Freely Determined versus Regulated Prices and the Policy Ineffectiveness Proposition

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ABSTRACT

Price regulations impart stickiness to prices. This study analyzes the degree of response of three CPI subindex inflations -- freely determined, regulated, and mixed prices -- and of aggregate CPI inflation to anticipated and unanticipated monetary policies. The results reveal that freely determined prices and aggregate CPI show similar response but faster and larger adjustments than regulated prices to both anticipated and unanticipated monetary policies. The results imply that the extent to which the monetary policies can influence prices depends on the price inertia in various sectors. For the monetary authorities to effectively control inflation, they need to focus on price movements in various sectors.

Freely Determined versus Regulated Prices and the Policy Ineffectiveness Proposition

I. Introduction

The well known *policy ineffectiveness proposition* asserts that only unanticipated money supply growth has impacts on real economic variables, and that anticipated money supply growth has no real impacts. One of the premises crucial to upholding the validity of this proposition is the assumption of *perfectly flexible prices*. Under the rational expectation and flexible price assumptions, nominal prices respond equiproportionately to anticipated money supply changes, and thus, relative prices are unchanged, which results in the neutrality of real economic variables (Lucas 1972).

Most modern economies are comprised of markets with different degrees of price flexibilities (Duca 1987). Consequently, the assumption of perfectly flexible prices has been increasingly subject to criticism. Numerous cases of price sluggishness can be found in the real world economic settings. For example, Dexter et al. (1993), in an important and recent contribution to this literature, conclude that price regulations contribute to price rigidity. They note that administered and regulated prices for such items as public transportation, postal charges, utility rates, and property taxes tend to be relatively sticky, whereas freely determined prices for such items as food, clothing, insurance, and precious metals, tend to be very flexible. Phelps and Taylor (1977) and Fischer (1977) observe that long term contracts inject nominal rigidity. Gordon (1982) identifies that adjustment costs and decentralized decision making can prevent prices from instantaneous adjustments. Devadoss and Choi (1991) document that increased government intervention in agricultural markets through price-fixing policies such as price supports and storage schemes impart sluggishness to commodity prices.

Differing assumptions regarding price level adjustments to macroeconomic policy changes contribute to some of the long standing disputes between monetarists and Keynesians. Monetarists view that the economy is comprised of markets with perfectly flexible prices. On the contrary, the Keynesian economy is characterized by nominal rigidities. Perfect flexibility or stickiness of prices therefore has important implications for the conduct of monetary policy. Numerous studies (Fischer 1977; Phelps and Taylor 1977; Gordon 1982; Blinder and Mankiw 1984; and Duca 1987) have used nonclassical rational expectation models, in which expectations are rational but wages and prices are imperfectly flexible, to show that nominal rigidity paves way for the systematic monetary policy to affect real economic variables. Though earlier empirical work by Barro (1978) supported the policy ineffectiveness proposition, later studies by Mishkin (1982), Gordon (1982), and Cecchetti (1986), among others, have produced evidence rejecting the conclusion of this proposition.

Given the significance of price stickiness for the conduct of monetary policies, it is useful to study the degree of response of prices with differing flexibilities to anticipated and unanticipated monetary policies. In this study, we examine the effects of unsystematic and systematic money growths on three consumer price subindices and the aggregate CPI for the Canadian economy. The three subindices are freely determined prices, regulated prices, and mixed prices category.[1]

Section II presents the data and empirical model and reviews various methodologies found in the macroeconomic literature for testing the policy ineffectiveness proposition. Section III discusses the estimated results of a money forecasting equation and price equations. The money forecasting equation is used to decompose the actual money growth into perceived and unperceived components, which are used as explanatory variables in the

four price equations. The empirical results reveal that freely determined price inflation shows faster and larger adjustments to unsystematic and systematic money growth than regulated price inflation. Concluding remarks and policy implications follow in section IV.

II. Data and the Model

The focus of this section is to briefly describe the data used in the analysis and present the empirical model and methodologies employed in the estimation.

Data: Dexter et al. (1993), by employing an extensive data collection effort for the Canadian economy, classified all the items included in the Consumer Price Index computation into three categories: freely determined, regulated, and mixed.[2,3] Freely determined prices are those that respond to market forces within a quarter. Regulated prices are those that would take more than a quarter to respond to market forces. Items whose prices moved between unfettered and regulated prices during the study period 1968-89, or items whose prices seem regulated only in some provinces are considered to be a mixed category. Consumer price subindices for these three categories with 1981 as the base year were constructed using appropriate weighing schemes for all items by accounting for the weight changes over the years.

