 =	0.939784
Durbin-Watson stat =		1.309419	RSS =	0.000157

The estimated ARIMA model for M1 (1974- 1983) is as follows:

$$\hat{m}_{1t} = 0.149324 - 0.438463M1_{t-1} - 0.125499M1_{t-2} + 4.721212\epsilon_{t-1} + 2.003681\epsilon_{t-2} \quad (7.6)$$

(0.014774)	(0.239573)	(0.429431)	(4.191919)	(2.980606)
[10.10754]	[-1.830185]	[-0.292245]	[1.126265]	[0.672239]

R^2 = 0.974193 Adj. R^2 = 0.939784 Durbin-Watson stat = 1.309419
Akaike info criterion = -6.747948 Schwarz criterion = -6.698297

On the basis of the model, the anticipated and unanticipated parts of money supply of this sub-period have been estimated. The anticipated and unanticipated parts of M1 for this sub-period are being presented through the following table (Table 7.7).

Table 7.7: Actual, Anticipated and Unanticipated Parts of M1 (1974-1983)

Sample (adjusted): 1976- 1983

Year	Actual M1	Anticipated. M1	Unanticipated. M1
1976	0.20433	0.19783	0.00650
1977	0.16668	0.17044	-0.00376
1978	0.12973	0.13010	-0.00036
1979	0.14137	0.14649	-0.00513
1980	0.12244	0.13034	-0.00790
1981	0.11226	0.11453	-0.00227
1982	0.14501	0.14242	0.00259
1983	0.16422	0.16357	0.00065

7.7 Output-Money supply (M1) relationship for the second sub-period (1974-1983)

The output level has been regressed over the anticipated and unanticipated parts of M1 over the period 1974-1983. The appropriate lag selection has been confirmed on the basis AIC and SC. The results of estimation are given in the following table (Table 7.8). The results of the estimation of two restricted equations are also being presented through the second and third parts of the Table 7.8.

Table 7.8: Output – Money supply (M1) relationship for the second sub-period*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	-0.089474	0.060455	-1.480010	0.1989
$AntM1_{t-1}$	0.695618	0.390186	1.782788	0.1347
$UnantM1_{t-1}$	-4.439031	2.284330	-1.943253	0.1096
Akaike info criterion =		-4.441358	R^2 :-	0.472341
Schwarz criterion =		-4.411567	Adj. R^2:-	0.261277
Durbin-Watson stat:-		1.927340	RSS :-	0.002606
F- statistic:-	2.237906	Prob.(F- statistic):-		0.202248

$(\Delta Yt = \alpha + \beta_1 AntM1_{t-1})$

Constant(α)	-0.020507	0.059191	-0.346452	0.7408
$AntM1_{t-1}$	0.270125	0.390592	0.691577	0.5151
R^2 :- 0.073828	RSS :- 0.004575		Adj. R^2:- -0.080534	

$(\Delta Yt = \alpha + \beta_1 UnantM1_{t-1})$

Constant(α)	0.017262	0.009795	1.762204	0.1285
$UnantM1_{t-1}$	-2.153688	2.207445	-0.975648	0.3669
R^2 :- 0.136925	RSS :- 0.004263		Adj. R^2:- -0.006921	

* $(\Delta Y_t = \alpha + \beta_1 AntM1_{t-1} + \beta_2 UnantM1_{t-1} + \varepsilon_t)$ Sample (adjusted):- 1977 1984

It has been observed from the table that the coefficients for anticipated and unanticipated parts of M1 are not statistically significant even at 10% level of significance. Thus both the systematic and surprise parts of money supply failed to exert any significant influence on output level over the period 1974-1983.

These results have further been verified through the estimation of two restricted equations. In our estimation-

F* =3.7778 when unanticipated part of money supply was restricted.

F*=3.1792 when anticipated part of money supply was restricted.

Critical Value = $F_{(1,5)}$ at 5% level is 6.61; $F_{(1,5)}$ at 10 % level is 4.06.

Consequently, both the estimated F-statistic falls short of the critical value of 'F' at 5% level of significance. This indicates that both the anticipated and unanticipated part of money supply had no significant effect on the variation in output level over the period concerned. Consequently, money supply (M1) was completely 'neutral' over the period.

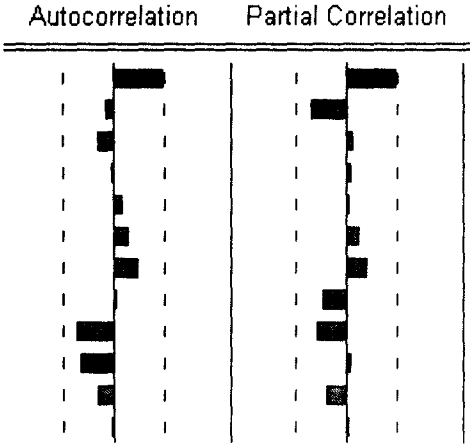
7.8 The ARIMA structure for third sub-period of M1 (1984-2003)

The Figure (7.3) presents the ACF and PACF of M1 for the third sub-period (1984-2003). The AC and PAC for the first lag seem more significant than other lags.

