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THE CREDIBILITY OF MONETARY TARGET ANNOUNCEMENTS: AN EMPIRICAL EVALUATION

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The Credibility of Monetary Target Announcements: An Empirical Evaluation

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Despite the vast growth in the theoretical literature on the importance of credibility and reputation effects in the conduct of monetary and fiscal policy, there is little empirical evidence on these issues available to date. In Weber (1988c) the empirical relevance of the game–theoretical models of Backus & Driffill [(1985a), (1985b)] is evaluated and the estimated counterinflation reputation measures are found to be fairly consistent with a large number of purely descriptive papers on this issue. The present paper extents this work to a second class of important game–theoretical credibility models; it aims at empirically estimating the credibility measures of Cukierman & Meltzer [(1983), (1986a), (1986b), (1986c)], which are derived from the public's expectations about the future course of monetary policy. These rational expectations critically depend on two specific aspects of the model: firstly, the policymaker's preferences for low money growth and economic stimulus through surprise money growth are supposed to change gradually over time and monetary control is assumed imperfect, as reflected by transitory control errors. As a result, the public becomes aware of changes in policy objectives only gradually by observing past monetary growth. Secondly, the policymakers are required to make announcements about planned money growth, but are not forced to issue precise announcements or to stick to the announced policies. As a result, these (possibly biased) monetary announcements represent no more than a piece of contemporary information, which the public may or may not use in its expectation formation process. Optimal expectations under incomplete contemporary information typically result as a weighted average of the expectation of money growth conditional on past information and additionally on the current money growth announcement. Under perfectly credible announcements, the weight attached to these announcements will be equal to one, and under non–credible announcements will tend towards zero. The paper presents empirical estimates of this credibility measure for the EMS–member countries Germany, France, Italy and the Netherlands as well as for the United States, Japan, Switzerland, the United Kingdom, Canada and Australia.

1.Introduction

In late 1974, the German Bundesbank was the first central bank to announce a formal monetary target in terms of the growth of a monetary aggregate for a period as long as a year. This example was followed by the Federal Reserve of the United States in early 1975, where the initiative for the move to monetary growth announcements came from the legislature rather than from the central bank. Also in

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1975, the Swiss and Canadian central banks announced formal monetary targets and in 1976 the monetary authorities of the United Kingdom and France followed suit.

In addition to these six countries with formally announced monetary aggregate targets, which constitute the focus of the paper, a number of borderline cases will also be considered: the Italian central bank chose a total domestic credit aggregate rather than a monetary aggregate as a formal intermediate target for monetary policy after 1974 but switched to monetary quantity targets in 1986. The Australian central bank since 1976 has announced 'guidelines' for monetary aggregates and, since 1978, the Bank of Japan has made 'projections' for a monetary aggregate. Finally, the Dutch Central Bank after early 1977 focused on a national liquidity ratio, defined in terms of a monetary aggregate relative to national income.

In the present study all the cases in the second group will be considered and are treated identically to those in the first group in order to facilitate an international comparison. This procedure, of course, can be criticized on various grounds: with respect to the Netherlands it is unclear whether the monetary authority actively seeks to control the monetary aggregate or national income to achieve the desired liquidity ratio in the long run. In the cases of Japan and Australia it is uncertain whether or not the actual monetary policy is subsequently adjusted to try and validate the 'projections' or 'guidelines' for the monetary aggregates.

A further drawback of this direct international comparison is given by the fact that the different countries under study focus on different monetary aggregates with different degrees of potential controllability from the monetary authority. Among the countries announcing target growth rates for narrowly controllable monetary aggregates, the Swiss National Bank focuses on a monetary base target, over which it has almost perfect control. Wider and less directly controllable monetary aggregates were targeted by both Canada and the United States, who announced growth targets for M1, while France, the Netherlands and again the United States announced growth targets for M2. Broadly defined monetary aggregates were targeted by Japan (M2 plus certificates of deposits), the United Kingdom (Sterling M3), Australia (M3) and again the United States (M2,M3). An intermediate case is the German central bank money (CBM) target, which comprisses reserve requirements on the components of M3 and hence is broadly defined but more directly controllable than the cases above. Finally, Italy targeted ceilings for total domestic credit (TDC), which is not a monetary but a credit aggregate.

A final complication for an empirical evaluation and comparison of monetary quantity target announcements since the mid seventies is given by the frequent shifts between different targeted monetary aggregates and by the transitory (or permanent) abolition of formal money growth target announcements.

Minor changes in the definition of the targeted monetary aggregate were observable in France (M2, M2R) and the United Kingdom (Sterling M3, M3). These minor changes were accounted for in this study by trying to use announcements for one monetary aggregate consistently throughout the sample where possible.[2]

Major shifts between different monetary aggregates took place in Switzerland, Germany, Italy and again in France and in the United Kingdom. The Swiss central bank focused on M1 targets at the beginning of its target announcements between 1975 and 1978, abolished target announcements altogether in 1979 and announced targets for the monetary base (MB) for 1980 and for the adjusted monetary base (MBA) between 1981 and 1988, as well as M3 after 1987. The French central bank announced targets for M2 from 1977 until 1982, for M2R in 1984 and 1985, for M3 in 1986 and for M2 again after January 1987. The German Bundesbank switched from announcing targets for the central bank money stock (CBM) between 1975 and 1987 to announcing targets for M3 for 1988 and 1989. The monetary authority of the United Kingdom announced targets for M3 from April 1976 until March 1987 and for M0 from April 1987 onwards. The Italian central bank switched from announcing