The freely determined items constituted 48-59 percent[4] of the total CPI basket of goods and cover such items as most foods, clothing, insurance, household repairs, furniture, automobile servicing, pharmaceuticals and personal care items, and recreation and reading. The regulated items include 18-20 percent of total CPI basket of goods and cover such items as public transportation, postal charges, vehicle registration, utility rates, property taxes, public education, liquor, tobacco, sugar, dairy, and poultry. The mixed category constitutes

17-22 percent of total CPI basket of goods and includes such items as rent, mortgage interest cost, gas and oil, and inner-city transportation.

Dexter et al. (1993) were the first to establish the connection between price regulations and price stickiness. As explained in that study, because of the complexity in developing the required data, there has not been previous work in examining the relationships between money and regulated and unfettered prices.

The data for four price series -- freely determined prices, regulated prices, mixed category prices, and the aggregate CPI, and M2 money supply are obtained from Professor Albert S. Dexter. The three-month treasury bill rate and gross domestic product, which are used in the money forecasting equation estimation, are collected from the International Financial Statistics. The data for all the variables are quarterly and cover the period 1968:1 - 1989:3.

Model: The framework used in the empirical analysis involves estimation of a money forecasting equation or feedback rules and reduced-form price equations.

The specification used to forecast the money growth is represented by the following equation:

$$MG_t = Z_{t-1}\phi + u_t \qquad (1)$$

where MG_t is the actual money growth in period t, Z_{t-1} is the vector of observable economic variables relevant to forecasting MG_t, ϕ is the corresponding coefficient vector, and u_t is the disturbance term assumed to be generated by a temporally independent white noise and thus uncorrelated to independent variables. The policy forecasting equation is used to identify the predictable and random portions of the actual money growth. The predicted values represent

the perceived policy measures and the residuals, the unperceived measures. Thus, the anticipated money growth denoted as MG_t^a is equal to $Z_{t-1}\phi$, and the unanticipated money growth, MG_t^u,is equal to $MG_t - Z_{t-1}\phi = u_t$.

First, the reduced-form price equations are estimated with inflation rates as dependent variables and anticipated money growths as explanatory variables:

$$\dot{P}_{it} = c + \sum_{j=0}^{n} \alpha_j MG_{t-j}^a + \eta_t \qquad (2)$$

where $\dot{P}_{it}$ is the seasonally adjusted quarterly rate of inflation of the i^{th} price index (i refers to aggregate CPI, freely determined, regulated, or mixed price index). Second, the price equations are estimated with unanticipated money growths as explanatory variables:

$$\dot{P}_{it} = b + \sum_{j=0}^{n} \beta_j MG_{t-j}^u + \epsilon_t \qquad (3)$$

Finally, price equations are estimated with unanticipated and anticipated money growths as explanatory variables:

$$\dot{P}_{it} = d + \sum_{j=0}^{n} \gamma_j MG_{t-j}^u + \sum_{j=0}^{n} \theta_j MG_{t-j}^a + \xi_t \qquad (4)$$

The estimation approach used in the pioneer work of Barro (1978) in testing the policy ineffectiveness proposition is a two-step ordinary least squares (2SOLS). As discussed above, in the first step of the 2SOLS, the feedback rule equation is specified and estimated. In the second step, the predicted and residual values from the feedback rule equation are used, respectively, as the systematic and unsystematic money growths in the estimation of reduced-form price equations. Therefore, in the second step, the price equations are estimated using the "generated regressors" from the money forecasting equation. Pagan (1984) examined the

econometric problems with the 2SOLS and concluded that 2SOLS estimates of standard errors are biased against acceptance of the policy ineffectiveness proposition. Thus, a correct computation of standard errors will not reverse Barro's conclusions.

Mishkin (1982) noted that the 2SOLS ignores possible covariances between the parameters across the policy forecasting and price equations. To remedy this problem, he developed a full information maximum likelihood (FIML) procedure in which the forecasting and price equations are simultaneously estimated using a joint nonlinear estimation. Mishkin (1982, p.46) concluded that the difference in the results between his FIML method and Barro's 2SOLS are not due to estimation techniques, but rather are due to the inclusion of additional lags of money growths in the reduced-form equations. Furthermore, a Monte Carlo simulation experiment by Hoffman et al. (1984) showed that the FIML procedure favored overrejection of the null hypothesis of the policy ineffectiveness proposition. In light of the conclusions of Pagan (1984) and Hoffman et al. (1984), and since we use longer lags of money growths in the reduced-form equations as suggested by Mishkin (1982), 2SOLS is chosen for the estimations.[5]

III. Empirical Analysis

The objective of this section is to present the estimated results of the money growth equation and the four inflation equations.