Figure 7.3: Correlogram of the series for the third sub-period of M1

Correlogram of DM1T3

Included observations: 20



	AC	PAC	Q-Stat	Prob
1	0.440	0.440	4.4782	0.034
2	-0.064	-0.319	4.5792	0.101
3	-0.141	0.051	5.0906	0.165
4	-0.015	0.033	5.0970	0.277
5	0.060	0.014	5.2043	0.391
6	0.119	0.109	5.6504	0.463
7	0.210	0.165	7.1368	0.415
8	0.010	-0.205	7.1404	0.522
9	-0.332	-0.263	11.538	0.241
10	-0.291	0.038	15.264	0.123
11	-0.139	-0.179	16.207	0.134
12	-0.011	0.012	16.214	0.182

On the basis of this pictorial presentation of ACF and PACF of M1, the ARIMA structure has been identified. The lag structure has been rationalized on the basis of AIC and SC. M1 is found to have ARIMA (2, 1, 2) model for the period concerned such that the model is,

$$(1-\Phi_1 L-\Phi_2 L^2)\ dM1t = (1-\theta_1 L-\theta_2 L^2)e_t \qquad (7.7)$$

7.7.1 Estimation of ARIMA (2, 1, 2) Model for M1 (1984- 2003)

The results of estimation of the model (Equation 7.7) are being presented through the Table 7.9.

Table 7.9: Estimation of ARIMA (2, 1, 2) Model for M1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	0.137223	0.019260	7.124691	0.0000
AR(1)	0.136558	0.190693	0.716114	0.4866
AR(2)	-0.488222	0.240962	-2.026136	0.0638
MA(1)	0.781524	0.071989	10.85620	0.0000
MA(2)	0.920149	0.140036	6.570814	0.0000
Akaike info criterion =		-3.346158	R^2 =	0.584085
Schwarz criterion =		-3.098832	Adj. R^2 =	0.456111
Durbin-Watson stat =		2.217500	RSS =	0.021296

The estimated ARIMA (2, 1, 2) equation is,

$$\hat{M}1t = 0.137223 + 0.136558M1_{t-1} - 0.\ 0.488222M1_{t-2} + 0.781524\epsilon_{t-1} + 0.920149\epsilon_{t-2} \quad (7.8)$$

(0.019260) (0.190693) (0.240962) (0.071989) (0.140036)
[7.124691] [0.716114] [-2.026136] [10.85620] [6.570814]

R^2 = 0.584085 Adj. R^2 = 0.456111 Durbin-Watson stat = 2.217500
Akaike info criterion = -3.346158 Schwarz criterion = -3.098832

7.7.2 Findings

It is observed from the estimated equation (7.8) that,

(i) $\hat{\Phi}_1$ = 0.136558 is insignificant even at 10% level of significance.

(ii) $\hat{\Phi}_2$ = -0.488222 is significant only at 10 % level of significance.

(iii) $\hat{\theta}_1$ = 0.781524 is significant at 1% level of significance.

(iv) $\hat{\theta}_2$ = 0.920149 is significant at 1% level of significance.

These indicate that,

(i) Money supply in this sub period was not significantly affected by its own first lag, but it was negatively affected at 10% level by its own second lag.

(ii) Money supply in this sub period was significantly affected by first two lags of residual term.

On the basis of these estimations the anticipated and unanticipated parts of money supply of this sub period has been estimated. The series of anticipated and unanticipated parts are being presented through the following table (Table 7.10).

Table 7.10: Actual, Anticipated and Unanticipated Parts of M1 (1984-2003)

Sample (adjusted): 1986- 2003

Year	Actual M1	Anticipated M1	Unanticipated M1
1986	0.21328	0.21860	-0.00531
1987	0.21659	0.20312	0.01347
1988	0.12956	0.11656	0.01299
1989	0.17627	0.11997	0.05629
1990	0.19230	0.20225	-0.00995
1991	0.21510	0.16970	0.04540
1992	0.14821	0.14729	0.00092
1993	0.21469	0.14320	0.07149
1994	0.18692	0.19916	-0.01224
1995	0.09461	0.16241	-0.06780
1996	0.05765	0.04289	0.01476
1997	0.08237	0.09631	-0.01394
1998	0.16477	0.17127	-0.00650
1999	0.19136	0.14986	0.04150
2000	0.13430	0.15762	-0.02332
2001	0.13533	0.13035	0.00498
2002	0.06692	0.12082	-0.05390
2003	0.08206	0.09100	-0.00894

7.9: Output-Money supply (M1) relationship for the third sub period (1984-2003)

The relationship between output level and anticipated and unanticipated parts money supply has been enquired into through the estimation of the equation,

$$y_t = \alpha + \beta_1 M1^c_t + \beta_2 UM1^c_t + \upsilon_t \qquad (7.9)$$

The results of estimation are being presented through the first part of the following table (Table 7.11).