[2]Note that the effects of such minor shifts in the definition of broader monetary aggregates are stronger when levels rather than average annual growth rates, like in the present study, are analysed. For the United Kingdom target growth rates for M3 were used throughout, while for France no adjustment was made. Hence, some reservations with respect to the estimates for France between 1984 and 1986 are in order.

targets for total domestic credit (TDC) ceilings between 1974 and 1987 to also announcing targets growth rates for M2 after 1984. As a result of the more recent discontinuities in Germany, the United Kingdom, the United States and Italy, the present paper only analyses the effects of announcements before end of 1987.[3] Furthermore, in the case of the earlier discontinuities in Switzerland, only the credibility of the Swiss adjusted monetary base target (MBA) announcements between January 1981 and December 1987 is analysed, while the earlier targets for M1 between 1975 and 1978 are looked at only briefly.

Finally, the abolition of official monetary target announcements was decided upon by the central banks of Canada, the Netherlands and Australia. In Australia, the government abandoned the conditional projections or 'guidelines' for M3 growth after January 1985, and policy setting is now made on the basis of the so-called 'check list', which considers a range of financial and economic indicators. Due to this, the credibility of Australian monetary announcements is only analysed before January 1985. In the case of the Netherlands, the onset of the European Monetary System (EMS) with its Exchange Rate Mechanism (ERM) in March 1979 led to a policy stance where exchange rate considerations, especially with respect to the German Mark were given priority over independent policy objectives. As a result, official announcements of M2 targets were not made after December 1981. Increasing orientation of monetary policy towards an exchange rate target was also the reason behind the abolition of M1 target announcements in Canada in November 1982. Nevertheless, the present paper considers an unofficial (constant) monetary quantity target for the Netherlands from January 1982 and for Canada from December 1982 to December 1987.[4] However, it is not being suggested that this is an adequate method

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[3]For Germany, France, the Netherlands, Japan, the United States, Canada the sample period ends in December 1987, for the United Kingdom in March 1987 and for Italy in November 1987.

[4]Data on this implicit M1 target for Canada and the implicit M2 target for The Netherlands are taken from "International Economic Conditions", Federal Reserve Bank of St. Louis, different volumes after August 31, 1982.

of dealing with this problem and all results must be viewed accordingly.

After having highlighted some of the problems of the attempted comparative study on the credibility of monetary announcements, I now turn to description of the theoretical model and empirical results. The remainder of the paper is organized as follows: firstly, the theoretical model of Cukierman & Meltzer (1986a) is briefly reviewed in section 2 and their theoretical credibility measures are discussed in section 3. The econometric approach to deriving some estimates of these credibility measures is described in section 4 and the estimates are presented in section 5. A discussion of the policy implications of the estimates conclude the paper.

2. The Model

In the theoretical model of Cukierman & Meltzer (1986a) monetary policy making is modelled as a repeated game with asymmetric information between the central bank and the public. Both players aim at optimizing their respective objective functions given their rational expectations of the other player's current moves conditional on their current information sets. The public's moves consist of forming rational money growth expectations while the central bank's moves consist of setting the actual and announced money growth rates to reflect their changing emphasis on policy objectives such as high employment or economic stimulus through surprise inflation and low inflation.

Each period the policymaker plans to achieve a particular rate of money growth m_t^p, which may differ from the actual rate of money growth m_t because control is imperfect:

$$m_t = m_t^p + B\,\epsilon_t \quad , \qquad E\epsilon_t|\Omega_{t-1} = 0, \qquad E(\epsilon_t\epsilon_t')|\Omega_{t-1} = \sigma_\omega^2 \tag{1}$$

where ϵ_t is period t's normally independently distributed serially uncorrelated stochastic variable with zero mean and constant finite variance σ_ϵ^2. The fixed system coefficient B is assumed to be known by the public and will be determined below.

Note that the variance $B^2\sigma_\epsilon^2$ reflects the extent to which the operating procedures and the institutional environment prevent perfect control of money growth.

In addition to the above choice of the planned money growth rate m_t^p the policymaker is assumed to make announcements of future money growth targets but is not required to make completely accurate announcements. It is assumed that at the beginning of each period the policymaker makes a noisy announcement m_t^a:

$$m_t^a = m_t^p + B\ \eta_t \quad , \quad E\eta_t | \Omega_{t-1} = 0, \quad E(\eta_t \eta_t') | \Omega_{t-1} = \sigma_\eta^2 \tag{2}$$

where η_t is a normally independently distributed serially uncorrelated stochastic variable with zero mean and constant finite variance σ_η^2. The variance $B^2\sigma_\eta^2$ reflects the extent to which the policymaker allows the announced target band to range around a point target $\overline{m}_t^a$ for money growth.