Money Forecasting Equation

M2 money growth is used to represent the monetary policy stimulus.[6] The first step in testing the hypothesis of policy ineffectiveness is to estimate the feedback rules for the money growth. Mishkin (1982) points out, in specifying the policy forecasting equations, that

an atheoretical statistical model is superior to the one implied by the economic theory because exclusion of any useful information based on theoretical grounds in predicting policy actions is not appropriate. As in Mishkin (1982), the specifications of the monetary feedback rules are based on the notion that agents use all the available and pertinent macroeconomic information in predicting the policy actions. Thus we considered the following potential explanatory variables in forecasting the M2 money growth: lagged values of M2 money growth, budget deficit, unemployment rate, GDP growth, inflation rate, exchange rate, balance of payments on current accounts, and the three-month treasury bill rate. These variables not only have macroeconomic relevance but also are readily available to the public to form expectations of future monetary policy actions.

In estimating the feedback equation an appropriate lag length needs to be specified. Because monetary policies are formulated based on the performance of the macroeconomic variables in the immediate preceding quarters, four to eight lags were considered for each of these variables. Furthermore, we considered a common lag length for all the explanatory variables. The choice of a common lag length prevents the researcher from searching for alternative specifications that would produce results confirming any a priori belief. Based on Theil's $\bar{R}^2$ criterion, a lag length of seven yielded the highest $\bar{R}^2$. Following Mishkin (1982), we used multivariate Granger tests to determine the significance of these variables in the money supply forecast equation. An F-test, under the null hypothesis that the seven coefficients of the individual policy response variables are jointly zero, was carried out. On the basis of this criterion, the M2 money growth (MG) equation is estimated as a function of the lagged money growths, GDP growths, and the change in the three-month treasury bill rate (TBR).

The money forecasting equation is estimated over the period 1970:1 - 1989:3. Though the data for all the variables cover the period 1968:1 - 1989:3, one observation is lost in the percentage computation, and an additional seven observations are used up because of the seven lags in the feedback rules equation, leaving us with the time period of 1970:1 - 1989:3 for the money growth forecasting equation. Table 1 reports the OLS estimates of the money supply growth equation with t-statistics and F-statistics along with the significance levels. The Durbin-Watson statistic of 1.92 indicates no evidence of serial correlation.

The F-statistics provide the explanatory power of the seven lagged values of each variable in predicting the money supply growth by testing the null hypothesis that the coefficients of each of the lagged set of regressors are not different from zero. The computed F-statistics indicate that lagged money growths and interest rates are significant at the 1% level and GDP is significant at the 7% level. Thus, these variables play important roles in predicting the money supply growth. The Bank of Canada Act mandates that the Bank regulate monetary policies "in the best interest of the economic life of the nation." Consequently, the Bank's policy stance is counter-cyclical, resulting from the close monitoring of the economic performance. Thus, the Central Bank's contractionary/ expansionary monetary policies in response to economic booms/slumps are captured by the lagged values of GDP growths. The lagged values of the treasury bill rate capture the policy changes pursued by the Central Bank in response to interest rate changes. Put differently, the significance of interest rates in the feedback rule equation underscore the Bank's ability to design the future course of money supply by controlling the short-term interest rates. The importance of economic growth and interest rates in explaining the money supply process emphasizes, as noted by Pesando and Smith (1976), that the Bank of Canada is departing

from the "monetarist approach" in formulating the monetary policy. The lagged values of the money growths capture the persistence effects not explained by other variables.

Effects of Anticipated and Unanticipated Monetary Policies:

The predicted values and residuals from the money forecasting equation represent the perceived (MG_t^a) and unperceived (MG_t^u) monetary policies, respectively. The effects of anticipated monetary policies on three CPI subindex inflations -- freely determined, regulated, and mixed -- and aggregate CPI inflation are estimated by following the specification in equation (2). The effects of unanticipated monetary policies on these four variables are estimated using the specification in equation (3). Finally, the effects of both anticipated and unanticipated monetary policies are determined by estimating equation (4). A dummy variable of one for the period 1975:4 - 1978:1 and zero for other periods is included in all the equations to account for the price control regime undertaken by the Anti Inflation Board. All the equations are estimated with 15 lags and with a fourth degree polynomial distributed lags (PDL) with no end point constraints as in Dexter et al. (1993) and also without PDL restrictions. Both methods produce similar results as in their study. Because additional 15 observations are used up due to 15 lags, the inflation equations are estimated over the period 1973:4 - 1989:3.[7]