Table 7.11: Output – Money supply (M1) relationship for the third sub-period*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	0.044332	0.020626	2.149313	0.0483
$AntM1_t$	-0.010615	0.134300	-0.079038	0.9380
$UnantM1_t$	0.252911	0.172216	1.468565	0.1626
Akaike info criterion :-		-4.394965	R^2 :-	0.127824
Schwarz criterion :-		-4.246569	Adj. R^2:-	0.011533
Durbin-Watson stat:-		2.634208	RSS :-	0.009318
F- statistic:-	1.099177	Prob.(F- statistic):-		0.358536
($\Delta Yt = \alpha + \beta_1 AntM1_t$)				
Constant(α)	0.047626	0.021232	2.243091	0.0394
AntM1t	-0.027317	0.138571	-0.197132	0.8462
R^2 :- 0.002423	RSS :- 0.010658		Adj. R^2:-	-0.059926
($\Delta Yt = \alpha + \beta_1 UnantM1_t$)				
Constant(α)	0.042770	0.005716	7.482413	0.0000
$UnantM1_t$	0.254063	0.166183	1.528815	0.1458
R^2 :- 0.127460	RSS :- 0.009322		Adj. R^2:-	0.072927

*($\Delta Yt = \alpha + \beta_1 AntM1t + \beta_2 UnantM1t + \varepsilon_t$) Sample (adjusted):- 1986 2003

Critical Value for $F_{(1, 14)}$ at 5% level of significance is 4.60.

It has been observed that,

(i) Both $\hat{\beta}_1$ and $\hat{\beta}_2$ are insignificant even at 10% level of significance.

(ii) Output level was irresponsive to variation to that in anticipated and unanticipated parts of money supply (M1) over the period concerned

This finding has further been examined through the estimation of two restricted equations (following Chow). The results of such estimations are being presented through second and third parts of the Table 7.11.

In this estimation,

$F^{*} = 2.157$ when unanticipated part of money supply is restricted.

$F^{*} = 0.0064$ when unanticipated part of money supply is restricted.

$F_{0.05}^{(1,15)} = 4.54$ (Critical Value for $F_{(1,15)}$ at 5% level of significance is 4.54)

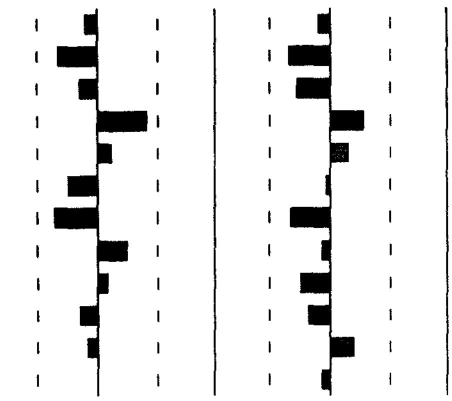
Here, both F^{*}s fall short of $F_{0.05}^{(1,15)}$. Consequently, both anticipated and unanticipated parts of M1 appear to appear to have no impact on output variation over the period 1984-2003. Thus systematic monetary policy and monetary surprise shocks are found to be non-effective in influencing output level over the sub-period concerned.

7.10: The ARIMA structure for first sub-period of M2 (1959-1973)

The broad money supply for the period of study has also been divided into three sub-periods (i.e.1959-1973, 1974-1983 and 1984-2003) following Chow Breakpoint Test. It is, therefore, necessary to identify the anticipated and unanticipated parts of money supply for each sub-period. The identification has been estimated on the basis of ARIMA structure for each sub period. The following figure (Figure 7.4) presents the correlogram for first sub-period of M2, on the basis of which the informal idea for finding the appropriate lag for ARIMA structure can be drawn.

Figure 7.4: Correlogram of the series for the first sub-period of M2

Included observations: 14



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.111	-0.111	0.2135	0.644
		2	-0.345	-0.362	2.4415	0.295
		3	-0.157	-0.291	2.9442	0.400
		4	0.442	0.291	7.3147	0.120
		5	0.126	0.159	7.7073	0.173
		6	-0.269	-0.041	9.7327	0.136
		7	-0.393	-0.351	14.672	0.040
		8	0.261	-0.077	17.206	0.028
		9	0.087	-0.260	17.542	0.041
		10	-0.151	-0.193	18.819	0.043
		11	-0.097	0.207	19.519	0.052
		12	0.001	-0.065	19.519	0.077

The following table (Table 7.12) presents the estimations of ARIMA structure for the first sub-period of M2. The appropriate lag for this model has been confirmed on the basis of AIC and SC.

Table 7.12: Estimation of ARIMA (2, 1, 2) Model for M2 (1959-1973)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	0.142594	0.018984	7.511409	0.0001
AR(1)	-1.078007	0.383875	-2.808224	0.0262
AR(2)	-0.107202	0.276402	-0.387848	0.7097
MA(1)	-0.124030	3.121399	-0.039735	0.9694
MA(2)	-7.577349	4.009974	-1.889625	0.1007
Akaike info criterion =		-5.063530	R^2 =	0.977135
Schwarz criterion =		-4.861486	Adj. R^2 =	0.964069
Durbin-Watson stat =		1.292068	RSS =	0.001931

The estimated ARIMA (2, 1, 2) equation is,

$$\hat{m}_{2t} = 0.142594 - 1.078007M2_{t-1} - 0.107202M2_{t-2} - 0.124030\epsilon_{t-1} - 7.577349\epsilon_{t-2} \quad (7.10)$$

(0.018984) (0.383875) (0.276402) (3.121399) (4.009974)

[7.511409] [-2.808224] [-0.387848] [-0.039735] [-1.889625]