The policymaker's objectives in Cukierman & Meltzer (1986a) are described by a multi–period state dependent policy preference function, the present value of which is maximized by the choice of the above actual and announced rate of money growth. Hence, as in Barro & Gordon [(1983a), (1983b)], Backus & Driffill [(1985a), (1985b)] and Barro (1986) monetary policy is viewed as a repeated game, where the policymaker's objective function Z_g is given by:

$$Z_g(m_t, m_t^p, m_t^a, m_t^e) = \sum_{t=0}^{\infty} \left[\frac{1}{(1+r)}\right]^t U_g(m_t, m_t^p, m_t^a, m_t^e) \ , \tag{3}$$

with r as the government's subjective discount factor. The policymaker's policy preference function U_g thereby involves two conflicting policy objectives. Firstly, policymakers like high output (or economic stimulus) and dislike high inflation (or money growth). The first argument is usually derived from a Phillips curve with natural rate properties, where deviations of actual output q_t from its natural rate q^n

are the result of money growth misperceptions on the side of the public:

$$q_t \;=\; q^n \;+\; (m_t - m_t^e) \,, \tag{4}$$

with m_t and m_t^e as actual and expected money growth. Hence the policymaker's one–period objective (payoff) function can be formalized by:

$$\begin{aligned} U_g(m_t,m_t^p,m_t^a,m_t^e) \;&=\; -\tfrac{1}{2}\,(m_t^p)^2 \;+\; x_t\,(\, q_t - q^n \,) \\ &=\; -\tfrac{1}{2}\,(m_t^p)^2 \;+\; x_t\,(\, m_t - m_t^e \,)\,, \end{aligned} \tag{5}$$

where the relative weight x_t attached to economic stimulation through surprise money growth is time–varying and described by:

$$x_t \;=\; A + p_t \qquad , \qquad g>0, \tag{6a}$$

$$p_t \;=\; p_{t-1} + s_t + v_t \qquad , \qquad Ev_t\,|\,\Omega_{t-1}=0, \qquad E(v_t v_t')\,|\,\Omega_{t-1}=\sigma_v^2 \,, \tag{6b}$$

$$s_t \;=\; s_{t-1} + w_t \qquad , \qquad Ew_t\,|\,\Omega_{t-1}=0, \qquad E(w_t w_t')\,|\,\Omega_{t-1}=\sigma_w^2 \,. \tag{6c}$$

Equations (6a) to (6c) specify the stochastic behaviour of the shift parameter x_t and indicate that the policymaker's objectives exhibit only a limited degree of persistence. The policymaker's relative costs weight x_t here is the sum of a systematic part A and a stochastic part p_t, which follows a non–stationary first order autoregressive or random walk process with a stochastic drift s_t, which itself follows a random walk. Note that the model here deviates slightly from Cukierman & Meltzer (1986), who explicitly assume a stationary autoregressive process $p_t=\rho p_{t-1}+w_t$ with $0<\rho<1$, but that for $\rho=1$ and $s_{t-i}=0$ for all i=0,1,...,N both models coincide. For the rest of the theoretical exposition $\rho=1$ and $s_{t-i}=0$ for all i=0,1,...,N is assumed.

The public's preference function U_p in Cukierman & Meltzer (1986a) can be formalized as:

$$U_p(m_t,m_t^a,m_t^e) \;=\; -\;(\;m_t \;-\; m_t^e\;)^2, \tag{7}$$

the expected value of which the public minimizes with respect to the expected rate of money growth m_t^e. Expectations are assumed to be of the least-squared error type and formed rationally, conditional on all publicly available information $\Omega_t^{\bullet}$ at the beginning of each period:

$$m_t^e \;=\; Em_t\,|\,\Omega_t^{\bullet}\;, \tag{8}$$

with E as the mathematical expectations operator conditioned ("|") on the information set $\Omega_t^{\bullet}$. The public's incomplete contemporary information set $\Omega_t^{\bullet}=\Omega_t^{\bullet}(m_0,m_1,...m_{t-1},\; m_0^a,m_1^a,...,m_{t-1}^a,m_t^a)$ includes all past actual and announced money growth rates up to period t-1 and the new money growth announcement m_t^a issued by the policymaker at the beginning of the current period.

2.1. The Derivation of the Public's Rational Expectations.

The solution to the above policy game depends critically on the information advantage of the policymaker, who at the beginning of the current period knows exactly the state in which his preference function lies. The best the public can do is to infer the unknown state of the policymaker's preferences by forming rational expectations conditional on the observations of past actual and current and past announced money growth rates. In the following description these rational expectation are focused upon, since the credibility measures estimated in the empirical section of the paper are derived from them. For the derivation of the public's rational expectations, the proof of their rationality and for the derivation of the government's optimal decision rule the exposition in Cukierman & Meltzer (1986a) is referred to.

Under the method of undetermined coefficients the reduced form solution for the government's decision rule derived from maximizing the policy preference function (3) can be postulated as:

$$m_t^p \;=\; B_0\, A \;+\; B\, p_t \;, \tag{9}$$

where B_0 and B are constants to be determined by the requirement of rational expectations.

Using equations (1) and (2) the public's information variables m_t and m_t^a can be expressed in terms of the policymaker's instrument variable m_t^p as:

$$m_t \;=\; m_t^p + B\,\epsilon_t \;=\; B_0\, A + B\,(p_t+\epsilon_t) \;, \tag{10a}$$

$$m_t^a \;=\; m_t^p + B\,\eta_t \;=\; B_0\, A + B\,(p_t+\eta_t) \;, \tag{10b}$$

where $Em_t|\Omega_{t-1}=Em_t^a|\Omega_{t-1}=Em_t^p|\Omega_{t-1}=B_0A+BEp_t|\Omega_{t-1}$ holds due to the distributional assumptions above. Furthermore, observing $m_t^a-m_t\equiv b_t$, the announcement bias, amounts to observing:

$$b_t \;=\; m_t^a-m_t \;=\; B\,(\eta_t-\epsilon_t) \;. \tag{11}$$

which has mean zero ($Eb_t|\Omega_{t-1}=0$) and constant finite variance $B^2(\sigma_\eta^2+\sigma_\epsilon^2)$ given the distributional assumptions above.