Table 2 presents the estimated results of the systematic monetary policy effects on inflation in three CPI components -- freely determined, regulated, and mixed -- and on total CPI. The relative impacts of systematic money growths on four inflation variables can be seen from the differences in R^2 and standard errors. The policy ineffectiveness proposition asserts that prices change equiproportionately to the anticipated money supply changes. The

estimated sum of the anticipated money growth coefficients in Table 2 show that a one percent change in money supply causes a 0.94 percent change in freely determined prices and a 0.66 percent change in regulated prices. This result does not support the conclusions of the policy ineffectiveness proposition because the anticipated money growths bring *approximately* equiproportional change in unfettered prices, maintaining the results of long-run neutrality, but less than equiproportional change in regulated prices. Furthermore, judging from the values of the mean lag coefficients, the average length of time it takes for the freely determined prices to respond to systematic monetary policies is approximately a year compared to a year and three quarters for the regulated prices. Thus, unfettered prices show not only larger, but also quicker, response to perceived monetary policy than do the regulated prices. This is because the unfettered prices, which are highly flexible, are able to adjust relatively quickly to systematic monetary policies, whereas regulated prices, which are administratively set and are likely to be changed less frequently, respond not only weakly, but also relatively slowly to anticipated monetary policies. This is because the administrative agents who set the prices in the regulated markets generally need additional time to reset the prices because they often need to get approval from higher administration, a board of directors, or from government agencies for changing the prices.

Anticipated monetary policies have the largest effect on mixed price inflation. This may be related to the fact that mixed prices include those CPI components which are unfettered in some provinces and regulated in other provinces and also those components which might have switched between regulated and freely determined. As prices switch, the built up pressure on the price control in the regulated market is released, resulting in a marked changes in prices. Consequently, mixed price inflation has considerable variation

and shows statistically the largest responses, which is also evident from the larger magnitudes of the individual coefficients, including some negative estimates.

It is worth noting that the smaller response of regulated price inflation and larger response of mixed price inflation seem to have offsetting effects, which result in aggregate CPI, similar to unfettered price, responding equiproportionally to the systematic monetary policies. Thus, though the regulated and mixed prices do not maintain the long run neutrality results of equiproportional changes, the aggregate CPI and freely determined prices tend to show the long run proportional changes with respect to the systematic monetary policies. This result corroborates Blinder and Mankiw's (1984) and Duca (1987) findings that aggregate level tests of the policy ineffectiveness proposition can obscure the true impacts of the perceived monetary policies at the sectoral levels, because aggregate level tests may net out the differing impacts of the perceived monetary policies at the various sectors. The mean lag for the aggregate CPI is between the lag for freely determined prices and that for regulated prices, and is similar to the lag found by Dexter et al. (1993) for the total money growth.

The dummy variable, which represents the Anti Inflation Board's price control regime in the mid 1970s, has significant negative effects on aggregate CPI, mixed price, and freely determined price (at the 10% level) inflations and insignificant effects on regulated prices. This result suggests that since regulated prices were mostly administratively set and relatively rigid, the Anti Inflation Board's action had lesser effect on the regulated prices than on other prices.

Comparison of the results of the anticipated monetary effects in Table 2 to those of Dexter et al. (1973) provide strikingly similar qualitative conclusions in that a) the freely

determined price inflation show larger and faster response than regulated price inflation, b) relative effects on freely determined price and total CPI inflation are comparable in both studies, and c) mixed CPI tends to show the largest response among the four inflation variables. The similarity of the perceived monetary policy effects in this study and the total monetary effects in Dexter et al. (1983) is not surprising because anticipated monetary growth forms the significant portion of the total money growth.

Table 3 presents the estimated results of unsystematic money growth effects. The relative impacts of unperceived money growths on four inflation variables can be seen from the differences in R^2, standard errors, and significant levels of coefficient estimates. The unanticipated money growths have positive effects on all four inflation variables as indicated by the sum of the coefficients and positive values of most of the individual coefficients. Comparisons of the effects of unsystematic money growths on unfettered and regulated price changes reveal the following results. First, the sum of the unanticipated money effects on unfettered price inflation is larger than that of the regulated price inflation. Also, the t-statistic of the sum of the coefficients in the freely determined price equation are more than double of that in the regulated price equation. Second, more coefficient estimates are significant in the freely determined price equation than in the regulated price equation (10 vs 4 coefficients at the 10 % significant level), which is also reflected in the higher R^2 in the former than in the latter. Third, the freely determined price equation has only two negative coefficient estimates, whereas the regulated price equation has six negative coefficient estimates. Fourth, values of mean lag coefficients indicate that the average length of time it takes for the unanticipated money to affect the freely determined prices is 6.4 quarters

compared to 12 quarters for the regulated prices, implying the freely determined prices respond much faster than the regulated prices.

The response of aggregate CPI to the unperceived money shocks is very similar to that of unfettered prices in that the coefficient sums in both cases are almost identical with large t-statistics, and the mean lags differ only by 1.3 quarters. As in the case of perceived monetary effects, the larger response of mixed prices seem to offset the smaller response of regulated prices, with the result that aggregate CPI response is similar to that of freely determined prices.