R^2 = 0.977135 Adj. R^2 = 0.964069 Durbin-Watson stat = 1.29206

The 't-statistic' of the coefficient of AR (1) is significant at 5% level while AR(2), MA(1) and MA(2) are insignificant even at 10% level of significance. On the basis of the estimations of the ARIMA structure which has been presented in the equation (7.10), the estimations of anticipated and unanticipated part of broad money supply for this sub period have been estimated. The fitted part of the above estimations shows the anticipated part while residual term of this estimation presents unanticipated part of money supply. The anticipated and unanticipated parts of M2 for this sub period are being presented through the following table (Table 7.13)

Table 7.13: Actual, Anticipated and Unanticipated Parts of M2 (1959-1973)

Sample (adjusted): 1962- 1973

Year	Actual M1	Anticipated M1	Unanticipated M1
1962	0.03977	0.06087	-0.02110
1963	0.22831	0.24977	-0.02147
1964	0.22249	0.22376	-0.00127
1965	0.22724	0.21010	0.01714
1966	0.05643	0.05029	0.00614
1967	0.07901	0.09577	-0.01677
1968	0.17702	0.17593	0.00109
1969	0.25037	0.23920	0.01117
1970	0.00939	0.01310	-0.00371
1971	0.17440	0.19049	-0.01609
1972	0.15404	0.15270	0.00133
1973	0.25182	0.24864	0.00318

7.11: Output-Money supply (M2) relationship for the first sub period (1959-1973)

The following table (Table 7.14) presents the relationship between output level and the first lag of anticipated and unanticipated parts of money supply for this sub period.

Table 7.14: Output-Money supply (M2) relationship for the first sub-period*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	-0.016824	0.011460	-1.468005	0.1803
AntM2$_{(-1)}$	0.219796	0.065283	3.366832	0.0098
UnantM2$_{(-1)}$	0.421837	0.409615	1.029837	0.3332
Akaike info criterion :-		-5.099765	R^2 :-	0.636731
Schwarz criterion :-		-4.991249	Adj. R^2:-	0.545913
Durbin-Watson stat:-		2.612283	RSS :-	0.002276
F- statistic:-	7.011116	Prob.(F- statistic):-		0.017415
($\Delta Yt = \alpha + \beta_1 AntM2_{t-1}$)				
Constant(α)	-0.020256	0.011002	-1.841239	0.0987
AntM2$_{t-1}$	0.231466	0.064508	3.588179	0.0059
R^2 :- 0.588572	RSS :- 0.002578		Adj. R^2:- 0.542858	
($\Delta Yt = \alpha + \beta_1 UnantM2_{t-1}$)				
Constant(α)	0.017333	0.007813	2.218307	0.0537
UnantM2$_{t-1}$	0.661212	0.591276	1.118280	0.2924
R^2 :- 0.121998	RSS :- 0.005502		Adj. R^2:- 0.024443	

* ($\Delta Yt = \alpha + \beta_1 AntM2_{(-1)} + \beta_2 UnantM2_{(-1)} + \varepsilon_t$) Sample (adjusted):- 1963 1973

The estimated equation is,

$$\hat{y}_t = -0.016824 + 0.219796\, M2^e_{t-1} + 0.421837 UM2^e_{t-1} \qquad (7.11)$$

(0.011460) (0.065283) (0.409615)

[-1.468005] [3.366832] [1.029837]

$R^2 =$ 0.636731 Adj. $R^2 =$ 0.545913

F- stat = 7.011116 D-W stat = 2.612283

The estimations based on the equation (7.11) present the findings that first lag of anticipated part of M2 has influenced real output at 1% level of significance while same lag of unanticipated part of M2 has no significant influence on real output even at 10% level. Again for assessing the significance of anticipated and unanticipated parts of broad money supply (M2) on output level, restricted regression equations have also been estimated. The second part of the Table 7.14 presents the regression equation where unanticipated part is restricted. Similarly, the third part of the table presents the regression equation where anticipated part of broad money supply (M2) is subject to restriction. It has been observed from the table that the anticipated part is significant at 1% level while unanticipated part is insignificant even at 10% level.

It is also found that-

$F^* = 1.0615$ when the first lag of unanticipated part of M2 is restricted.

$F^* = 11.3392$ when the first lag of anticipated part of M2 is restricted.

Critical Value for $F_{(1, 8)}$ at 5% level of significance is 5.32.

It is further observed that estimated 'F^* -statistic' is less than the critical value for $F_{(1, 8)}$ at 5% level of significance for the first case (when unanticipated part of M2 is restricted) while 'F^* -statistic' is greater than the critical value for the second case.

The F-statistic of first case shows that the unanticipated part of money supply does not affect the output level in this sub-period at 5 % level of significance while the anticipated part has affected the real output at 5% level. This indicates that-

(i) The first lag of anticipated part of M2 has significant effect on real output while same lag of unanticipated part of M2 has insignificant effect on real output level.

(ii) Monetary policy contrary to 'Invariance Proposition' had significant impact on real output level.

(iii) Surprise in money supply (unanticipated part of broad money supply) supplanted the influence of money supply on real output level in this sub-period.

The following table (Table 7.15) presents the relationship between output level and anticipated and unanticipated parts of money supply for the same period.