Since under rational expectations the constants B_0A and B are known to the public, the current observation of m_t^a amounts to observing the 'news' term $p_t+\eta_t\equiv z_t$, while observing m_t reveals the 'news' term $p_t+\epsilon_t=y_t$. Cukierman & Meltzer (1986a) show that the optimal predictor of the unobservable planned current money growth conditional on the information set $\Omega_t^\bullet$ is given by:

$$Em_t^p|\Omega_t^\bullet \;=\; B_0\, A \;+\; B\; Ep_t|(z_t,z_{t-1},z_{t-2},\ldots,y_{t-1},y_{t-2},\ldots) \;, \tag{12}$$

where the information set $\Omega_t^{\bullet}$ is now expressed in terms of the 'news' components of m_{t-i} (i=1,2,...t) and m_{t-i}^a (i=0,1,2,...,t). Inserting equation (12) in the public's preference function (7), postulating a reduced form solution for $Ep_t|\Omega_t^{\bullet}$:

$$Ep_t|\Omega_t^{\bullet} \; = \; \sum_{i=1}^{\infty} a_i y_{t-i} \; + \; \sum_{i=0}^{\infty} c_i z_{t-i} \, , \tag{13}$$

which is linear in the 'news' terms with undetermined coefficients a_i and c_i, and minimizing the expected squared forecast errors $(p_t - Ep_t|\Omega_t^{\bullet})$ with respect to the coefficients a_i and c_i leads to the rational expectations formula:

$$Ep_t|\Omega_t^{\bullet} \; = \; \frac{(1-\delta)\,(\sigma_\epsilon^2+\sigma_\eta^2)}{\sigma_\epsilon^2 + \delta\sigma_\eta^2} \left[\sum_{i=0}^{\infty} \delta^i \left\{ \Theta y_{t-i} + (1-\Theta) z_{t-i} \right\} + (1-\Theta) z_t \right], \tag{14a}$$

$$\delta \; = \; 1 + \frac{r}{2} - \sqrt{\frac{r^2}{4} + r} \, , \tag{14b}$$

$$r \; = \; \frac{\sigma_v^2 \;\; (\sigma_\epsilon^2+\sigma_\eta^2)}{\sigma_\epsilon^2 \;\; \sigma_\eta^2} \; = \; \frac{\sigma_v^2}{\sigma_\epsilon^2} + \frac{\sigma_v^2}{\sigma_\eta^2} \, , \tag{14c}$$

$$\Theta \; = \; \frac{\sigma_\eta^2}{\sigma_\epsilon^2 + \sigma_\eta^2} \, . \tag{14d}$$

Substituting (14a) into (12) and using (10a), (10b) and (11) results in:

$$\begin{aligned} Em_t^p|\Omega_t^{\bullet} \; = \; & \frac{(1-\delta)(1-\Theta)}{\delta+(1-\delta)(1-\Theta)} \, m_t^a \\ & + \frac{\delta}{\delta+(1-\delta)(1-\Theta)} \; \sum_{i=0}^{\infty} \delta^i \left\{ (1-\delta) \; [\; \Theta m_{t-1-i} + (1-\Theta) m_{t-1-i}^a \;] \right\} \\ = \; & \frac{(1-\delta)(1-\Theta)}{\delta+(1-\delta)(1-\Theta)} \, m_t^a \; + \; \frac{\delta}{\delta+(1-\delta)(1-\Theta)} \, Em_t^p|\Omega_{t-1} \, , \end{aligned} \tag{15}$$

which derives the optimal prediction of the unobservable current planned money growth as a weighted average of the current announcement m_t^a and the expectation of planned money growth conditional on past information $Em_t^p|\Omega_{t-1}$ with weights that sum to unity. The expectation $Em_t^p|\Omega_{t-1}$ itself is given by a weighted average of the expectation of planned money growth conditional on the past history of actual money growth, $Em_t^p|(m_{t-1},m_{t-1},...)= (1-\delta) \sum_{i=0}^{\infty} \delta^i \; m_{t-1-i}$, and the expectation of planned money growth conditional on the past history of monetary announcements, $Em_t^p|(m_{t-1}^a,m_{t-2}^a,...) = (1-\delta) \sum_{i=0}^{\infty} \delta^i \; m_{t-1-i}^a$, with weights which again sum to unity. The weight placed on each term depends on σ_η^2. Noisy announcements with large σ_η^2 reduce the usefulness of announcements, so the public pays less attention to them. In the limit as $\sigma_\eta^2 \rightarrow \infty$, $\Theta \rightarrow 1$ and announcements are ignored since observing a completely noisy signal provides no information at all. In this case the optimal predictor of planned money growth m_t^p in (15) reduces to:

$$Em_t^p|\Omega_t^* \;=\; Em_t^p|(m_{t-1},m_{t-2},...) \;=\; (1-\delta) \sum_{i=0}^{\infty} \delta^i \; m_{t-1-i} \;, \tag{16}$$

which is identical to the exponentially weighted forecast derived in Muth (1960). At the other extreme, for the limiting case of $\sigma_\eta^2 \rightarrow 0$, announcements are completely accurate statements of planned money growth. Since as $\sigma_\eta^2 \rightarrow 0$, $\Theta \rightarrow 0$, $r \rightarrow \infty$ and $\delta \rightarrow 0$, the optimal predictor of m_t^p is equal to the current announcement:

$$Em_t^p|\Omega_t^* \;=\; m_t^a \;. \tag{17}$$

In this case the current announcement is fully credible. Cukierman & Meltzer (1986) show that this remains true even if σ_ϵ^2 is relatively large and hence monetary control is relatively poor.