Comparisons of systematic and unsystematic effects in tables 2 and 3 show several insightful results. First, the mean lag values reveal that all four inflation variables respond more rapidly to perceived money shocks than to unperceived money shocks. Stated differently, the effects of unanticipated monetary policies are spread over a longer period of time than those of anticipated monetary policies. This is because unanticipated money, because it is unperceived by the agents, takes time to operate through the market structure to influence the prices, while the anticipated money, being fully perceived by the agents, is incorporated into the decision process swiftly and thus reflected more quickly in the price changes.

Second, both the unanticipated and anticipated policies have permanent impacts on all four inflations since the sum of the coefficient estimates are statistically significant at the one percent level in all cases. However, the cumulative effects of unanticipated monetary policies are significantly greater than one and more than double the values of those of anticipated monetary policies in all four cases. The pattern of such impacts can be related to the source of the unanticipated money supply shocks. According to the theoretical results of the partial

information-localized market framework of the rational expectation models put forth by Barro (1976) and Hercowitz (1981), the unanticipated money supply is misinterpreted as market-specific shocks because market participants with imperfect information cannot distinguish between aggregate and market-specific shocks. As a result, unanticipated money interferes with market signals, and nominal movements associated with the unanticipated money are misinterpreted as relative price changes associated with a shift in demand. Consequently, market participants respond by bidding up prices substantially, which persists over a longer period. This change in prices due to unanticipated money shocks is the main cause for the response of real economic variables as elucidated in the policy ineffectiveness proposition. On the other hand, anticipated monetary policies are correctly identified as macro policy changes and agents do not confuse them with market-specific changes. Consequently, market participants try to accommodate the anticipated monetary policies by changing the prices accordingly.

Third, the differences in the response of inflation to perceived monetary policies in various markets (e.g. freely determined versus regulated) is mainly due to the differences in the degree of price flexibilities. Thus, our results corroborate the conclusions of the nonclassical rational expectation model in that the unperceived monetary policies do have larger effects than the anticipated monetary policies (as in the new classical model); however, in contrast to the results of the new classical model, the hypothesis of the policy ineffectiveness proposition is not supported because anticipated monetary policy does not have equiproportional effects on regulated and mixed prices.

Fourth, the regression results in both tables 2 and 3 show that R^2 (standard errors) for the aggregate CPI is higher (smaller) than for any of the three subindices. This may suggest

that the central bank, in formulating monetary policies, focuses more heavily on the aggregate prices than on prices in various sectors and industries.[8] This is because movements in aggregate prices are frequently reported in the popular press and targeted by the central bank.

Table 4 presents the results of the impacts of both unanticipated and anticipated monetary policies on four inflation variables. Judging from the R^2 and standard errors, the freely determined prices and aggregate CPI perform better than regulated and mixed price equations. Examination of coefficient sums indicates that they are all positive for both unanticipated and anticipated money growths. Furthermore, as in Tables 2 and 3, the unanticipated money growths have larger effects than the anticipated money growths on all four equations. However, except for the sum of unanticipated money growth effects in the regulated price equation, all other coefficient sums are considerably smaller than corresponding sums in table 2 and 3. This is because both unsystematic and systematic monetary policies are included in the estimation, and consequently variability in inflations is now explained by both types of money growths. As one would expect, the sum of the unperceived and perceived monetary policy effects on freely determined prices (2.363) is higher than that of regulated prices (2.027).

IV. Conclusions

This paper estimates the effects of systematic and unsystematic monetary policies on three CPI subindex inflations -- freely determined, regulated, and mixed -- and on aggregate CPI inflation. The important conclusions of this study are that the links between both anticipated and unanticipated money and freely determined prices are stronger than those for regulated prices. The aggregate CPI and freely determined prices have very similar links to

the anticipated and unanticipated money, and both have equiproportional links to both anticipated monetary policies. In contrast, regulated prices have a less than equiproportional link to anticipated monetary policies.

The bank of Canada considers monetary aggregate as the chief determinant of inflation. Consequently, one of the objectives of the bank is to achieve price stability (Freedman 1991). The policy implications of this study are that the monetary policies do affect the price level. However, the extent to which the monetary policies can influence the price depends on the price inertia in various markets. For the monetary authorities to effectively control inflation, they need to have a good understanding of price adjustment mechanisms in various markets. This understanding is also crucial if the monetary authorities want to stabilize real economic variables such as real GNP, and unemployment. Price sluggishness in various markets and the lack of understanding of the price adjustments by policy makers can explain why prices are unstable, why the economy recovers slowly from recession, and why counter-active policies are often ineffective in curing recession. Furthermore, as noted by Evans (1983), instability in prices will lead to lower output.