Table 7.15: Output-Money supply (M2) relationship for the first sub-period*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	0.040876	0.011804	3.462732	0.0071
$AntM2_t$	-0.131109	0.064476	-2.033465	0.0725
$UnantM2_t$	1.322521	0.423797	3.120648	0.0123
Akaike info criterion :-		-5.036964	R^2 :-	0.564820
Schwarz criterion :-		-4.915737	Adj. R^2:-	0.468113
Durbin-Watson stat:-		2.262722	RSS :-	0.002767
F- statistic:- 5.840545		Prob.(F- statistic):-		0.023660
($\Delta Y_t = \alpha + \beta_1 AntM2_t$)				
Constant(α)	0.029525	0.015373	1.920596	0.0837
$AntM2_t$	-0.087755	0.086187	-1.018193	0.3326
R^2 :- 0.093933	RSS :- 0.005761		Adj. R^2:- 0.003327	
($\Delta Y_t = \alpha + \beta_1 UnantM2_t$)				
Constant(α)	0.019376	0.006017	3.220454	0.0092
$UnantM2_t$	1.136831	0.474295	2.396883	0.0375
R^2 :- 0.364880	RSS :- 0.004039		Adj. R^2:- 0.301368	

* ($\Delta Yt = \alpha + \beta_1 AntM2_t + \beta_2 UnantM2_t + \varepsilon_t$) Sample (adjusted):- 1962 1973

The estimated equation is,

$$\hat{y}_t = 0.040876 - 0.131109M2^e_t + 1.322521UM2^e_t \quad (7.12)$$

$$(0.011804) \; (0.064476) \quad (0.423797)$$

$$[3.462732] \; [-2.033465] \quad [3.120648]$$

$R^2 =$ 0.564820 Adj. $R^2 =$ 0.468113

F- stat = 5.840545 D-W stat = 2.262722

The estimations based on the equation (7.12) present the findings that anticipated part of M2 has influenced real output at 10% level of significance while unanticipated part of M2 has significant influence on real output at 5% level. Again for assessing the significance of anticipated and unanticipated parts of broad money supply (M2) on output level, restricted regression equations have also been estimated. The second part of the Table 7.15 presents the regression equation where unanticipated part is restricted. Similarly, the third part of the table presents the regression equation where anticipated part of broad money supply (M2) is subject to restriction. It has been observed from the table that the anticipated part is significant at 10% level while unanticipated part is insignificant even at 5% level.

It is also found that-

$F^* = 9.7383$ when the first lag of unanticipated part of M2 is restricted.

$F^* = 4.137$ when the first lag of anticipated part of M2 is restricted.

Critical Value for $F_{(1,9)}$ at 5% level of significance is 5.12.

Critical Value for $F_{(1,9)}$ at 10 % level of significance is 3.36.

It is further observed that estimated 'F^* -statistic' is greater than the critical value for $F_{(1,9)}$ at 5% level of significance for the first case (when unanticipated part of M2 is restricted) while 'F^* -statistic' is less than the critical value at 5% level but greater than the critical value at 10% level of significance for the second case.

The F-statistic of first case shows that the unanticipated part of money supply has affected the output level in this sub-period at 5 % level of significance while the anticipated part has not affected the real output at 5% level but it has affected at 10% level of significance. This indicates that-

(i) The anticipated part of M2 has no significant effect (at 5%) on real output while the unanticipated part of M2 has significant effect on real output level.

(ii) Monetary policy contrary to 'Invariance Proposition' had no significant impact on real output level.

(iii) Surprise in money supply (unanticipated part of broad money supply) did not supplant the influence of money supply on real output level in this sub-period.

7.12 The ARIMA structure for second sub-period of M2 (1974-1983)

In order to identify the relationship between the output level and money supply (M2) for the second sub period according to 'Invariance Proposition of Rational Expectation', it is necessary to quantify the anticipated and unanticipated parts of money supply. The following figure (Figure 7.5) has presented the correlogram of M2 series for second sub period, on the basis of which the ARIMA structure has been identified.

Figure 7.5: Correlogram of the series for the second sub-period of M2

Correlogram of DM2T2

Included observations: 10

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.173	-0.173	0.3985	0.528
		2	-0.227	-0.265	1.1724	0.556
		3	-0.305	-0.444	2.7635	0.430
		4	0.026	-0.325	2.7766	0.596
		5	0.145	-0.264	3.2794	0.657
		6	0.156	-0.168	4.0118	0.675
		7	-0.043	-0.181	4.0845	0.770
		8	-0.068	-0.124	4.3605	0.823

7.12.1 Estimation of the ARIMA structure of M2 (1974-1983)

The correlogram shows that the estimations of ACF and PACF are almost insignificant at all the lags presented in the Figure (7.5). This scenario presents an informal idea for ARIMA structure for this sub period. The following table (Table 7.16) presents the estimations for ARIMA model of this sub-period.

Table 7.16: Estimation of ARIMA (2, 1, 2) Model for M2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	0.167736	0.022326	7.513006	0.0049
AR(1)	-0.101416	0.365324	-0.277606	0.7993
AR(2)	0.309093	0.203580	1.518287	0.2262
MA(1)	1.602355	0.248077	6.459106	0.0075
MA(2)	0.994995	1.31E-05	75755.51	0.0000
Akaike info criterion =		-5.794281	R^2 =	0.942954
Schwarz criterion =		-5.744630	Adj. R^2 =	0.866892
Durbin-Watson stat =		1.330037	RSS =	0.000409