2.2. The Credibility of Monetary Announcements Under Rational Expectations

Cukierman & Meltzer (1986a) use the optimal predictor of money growth in (15) to define two measures of credibility, average and marginal credibility. Average credibility measures the extent to which the public's expectations of current planned money growth ($Em_t^p | \Omega_t^\bullet$) deviate from the current announcement (m_t^a):

$$\text{Average Credibility} = AC = - \mid m_t^a - Em_t^p | \Omega_t^\bullet \mid . \tag{18}$$

The smaller the deviation ($m_t^a - Em_t^p | \Omega_t^\bullet$), the larger is average credibility and for $m_t^a = Em_t^p | \Omega_t^\bullet$ average credibility is perfect. Using equation (15) average credibility can be expressed as:

$$AC = - \frac{\delta}{\delta + (1-\delta)(1-\Theta)} \left[m_t^a - \sum_{i=0}^{\infty} \delta^i \left\{ (1-\delta)[\Theta m_{t-1-i} + (1-\Theta) m_{t-1-i}^a] \right\} \right] \tag{19}$$

$$= - \frac{\delta}{\delta + (1-\delta)(1-\Theta)} \left[m_t^a - Em_t | (m_{t-1}, m_{t-2}, \ldots) + \Theta \; Eb_t | (b_{t-1}, b_{t-2}, \ldots) \right],$$

Average credibility is perfect for $\delta=0$ (and hence lim $r \rightarrow \infty$), which is the case for both perfect monetary control ($\sigma_\epsilon^2 = 0$) or fully precise announcements ($\sigma_\eta^2 = 0$). Furthermore, credibility is perfect if the current announcement is identical to the prior expectation of the announcement conditional on past information, $Em_t^a | \Omega_{t-1}$, which is given by the expectation of the announcement conditional on past announcements $Em_t^a | (m_{t-1}^a, m_{t-2}^a, \ldots)$ corrected for the expected announcement bias conditional on the past history of the bias $Eb_t | (b_{t-1}, b_{t-2}, \ldots)$. The 'weight' or regression coefficient $[\Theta = \sigma_\eta^2 / (\sigma_\eta^2 + \sigma_\epsilon^2)]$ attached to the expected bias here is given by the ratio of the covariance between the announcement and the bias ($B^2 \sigma_\eta^2$) and the variance of the bias $[B^2(\sigma_\eta^2 + \sigma_\epsilon^2)]$. Thus, whilst large unexpected changes in announcements lead to a direct decrease in AC, large unexpected changes in actual money growth influence AC only with a time lag through the increase in the expectations of the bias. Therefore, if policymakers aim at maintaining a given level of average credibility under asymmetric information, a shift in the government's policy preferences x_t is unlikely to be revealed to the public in the form of surprise announcements and is more likely to result in surprise money growth.

While the above measure of average credibility focuses on the difference between the current announcement and beliefs, the concept of marginal credibility focuses on the ability of current announcements to influence expectations. Marginal credibility in Cukierman & Meltzer (1986a) is defined as:

$$\text{Marginal Credibility} = MC = \frac{\partial Em_t \mid \Omega_t^{\bullet}}{\partial m_t^a}, \tag{20}$$

which measures the extent to which a unit change in the announcement m_t^a affects the public's expectations of money growth $Em_t \mid \Omega_t^{\bullet}$. From equation (15) it is obvious that marginal credibility is given by:

$$MC = \frac{(1-\delta)(1-\Theta)}{\delta+(1-\delta)(1-\Theta)}, \tag{21}$$

and depends on the magnitude of the variance σ_ϵ^2 of the money control error relative to the variance $\sigma_\epsilon^2+\sigma_\eta^2$ of the announcement bias. If the policymaker always makes completely accurate announcements ($\sigma_\eta^2=0$), this measure of marginal credibility is equal to unity. If, on the other hand, the policymaker makes extremely noisy announcements and the variance of new information conveyed by the announcement approaches infinity ($\lim \sigma_\eta^2 \rightarrow \infty$), the announcements will be disregarded in expectation formation since their information content is zero and marginal credibility will equal zero. In general, the greater the variance σ_η^2, the less credible the announcement becomes.

Before turning to the empirical implementation of the above credibility measures, some comments on related game–theoretic models of policymaking are in order. As discussed by Cukierman & Meltzer (1986b), their model is closely related to the models of Barro & Gordon [(1983a), (1983b)] on the one side and the models of Backus & Driffill [(1985a), (1985b)] on the other side. With the latter it shares the asymmetric information about policymakers objectives, but while in the Backus & Driffill model there are two types of policymakers that never change, the Cukierman & Meltzer model, like the Barro & Gordon model, builds on policymakers preferences that change over time. Consequently, while the observation of an inflationary bias in the Backus & Driffill model reveals the true (weak) type of government and for the rest of the game eliminates asymmetric information and credibility,[5] defined as the probability of a non–inflationary (hard–nosed) government, non–zero credibility and an inflationary bias can coincide in the Cukierman & Meltzer model. Therefore, the concept of credibility developed by Cukierman & Meltzer (1986a), which relates credibility to the divergence of policy actions from policy announcements can be expected to have more descriptive realism because an inflationary bias was the rule rather than the exception in the western industrialized countries during the 1970's and 1980's.