Table 1. Estimated Results of Monetary Policy Equation, 1970:1 - 1989:3.

Regressors	Estimates	t-statistics	F-statistics	Significant Level
Constant	0.030	1.62		
MG_{t-1}	0.679	4.87		
MG_{t-2}	-0.113	-0.72		
MG_{t-3}	-0.029	-0.18		
MG_{t-4}	-0.246	-1.59	5.12	0.00
MG_{t-5}	0.415	2.79		
MG_{t-6}	-0.174	-1.16		
MG_{t-7}	-0.068	-0.54		
GDP_{t-1}	0.243	2.73		
GDP_{t-2}	-0.022	-0.22		
GDP_{t-3}	0.775	0.80		
GDP_{t-4}	-0.056	-0.55	1.96	0.07
GDP_{t-5}	0.047	0.46		
GDP_{t-6}	0.180	1.74		
GDP_{t-7}	-0.181	-1.89		
INT_{t-1}	-0.007	-1.59		
INT_{t-2}	-0.002	-0.34		
INT_{t-3}	0.017	3.81		
INT_{t-4}	-0.010	-1.93	3.24	0.00
INT_{t-5}	0.004	0.88		
INT_{t-6}	0.004	1.03		
INT_{t-7}	0.002	0.35		
$R/\bar{R}^2$	0.67/0.55			
DW	1.92			
SEE	0.032			

Notes: MG_t = M2 money supply growth, GDP_t = gross domestic product growth rates, INT_t = change in three-month Treasury bill rate. The approximate critical values of t-statistics are 1.645 at the 10%, 1.960 at the 5%, and 2.576 at the 1% levels. The F-statistics test the null hypothesis that the coefficients on the seven lagged values of each of the explanatory variables are equal to zero. The degrees of freedom of F-statistics are 7 and 57, and approximate critical values of F-statistics are 2.17 at the 5% level and 2.95 at the 1% level.

Table 2. Effects of Anticipated Monetary Policies on CPI components and Aggregate CPI Inflation, 1973:4 - 1989:3.

	Freely Determined	Regulated	Mixed	Aggregate CPI
Intercept	-0.040(-2.455)	-0.020(-0.863)	-0.120(-3.450)	-0.061(-4.881)
Dum	-0.016(-1.768)	-0.019(-1.455)	-0.043(-2.182)	-0.023(-3.352)
MG^a_t	0.209(2.239)	-0.033(-0.245)	-0.040(-0.200)	0.194(2.726)
MG^a_{t-1}	0.322(3.111)	-0.284(-1.906)	0.449(2.032)	0.205(2.593)
MG^a_{t-2}	0.092(0.871)	0.423(2.785)	0.157(0.695)	0.076(0.946)
MG^a_{t-3}	-0.094(-0.884)	0.345(2.259)	0.201(0.884)	0.086(1.057)
MG^a_{t-4}	0.056(0.525)	0.036(0.234)	-0.182(-.801)	0.090(1.106)
MG^a_{t-5}	0.172(1.638)	-0.185(-1.232)	0.117(0.523)	0.091(1.142)
MG^a_{t-6}	0.004(0.040)	0.048(0.321)	-0.096(-0.434)	0.006(0.075)
MG^a_{t-7}	0.090(0.865)	0.287(1.931)	0.299(1.356)	0.143(1.808)
MG^a_{t-8}	-0.038(-0.345)	0.029(0.185)	0.366(1.573)	0.115(1.380)
MG^a_{t-9}	0.066(0.650)	-0.174(-1.189)	0.392(1.801)	-0.034(-0.434)
MG^a_{t-10}	-0.109(-1.048)	0.139(0.932)	-0.202(-0.907)	-0.082(-1.035)
MG^a_{t-11}	-0.057(-0.538)	0.089(0.586)	0.414(1.841)	0.105(1.301)
MG^a_{t-12}	0.009(0.087)	0.093(0.615)	-0.158(-0.701)	0.023(0.284)
MG^a_{t-13}	0.043(0.408)	-0.052(-0.343)	-0.153(-0.684)	0.022(0.278)
MG^a_{t-14}	0.151(1.404)	0.046(0.301)	-0.322(-1.404)	0.018(0.224)
MG^a_{t-15}	0.025(0.256)	0.047(0.346)	0.467(2.290)	0.125(1.709)
Coef. Sum	0.941(6.556)	0.655(4.154)	1.709(5.585)	1.083(10.803)
Mean Lag	3.916	6.955	6.055	5.157
$R^2/\bar{R}^2$	0.670/0.548	0.511/0.330	0.571/0.412	0.802/0.729
SEE	0.021	0.031	0.045	0.016

Notes: The t-statistics are given in parenthesis. Coef. Sum is the sum of unanticipated money growth coefficient estimates. SEE is the estimated standard error.