The table shows that the ARIMA structure has been estimated appropriately according to AIC and SC. The fitted part of this estimation provides the anticipated part of money supply. The estimated ARIMA model for M2 (1974-1983) is as follows:

$$\hat{m}_{2t} = 0.167736 - 0.101416M2_{t-1} + 0.309093M2_{t-2} + 1.602355\epsilon_{t-1} - 0.994995\epsilon_{t-2} \quad (7.13)$$

(0.022326) (0.365324) (0.203580) (0.248077) (1.31E-05)

[7.513006] [-0.277606] [1.518287] [6.459106] [75755.51]

The't-statistic' of the coefficients of AR (1) and AR(2) are insignificant even at 10% level while MA(1) and MA(2) are significant at 1% level of significance. On the basis of the estimations of the ARIMA structure which has been presented in the equation (7.13), the estimations of anticipated and unanticipated part of broad money supply for this sub period have been estimated. The fitted part of the above estimations shows the anticipated part while residual term of this estimation presents unanticipated part of money supply. The anticipated and unanticipated parts of M2 for this sub period are being presented through the following table (Table 7.17)

Table 7.17: Actual, Anticipated and Unanticipated Parts of M2 (1974-1983)

Sample (adjusted): 1976- 1983

Year	Actual M2	Anticipated. M2	Unanticipated. M2
1976	0.25406	0.24964	0.00442
1977	0.19061	0.19647	-0.00586
1978	0.17960	0.18710	-0.00750
1979	0.14649	0.15575	-0.00926
1980	0.15929	0.15126	0.00803
1981	0.17459	0.16569	0.00891
1982	0.19385	0.18669	0.00715
1983	0.18331	0.18753	-0.00421

7.13: Output-Money supply (M2) relationship for the second sub period (1974-1984)

The following table (Table7.18) presents the output –money supply relationship for the second sub-period (1974-1983). Output level for this sub-period has been regressed with the anticipated and unanticipated parts of money supply of the same period.

Table 7.18: Output – Money supply (M2) relationship for the second sub-period*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	-0.012821	0.067652	-0.189515	0.8571
$AntM2_t$	0.168343	0.361298	0.465939	0.6609
$UnantM2_t$	0.773795	1.462631	0.529043	0.6194
Akaike info criterion :-		-3.925692	R^2 :-	0.092020
Schwarz criterion :-		-3.895902	Adj. R^2:-	-0.271172
Durbin-Watson stat:-		2.138955	RSS :-	0.004365
F- statistic:-	0.253364	Prob.(F- statistic):-		0.785581
($\Delta Yt = \alpha + \beta_1 AntM2_t$)				
Constant(α)	-0.013344	0.063456	-0.210285	0.8404
$AntM2_t$	0.172046	0.338860	0.507720	0.6298
R^2 :- 0.041193	RSS :- 0.004609		Adj. R^2:-	-0.118608
($\Delta Yt = \alpha + \beta_1 UnantM2_t$)				
Constant(α)	0.018322	0.009745	1.880129	0.1091
$UnantM2_t$	0.786999	1.363616	0.577141	0.5848
R^2 :- 0.052595	RSS :- 0.004555		Adj. R^2:-	-0.105305

*($\Delta Yt = \alpha + \beta_1 AntM2t + \beta_2 UnantM2t + \varepsilon_t$) Sample (adjusted):- 1976 1983

It has been observed from the table that the coefficients for anticipated and unanticipated parts of M2 are not statistically significant even at 10% level of significance. Thus both the systematic and surprise parts of money supply failed to exert any significant influence on output level over the period 1974-1983.

These results have further been verified through the estimation of two restricted equations. In our estimation-

F^* =0.2795 when unanticipated part of money supply was restricted.

F^*=0.2176 when anticipated part of money supply was restricted.

Critical Value for $F_{(1,5)}$ at 5% level of significance is 6.61.

Consequently, both the estimated F-statistic falls short of the critical value of 'F' at 5% level of significance. This indicates that both the anticipated and unanticipated parts of money supply had no significant effect on the variation in output level over the period concerned. Consequently, money supply (M2) was completely 'neutral' over the period.

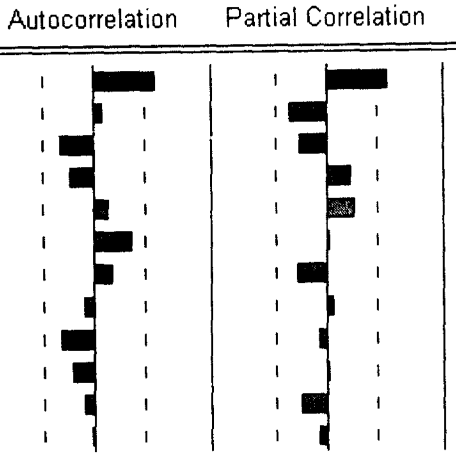
7.14: The ARIMA structure for third sub-period of M2 (1984-2003)

The Correlogram for the third sub-period of M2, which has been presented in the following figure (Figure 7.6), depicts the ACF and PACF at different lags.