3. The Empirical Implementation of the Credibility Hypotheses

In order to derive an empirical counterpart to the above credibility measures, the modelling of the public's expectations formation process is required. In the present study a two–step approach is adopted: firstly the optimal time series expectations of the unobservable planned money growth rate conditional on past information, $Em_t^p | \Omega_{t-1}$, are derived by using signal extraction methods. Secondly, the rational expectations of money growth under incomplete contemporary information,

[5]Weber (1988c) provides some empirical evidence on the theoretical credibility measures derived in a class of models of the Backus & Driffill [(1985a) (1985b)] type.

$Em_t|\Omega_t^{\bullet}=Em_t^p|\Omega_t^{\bullet}$, are derived by incorporating the current announcement into the above time series expectations.

3.1. Implementing the Univariate Time Series Expectations.

In implementing the expectation of planned money growth conditional on past information, $Em_t^p|\Omega_{t-1}$, in equation (15), the two univariate time series expectations $Em_t^p|(m_{t-1},m_{t-2},...)$ and $Em_t^p|(m_{t-1}^a,m_{t-2}^a,...)$ have to be quantified. In the former case, consider the following 'state space' or 'dynamic linear model':

$$m_t = m_t^p + \xi_t \quad , \quad E\xi_t|\Omega_{t-1}=0, \quad E(\xi_t\xi_t')|\Omega_{t-1}=\sigma_\xi^2 , \tag{22a}$$
$$m_t^p = m_{t-1}^p + \mu_t + \gamma_t , \quad E\gamma_t|\Omega_{t-1}=0, \quad E(\gamma_t\gamma_t')|\Omega_{t-1}=\sigma_\gamma^2 , \tag{22b}$$
$$\mu_t = \mu_{t-1} + \psi_t \quad , \quad E\psi_t|\Omega_{t-1}=0, \quad E(\psi_t\psi_t')|\Omega_{t-1}=\sigma_\psi^2 , \tag{22c}$$

which results from equations (10a) and (6a) to (6c) by defining $\xi_t\equiv B\epsilon_t$, $\gamma_t\equiv v_t/B$, $\mu_t\equiv s_t/B$ and $\psi_t\equiv w_t/B$. In the measurement equation (22a) the non–observable state of the government's planned money growth rate m_t^p is contained in the observable signal m_t, which is contaminated by a measurement error ξ_t. Furthermore, the dynamic process for the state variable m_t^p is captured by the transition equations (22b) and (22c), which describe m_t^p as a random walk process with stochastic drift μ_t, which itself follows a random walk.

For the expectations of planned money growth conditional to the history of past announcements, $Em_t^p|(m_{t-1}^a,m_{t-2}^a,...)$ a second 'state space' model is considered:

$$m_t^a = m_t^p + \omega_t \quad , \quad E\omega_t|\Omega_{t-1}=0, \quad E(\omega_t\omega_t')|\Omega_{t-1}=\sigma_\omega^2 , \tag{23a}$$
$$m_t^p = m_{t-1}^p + \mu_t + \gamma_t , \quad E\gamma_t|\Omega_{t-1}=0, \quad E(\gamma_t\gamma_t')|\Omega_{t-1}=\sigma_\gamma^2 , \tag{23b}$$
$$\mu_t = \mu_{t-1} + \psi_t \quad , \quad E\psi_t|\Omega_{t-1}=0, \quad E(\psi_t\psi_t')|\Omega_{t-1}=\sigma_\psi^2 , \tag{23c}$$

which results from equations (10b) and (6a) to (6c) by defining $\omega_t\equiv B\eta_t$, $\gamma_t\equiv v_t/B$, $\mu_t\equiv s_t/B$ and $\psi_t\equiv w_t/B$. Note that equations (23a) to (23c) implicitly assume that innovations in actual and announced money growth have the same time frequency. While the present study uses monthly data on actual money growth, the common practice with monetary announcements is to issue annual announcements of a money growth target, except in the case of Japan, where quarterly projections are announced or the United States, where even weekly announcements are issued. Thus, while announcements typically provide a low–frequency signal, observations on actual money growth provide a high frequency signal. In terms of equations (23a) to (23c) this implies that for announcements to be a noisy and random signal of planned money growth $[E\omega_t|\Omega_{t-1}=0,\ E(\omega_t\omega_t')|\Omega_{t-1}=\sigma_\omega^2]$, planned money growth must be postulated to exhibit only permanent level shocks γ_t and no permanent first difference shocks μ_t $(\sigma_\psi^2=0)$. Furthermore, permanent level shocks γ_t are allowed to occur only in twelve period intervals and have to be identically equal to zero at all periods in between. Formally, this implies $\gamma_{t-i}\equiv0$ and $\sigma_\gamma^2\equiv\sigma_v^2/B^2=0$ for all $i=1,2,...11$ and $\gamma_{t-i}\neq0$ and $\sigma_\gamma^2\equiv\sigma_v^2/B^2>0$ for $i=0$. Hence monetary announcements have a positive information content, as reflected by the signal $m_t^a-Em_t^a|(m_{t-1}^a,m_{t-2}^a,...)$, only every twelve periods and in between these periods the information content of annual announcements is zero. As a result, past announcements will tend to be disregarded in expectations formation and only the current announcement will be used as an information variable if planned money growth is a high frequency state variable and if the high frequency observations of actual money growth provide a noisy signal of this non–observable state variable. In the empirical section evidence on this proposition will be provided.