Table 3. Effects of Unanticipated Monetary Policies on CPI components and Aggregate CPI Inflation, 1973:4 - 1989:3.

	Freely Determined	Regulated	Mixed	Aggregate CPI
Intercept	0.067(23.501)	0.073(19.168)	0.068(10.563)	0.071(29.289)
Dum	-0.010(-1.270)	0.008(0.807)	0.004(0.229)	-0.002(-0.306)
MG^u_t	0.205(1.836)	-0.379(-2.540)	-0.288(-1.150)	-0.065(-0.682)
MG^u_{t-1}	0.193(1.831)	-0.408(-0.290)	-0.152(-0.641)	0.128(1.423)
MG^u_{t-2}	0.247(2.336)	-0.768(-0.544)	0.189(0.794)	0.270(2.993)
MG^u_{t-3}	0.303(2.848)	-0.553(-0.389)	-0.218(-0.914)	0.081(0.888)
MG^u_{t-4}	0.305(2.840)	0.055(0.384)	0.491(2.040)	0.259(2.826)
MG^u_{t-5}	0.219(2.096)	0.510(3.656)	0.122(0.519)	0.302(3.383)
MG^u_{t-6}	0.318(3.143)	0.056(0.412)	0.195(0.857)	0.326(3.767)
MG^u_{t-7}	0.300(2.966)	-0.147(-1.088)	0.191(0.841)	0.278(3.210)
MG^u_{t-8}	0.234(2.281)	0.467(3.414)	0.378(1.645)	0.311(3.553)
MG^u_{t-9}	-0.016(-0.156)	0.488(3.515)	0.802(3.434)	0.243(2.740)
MG^u_{t-10}	0.142(1.345)	0.028(0.198)	0.688(2.897)	0.150(1.657)
MG^u_{t-11}	0.018(0.172)	0.139(0.968)	0.454(1.886)	0.166(1.806)
MG^u_{t-12}	-0.025(-0.230)	0.235(1.637)	0.516(2.137)	0.114(1.242)
MG^u_{t-13}	0.128(1.179)	0.207(1.434)	0.001(0.005)	0.086(0.929)
MG^u_{t-14}	0.266(2.449)	-0.020(-0.140)	0.495(2.030)	0.300(3.233)
MG^u_{t-15}	0.207(1.868)	0.241(1.630)	-0.267(-1.072)	0.093(0.981)
Coef. Sum	3.042(8.938)	1.707(3.755)	3.597(4.706)	3.041(10.454)
Mean Lag	6.393	12.006	9.982	7.705
$R^2/\bar{R}^2$	0.688/0.573	0.599/0.450	0.550/0.383	0.765/0.678
SEE	0.021	0.028	0.099	0.018

Notes: The t-statistics are given in parenthesis. Coef. Sum is the sum of unanticipated money growth coefficient estimates. SEE is the estimated standard error.

Table 4. Effects of Unanticipated and Anticipated Monetary Policies on CPI components and Aggregate CPI Inflation, 1973:4 - 1989:3.

	Freely Determined	Regulated	Mixed	Aggregate CPI
Intercept	0.013(0.389)	0.068(1.213)	-0.045(-0.558)	-0.026(-0.997)
Dum	-0.017(-1.514)	0.001(0.516)	-0.018(-0.666)	-0.022(-2.504)
MG^u_t	0.185(2.164)	-0.257(-1.778)	-0.309(-1.471)	-0.0002(-0.003)
MG^u_{t-1}	0.215(3.248)	-0.082(-0.731)	-0.190(-1.172)	0.084(1.603)
MG^u_{t-2}	0.218(3.070)	0.023(0.195)	-0.083(-0.474)	0.134(2.378)
MG^u_{t-3}	0.202(2.903)	0.080(0.679)	-0.014(0.081)	0.157(2.842)
MG^u_{t-4}	0.174(2.660)	0.106(0.964)	0.099(0.620)	0.160(3.094)
MG^u_{t-5}	0.137(2.110)	0.117(1.064)	0.173(1.081)	0.148(2.880)
MG^u_{t-6}	0.099(1.403)	0.123(1.037)	0.233(1.346)	0.128(2.294)
MG^u_{t-7}	0.063(0.817)	0.133(1.027)	0.278(1.471)	0.103(1.688)
MG^u_{t-8}	0.033(0.411)	0.151(1.103)	0.306(1.534)	0.077(1.198)
MG^u_{t-9}	0.014(0.168)	0.179(1.262)	0.316(1.534)	0.054(0.812)
MG^u_{t-10}	0.008(0.088)	0.213(1.445)	0.304(1.420)	0.036(0.515)
MG^u_{t-11}	0.017(0.179)	0.247(1.574)	0.267(1.169)	0.024(0.321)
MG^u_{t-12}	0.043(0.433)	0.274(1.636)	0.202(0.831)	0.019(0.247)
MG^u_{t-13}	0.088(0.880)	0.278(1.658)	0.105(0.431)	0.023(0.291)
MG^u_{t-14}	0.151(1.614)	0.246(1.553)	-0.028(-0.122)	0.034(0.456)
MG^u_{t-15}	0.235(2.104)	0.156(0.830)	-0.202(-0.739)	0.051(0.579)
Coef. Sum	1.881(2.442)	1.989(1.530)	1.485(0.785)	1.231(2.019)
Mean Lag	6.175	11.685	10.727	5.833
MG^a_t	0.044(0.526)	-0.127(-0.889)	0.318(1.533)	0.105(1.568)
MG^a_{t-1}	0.079(2.195)	-0.012(-0.190)	0.066(0.748)	0.082(2.869)
MG^a_{t-2}	0.092(2.400)	0.051(0.789)	-0.044(-0.474)	0.072(2.366)
MG^a_{t-3}	0.087(2.146)	0.074(1.074)	-0.061(-0.612)	0.068(2.112)
MG^a_{t-4}	0.072(2.019)	0.069(1.140)	-0.023(-0.263)	0.067(2.382)
MG^a_{t-5}	0.050(1.644)	0.046(0.882)	0.038(0.506)	0.066(2.726)