Figure 7.6: Correlogram of the series for the third sub-period of M2

Correlogram of DM2T3

Included observations: 20



Lag	AC	PAC	Q-Stat	Prob
1	0.542	0.542	6.7937	0.009
2	0.063	-0.326	6.8906	0.032
3	-0.289	-0.250	9.0520	0.029
4	-0.200	0.217	10.152	0.038
5	0.126	0.245	10.619	0.059
6	0.331	0.014	14.067	0.029
7	0.152	-0.255	14.846	0.038
8	-0.093	0.052	15.161	0.056
9	-0.302	-0.068	18.800	0.027
10	-0.197	0.017	20.501	0.025
11	-0.090	-0.237	20.894	0.034
12	-0.013	-0.076	20.903	0.052

On the basis of this pictorial presentation of ACF and PACF of M2, the ARIMA structure has been identified. The lag structure has been rationalized on the basis of AIC and SC. M2 is found to have ARIMA (2, 1, 2) model for the period concerned such that the model is,

$$(1-\Phi_1L-\Phi_2L^2)\ dM2t = (1-\theta_1L-\theta_2L^2)\epsilon_t \qquad (7.14)$$

Table 7.19: Estimation of ARIMA (2, 1, 2) Model for M2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	0.169381	0.008815	19.21425	0.0000
AR(1)	1.177409	0.098077	12.00497	0.0000
AR(2)	-1.120551	0.126385	-8.866179	0.0000
MA(1)	-0.507991	0.073687	-6.893883	0.0000
MA(2)	0.981397	0.070479	13.92463	0.0000
Akaike info criterion =		-4.421542	R^2 =	0.792538
Schwarz criterion =		-4.174217	Adj. R^2 =	0.728704
Durbin-Watson stat =		2.079583	RSS =	0.007266

The table shows that the ARIMA structure has been estimated appropriately according to AIC and SC. The fitted part of this estimation provides the anticipated part of money supply. The estimated ARIMA model for M2 (1984-2003) is as follows:

$$\hat{m}_{2t} = 0.169381 + 1.177409M2_{t-1} - 1.120551M2_{t-2} - 0.507991\epsilon_{t-1} + 0.981397\epsilon_{t-2} \quad (7.15)$$

(0.008815) (0.098077) (0.126385) (0.073687) (0.070479)

[19.21425] [12.00497] [-8.866179] [-6.893883] [13.92463]

On the basis of the estimations of the ARIMA model, anticipated and unanticipated parts of money supply for this sub-period have been estimated. The fitted part of above model presents the anticipated part of M2 while the residual part presents the unanticipated part of money supply for this sub-period. The series of anticipated and unanticipated parts of M2 for this sub-period are being presented through following table (Table 7.20).

Table 7.20: Actual, Anticipated and Unanticipated Parts of M2 (1984-2003)

Sample (adjusted): 1986- 2003

Year	Actual M1	Anticipated M1	Unanticipated M1
1986	0.17757	0.18241	-0.00484
1987	0.20210	0.19900	0.00310
1988	0.19927	0.19240	0.00687
1989	0.19101	0.16747	0.02354
1990	0.16969	0.15613	0.01356
1991	0.20435	0.16173	0.04262
1992	0.18822	0.20186	-0.01364
1993	0.22139	0.20114	0.02025
1994	0.16665	0.18583	-0.01918
1995	0.14504	0.13751	0.00753
1996	0.11503	0.12113	-0.00610
1997	0.14638	0.14315	0.00323
1998	0.21520	0.19558	0.01962
1999	0.19575	0.24230	-0.04655
2000	0.17227	0.19199	-0.01972
2001	0.10905	0.10757	0.00148
2002	0.05035	0.07500	-0.02465
2003	0.10746	0.11081	-0.00335

7.15: Output-Money supply (M2) relationship for the third sub-period (1984-2003)

The relationship between output level and anticipated and unanticipated parts of money supply (M2) for the third sub-period has been presented through the following table (Table 7.21).

Table 7.21: Output – Money supply (M2) relationship for the third sub-period*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant(α)	0.008254	0.023814	0.346605	0.7337
$AntM2_t$	0.213741	0.139898	1.527832	0.1474
$UnantM2_t$	0.279747	0.286829	0.975311	0.3449
Akaike info criterion :-		-4.442409	R^2 :-	0.168237
Schwarz criterion :-		-4.294014	Adj. R^2:-	0.057336
Durbin-Watson stat:-		2.780245	RSS :-	0.008886
F- statistic:- 1.516994		Prob.(F- statistic):-		0.251186
($\Delta Yt = \alpha + \beta_1 AntM2_t$)				
Constant(α)	0.010414	0.023674	0.439883	0.6659
$AntM2_t$	0.201018	0.139076	1.445380	0.1677
R^2 :- 0.115491	RSS :- 0.009450		Adj. R^2:- 0.060209	
($\Delta Yt = \alpha + \beta_1 UnantM1_t$)				
Constant(α)	0.043566	0.005972	7.295393	0.0000
$UnantM2_{t-1}$	0.238885	0.297248	0.803654	0.4334
R^2 :- 0.038800	RSS :- 0.010269		Adj. R^2:- -0.021275	

* ($\Delta Yt = \alpha + \beta_1 AntM2_t + \beta_2 UnantM2_t + \varepsilon_t$) Sample (adjusted):- 1986 2003

It has been observed from the table that the coefficients for anticipated and unanticipated parts of M2 are not statistically significant even at 10% level of significance. Thus both the systematic and surprise parts of money supply failed to exert any significant influence on output level over the period 1984-2003.

These results have further been verified through the estimation of two restricted equations. In our estimation-

F* =0.9521 when unanticipated part of money supply was restricted.

F*=2.2346 when anticipated part of money supply was restricted.