In order to empirically extract an estimate of the non–observable state m_t^p from historical data of actual and announced money growth the multi–process Kalman filter (MPKF) is employed. The MPKF, which is outlined in the Weber [(1988a), (1988c)], is a highly flexible, time–varying learning algorithm and incorporates feed–back mechanisms from the specification of the statistical model to the data in the form of both Bayesian and least–squares learning. Formally, this projection method distinguishes between transitory and permanent movements in the state variable m_t^p by assigning a probability $\pi_t^{(i)}$ to the occurrence of each type of shock

(ξ_t, γ_t and ψ_t) in equations (22a) to (22c) for each period t. Three different pure process states are postulated:

(a) purely transitory level shocks ξ_t ($\sigma_\xi^2>0$, $\sigma_\gamma^2=\sigma_\psi^2=0$),

(b) purely permanent level shocks γ_t ($\sigma_\gamma^2>0$, $\sigma_\xi^2=\sigma_\psi^2=0$) and

(c) purely permanent first difference shocks ψ_t ($\sigma_\psi^2>0$, $\sigma_\gamma^2=\sigma_\xi^2=0$).

The projection of the state variable, $Em_t^p|(m_{t-1},m_{t-2},...)$, is then derived as a probability weighted average of the projections $E^{(j)}m_t^p|(m_{t-1},m_{t-2},...)$ resulting from the three pure process specifications (j=1,2,3), where $0\leq\pi_t^{(j)}\leq 1$ and $\sum_j \pi_t^{(j)}=1$ holds.

3.2. Implementing the Expectations Conditional on Current Information.

In order to derive rational expectations of planned money growth conditional on current and past information, $Em_t^p|\Omega_t^\bullet$, a weighted average of the current monetary announcement m_t^a and the expectation of planned money growth conditional on past information, $Em_t^p|\Omega_{t-1}$ is required:

$$Em_t^p|\Omega_t^\bullet \;=\; \beta\, m_t^a \;+\; (1-\beta)\; Em_t^p|\Omega_{t-1}\;. \tag{24}$$

The second component $Em_t^p|\Omega_{t-1}$ is derived as a weighted average of the univariate time series expectations of planned money growth based on past actual money growth rates, $Em_t^p|(m_{t-1},m_{t-1},...)$, and the corresponding time series expectations of m_t^p based on past monetary announcements, $Em_{t-1}^p|(m_{t-1}^a,m_{t-2}^a,...)$:

$$Em_t^p|\Omega_{t-1} \;=\; \alpha\; Em_t^p|(m_{t-1},m_{t-2},...) \;+\; (1-\alpha)\; Em_t^p|(m_{t-1}^a,m_{t-2}^a,...), \tag{25}$$

with weights that sum to unity. Empirically these expectations are derived in two steps: firstly, a time series for $Em_t^p|\Omega_{t-1}$ is constructed from the two univariate projections $Em_t^p|(m_{t-1},m_{t-2},...)$ and $Em_t^p|(m_{t-1}^a,m_{t-2}^a,...)$, which result from applying the MPKF to actual and announced money growth data, by iterating the relative weight α in the interval between zero and one. The resulting time series of $Em_t^p|\Omega_{t-1}$ and the time series of current announcements m_t^a are then regressed on actual money growth m_t, which due to $Em_t^p|\Omega_t^\bullet=Em_t|\Omega_t^\bullet$ is equivalent to minimizing the expected squared deviation $m_t-Em_t|\Omega_t^\bullet$ and thus is identical to minimizing the public's preference function in equation (7).

3.3. The Empirical Estimates of the Public's Rational Expectations.

In equation (22a) to (22c) the actual rate of money growth m_t is modelled as an ARIMA(0,2,2) time series process. Monthly data on money growth for Canada, France, Germany, Italy, the Netherlands, Switzerland, the United Kingdom and the United States were calculated from the levels of the relevant monetary aggregates.[6] To avoid seasonality in growth rates, the relative rate of change of the monetary aggregates M_t over last years level M_{t-12} was used $[m_t\equiv\{(M_t-M_{t-12})/M_{t-12}\}*100]$. With monthly data for levels of M_t starting in January 1970, the resulting time series on money growth m_t ranged from January 1971 to December 1987 for all countries under study. Initializing the multi-process Kalman filter in January 1971 then gives univariate projections of planned money growth for February 1971 to December 1987, which together with the actual and projected announcements are used to implement the rational expectations conditional on current information. The results of these estimates and the derived credibility measures will be discussed below.

Table 1. summarizes the empirical results when the public's rational expectations of planned money growth $Em_t^p|\Omega_t^\bullet$ are formed by fitting the regression equation:

$$m_t = \beta_1 m_t^a + \beta_2 [\lambda Em_t|(m_{t-1},m_{t-2},...) + (1-\lambda)Em_t^a|(m_{t-1},m_{t-1},...)] + v_t, \qquad (26)$$

[6]Data on the levels of the relevant monetary aggregates for Germany (CBM), France (M2), Italy (TDC), the Netherlands (M2), the United States (M1,M3), Canada (M1), Japan (M2), the United Kingdom (M3), Australia (M3) and Switzerland (M1) were taken from OECD Main Economic Indicators, 1970–1989, different volumes. Data on the levels of the adjusted monetary base (MBA) for Switzerland were taken from Monatsberichte der Schweizer Nationalbank, 1980–1989, different volumes.

with v_t as an normally independently distributed, serially uncorrelated random variable with mean zero and constant finite variance σ^2. Note that in equation (20) actual money growth m_t is regressed on announced money growth m_t^a and on the time series expectation $Em_t|\Omega_{t-1}$, which is generated as a weighted average of the two time-series expectations $Em_t|(m_{t-1},m_{t-2},...)$ and $Em_t^a|(m_{t-1},m_{t-1},...)$ by iterating λ in the]0,1[interval. At this stage the coefficient restriction $\beta_1+\beta_2=1$ is not imposed and the unrestricted form of equation (20) is estimated.