Table 4. Effects of Unanticipated and Anticipated Monetary Policies on CPI components and Aggregate CPI Inflation, 1973:4 - 1989:3 (Continued.)

	Freely Determined	Regulated	Mixed	Aggregate CPI
MG^a_{t-6}	0.027(0.854)	0.014(0.263)	0.097(1.275)	0.063(2.536)
MG^a_{t-7}	0.004(0.124)	-0.019(-0.330)	0.138(1.632)	0.056(2.037)
MG^a_{t-8}	-0.014(-0.384)	-0.047(-0.776)	0.150(1.699)	0.045(1.588)
MG^a_{t-9}	-0.026(-0.726)	-0.065(-1.100)	0.131(1.518)	0.033(1.176)
MG^a_{t-10}	-0.029(-0.839)	-0.070(-1.186)	0.086(1.000)	0.020(0.729)
MG^a_{t-11}	-0.024(-0.642)	-0.059(-0.922)	0.027(0.290)	0.011(0.364)
MG^a_{t-12}	-0.010(-0.259)	-0.032(-0.465)	-0.026(-0.257)	0.009(0.288)
MG^a_{t-13}	0.012(0.333)	0.011(0.185)	-0.045(-0.517)	0.021(0.738)
MG^a_{t-14}	0.041(1.723)	0.068(1.676)	0.004(0.068)	0.051(2.710)
MG^a_{t-15}	0.076(1.125)	0.135(1.180)	0.163(0.979)	0.109(2.036)
Coef. Sum	0.482(1.609)	0.036(0.071)	1.019(1.387)	0.877(3.702)
Mean Lag	4.358	33.204	6.455	6.273
$R^2/\bar{R}^2$	0.708/0.646	0.497/0.390	0.401/0.274	0.812/0.772
SEE	0.018	0.111	0.052	0.012

Notes: The t-statistics are given in parenthesis. Coef. Sum is the sum of unanticipated money growth coefficient estimates. SEE is the estimated standard error.

Endnotes

1. A brief discussion about the construction of these series are explained in the next section. Extensive details of how these indices were constructed can be found in Dexter et al. (1993).

2. Dexter et al. (1993) had actually included another category termed as 'Don't Know', which included the items that do not fit in the first three categories. Since the items under this category constituted only a very small portion of the CPI basket of goods, they did not construct a separate subindex for this category.

3. A detailed appendix, available from Dexter et al. (1993), provides very extensive information of the survey and procedures used in constructing the price indices for these three categories.

4. The variation in the percentage is due to changes in the composition of the basket of goods.

5. Cecchetti (1986) implements a more general procedure that tests the neutrality of money under incomplete information set in the prediction equation and time-varying coefficients in the output equation.

6. M1 money growth is also employed in this study. The estimated results of M1 money forecasting equation and the effects of M1 systematic and unsystematic money growths on four inflation variables are available from the author upon request.

7. Because of the seven lags in the money forecasting equation, the estimation period for the price equations are seven quarters shorter than the 1972:1-1989:3 period used in Dexter et al. (1993)

8. Dexter et al. (1993) provide other explanation for this result, i.e., the domination of real cash balance effect over the substitution effect.

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