Critical Value for $F_{(1, 15)}$ at 5% level of significance is 4.54.

Consequently, both the estimated F-statistic falls short of the critical value of 'F' at 5% level of significance. This indicates that both the anticipated and unanticipated parts of money supply had no significant effect on the variation in output level over the period concerned. Consequently, money supply (M2) was completely 'neutral' over the period.

7.16: Summary

The present chapter has been related to the output-money supply relationship in different sub-periods. The different sub-periods have been identified on the basis of stability test and hence the structural breaks of the period of study. The structural breaks have been identified using Chow Break-point Test. After identifying the structural breaks, the series of real output, M1 and M2 of the present study have been divided into three sub-periods i.e. 1959-1973, 1974-1983 and 1984-2003. The anticipated and unanticipated parts of money supply for each sub-period have been found using ARIMA structure.

The findings of the present study have been presented separately for narrow money supply and broad money supply.

7.13.1 Narrow Money Supply (M1)

(i) The anticipated and unanticipated parts of M1 for the first sub-period (1959-1973) have been estimated using ARIMA (1, 1, 1) structure. Regressing the real output level for the first sub-period (1959-1973) with the first lag of anticipated and unanticipated parts of narrow money supply, the 't-statistic' of the coefficients of both anticipated and unanticipated parts are significant only at 10 % level of significance. The 'F-statistic' of both cases shows that both parts of money supply do not affect the output level in this sub-period at 5 % level of significance.

(ii) The anticipated and unanticipated parts of M1 for the second sub-period (1974-1983) have been estimated using ARIMA (2, 1, 2) structure. The real output level for the second sub-period (1974-1983) has been regressed with the first lag of anticipated and unanticipated parts of narrow money supply, the 't-statistic' of the coefficients of both anticipated and unanticipated parts are insignificant even at 10 % level of significance. The 'F-statistic' of both cases shows that both parts of money supply do not affect the output level in this sub-period at 5 % level of significance.

(iii) The anticipated and unanticipated parts of M1 for the third sub-period (1984-2003) have been estimated using ARIMA (2, 1, 2) structure. The real output level for the third sub-period (1984-2003) has been regressed with the anticipated and unanticipated parts of narrow money supply. The't-statistic' of the coefficients of both anticipated and unanticipated parts are insignificant even at 10 % level of significance. The 'F-statistic' of both cases shows that both parts of money supply do not affect the output level in this sub-period at 5 % (even at10%) level of significance.

7.15.2 Broad Money Supply (M2)

(i) The anticipated and unanticipated parts of M2 for the first sub-period (1959-1973) have been estimated using ARIMA (2, 1, 2) structure. The real output level for this sub-period (1959-1973) has been regressed with the first lag of anticipated and unanticipated parts of broad money supply. The‘t-statistic’ of the coefficient of the anticipated part is significant at 1% level while the coefficient of unanticipated part is insignificant even at 10 % level of significance. The ‘F-statistic’ of both cases shows that the anticipated part of money supply has affected the real output level in this sub-period at 5 % level of significance while the unanticipated part has no significant influence on real output. Similarly the real output for this sub-period has also been regressed with anticipated and unanticipated parts of money supply for the same period (i.e. no lags). It has found from this estimation that the‘t-statistic’ of the coefficient of the anticipated part is significant only at 10% level while the coefficient of unanticipated part is significant even at 5 % level of significance. The ‘F-statistic’ of both cases shows that the anticipated part of money supply has not affected the real output level in this sub-period at 5 % level of significance but it has affected the real output at 10% level of significance while the unanticipated part has significant influence on real output at 5% level of significance.

(ii) The anticipated and unanticipated parts of M2 for the second sub-period (1974-1983) have been estimated using ARIMA (2, 1, 2) structure. The real output level for the second sub-period (1974-1983) has been regressed with the anticipated and unanticipated parts of broad money supply. The‘t-statistic’ of the coefficients of both anticipated and unanticipated parts are insignificant even at 10 % level of significance. The ‘F-statistic’ of both cases shows that both parts of money supply do not affect the output level in this sub-period even at 10 % level of significance.

(iii) The anticipated and unanticipated parts of M2 for the third sub-period (1984-2003) have been estimated using ARIMA (2, 1, 2) structure. The real output level for the third sub-period (1984-2003) has been regressed with the anticipated and unanticipated parts of broad money supply. The't-statistic' of the coefficients of both anticipated and unanticipated parts are insignificant even at 10 % level of significance. The 'F-statistic' of both cases shows that both parts of money supply do not affect the real output level in this sub-period at 5 % (even at10%) level of significance.

7.13.2 Conclusion:

The broad conclusion of the present chapter has been summarized as following:

(i) The real output has been influenced by both money supplies at the initial sub-period (1959-1973) but the effectiveness of broad money supply is comparatively higher than narrow money supply.

(ii) The monetary policy seems more effective to affect real output in the case of first lag of anticipated and unanticipated parts of M2 while the 'Invariance Proposition' has been effective when there is no lag of these parts for this sub-period. Unanticipated part of M2 for the same period is more effective.

(iii) The real output has not been affected by both money supplies at the second and third sub periods. Both parts of money supplies are ineffective to influence the real variable in these sub-periods. Neither anticipated part nor surprise part has influential role to affect real output in these sub-periods.

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