The first results apparent form table 1 is that the least-squares estimate of λ is equal to unity in eight out of eleven cases and near to unity for Australia (λ=0.85), and the United States (M1, λ=0.94).[7] Hence the empirical estimates are consistent with the above presumption that the information content of past monetary announcements is either zero or close to zero. Secondly, a closer look at the results reveals that the lower the estimate of λ, the lower the estimate of the coefficient β_1 and the higher the estimate of the coefficient β_2. Since therefore different estimates of β_1 and β_2 are not comparable for different values of λ, λ=1 is assumed in all cases for the remainder of the paper, that is the information content of past monetary announcements is set equal to zero.

A further important result for table 1 is that for λ=1 the regression coefficients β_1 and β_2 all lie in the interval between zero and one and almost exactly sum up to unity,[8] as postulated by the theoretical model.[9] Before turning to a more formal test of this unity restriction on the regression coefficients, some comments on the unrestricted marginal credibility estimates in table 1 are in order: among the countries with freely floating exchange rates the estimated marginal credibility of

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[7]The only estimate of a relatively low λ (=0.57) is derived for the Netherlands, were the central bank primarily followed an exchange rate target. Due to the inofficial character of the monetary target used here this result has to be interpreted with caution.

[8]Toyoda (1974) demonstrates that the F–test of Chow (1960) is biased in the presence of heteroscedastisity. See also Jaytissa (1977) and Schmidt & Sickles (1977) on this point. For problems of the Chow test under misspecification see Thursby (1982).

[9]This is true in all cases if the sum of the two regression coefficients is compared to a value of one plus/minus the sum of the standard errors of the two regression coefficients.

Table 1.: Mean Square Estimate of the Weighting Factor λ by Ordinary Least Squares Regression

	Start / End	λ	β_1 / $t(\beta_1)$	β_2 / $t(\beta_2)$	R^2 / $R^2_{adj.}$	DW / SQR	SEE / LOGL
D (CBM)	75M2	1	0.1010	0.9116	0.963	2.250	0.450
(n=155)	87M12		(4.19)	(45.65)	0.963	31.00	–510.3
F (M2)	77M2	1	0.1027	0.9102	0.903	2.236	0.763
(n=131)	87M12		(2.97)	(28.87)	0.902	75.12	–461.2
I (TDC)	77M2	1	0.1031	0.8896	0.898	2.133	1.856
(n=130)	87M11		(4.20)	(35.00)	0.897	440.7	–507.8
NL (M1)	79M2	.57	–0.382	1.3711	0.539	2.275	1.491
(n=107)	87M12		(3.94)	(14.31)	0.534	233.5	–407.8
NL (M1)	79M2	1	0.2111	0.7796	0.537	2.267	1.494
(n=107)	87M12		(3.69)	(14.29)	0.533	234.2	–407.9
J (M2CD)	78M8	1	0.2730	0.7319	0.950	1.676	0.364
(n=113)	87M12		(4.10)	(11.10)	0.950	14.70	–361.5
CH (MBA)	81M2	1	0.2482	0.6081	0.382	1.805	1.842
(n= 83)	87M12		(2.82)	(8.07)	0.374	274.8	–323.8
USA (M1)	75M2	.94	0.1081	0.9395	0.893	2.029	0.941
(n=155)	87M12		(2.90)	(38.25)	0.892	135.5	–560.0
USA (M1)	75M2	1	0.1637	0.8836	0.893	2.030	0.941
(n=155)	87M12		(4.56)	(38.24)	0.892	135.6	–560.0
USA (M3)	75M2	1	0.0712	0.9390	0.947	1.998	0.400
(n=155)	87M12		(3.62)	(60.00)	0.947	24.45	–502.3
GBR (M3)	76M5	1	0.1268	0.9224	0.913	2.058	1.603
(n=131)	87M3		(3.36)	(39.75)	0.912	331.5	–503.5
CAN (M1)	75M5	1	0.2288	0.7744	0.834	1.835	2.070
(n=152)	87M12		(5.91)	(23.95)	0.833	642.6	–601.1
AUS (M3)	76M9	.85	0.0643	0.9631	0.825	2.106	0.772
(n=101)	85M1		(1.32)	(22.36)	0.823	58.95	–356.0
AUS (M3)	76M9	1	0.2076	0.8197	0.823	2.119	0.775
(n=101)	85M1		(4.87)	(22.25)	0.822	59.46	–356.2

Key: numbers in parenthesis below parameter estimates are absolute t–values monetary announcements is highest for Japan (0.27), followed by Switzerland (0.25), Canada (0.23) and Australia (0.21) and lowest for M3 of the United States (0.07), the United Kingdom (0.13) and M1 of the United States (0.16). Within the group of countries participating in the fixed exchange rate system of the EMS for part of the sample period the estimate of marginal credibility of monetary announcements is relatively high for the Netherlands (0.21) and almost identical for Germany (0.10), France (0.10) and Italy (0.10). Note that in all cases the credibility of monetary announcements is far from being perfect (MC=1). Nevertheless the effect of current monetary announcements on the public's expectations is significantly different from zero in all cases above. Hence, although monetary announcements did not completely fail to provide the public with some information about the future course of policy, there is still room improving their credibility.

Before analysing the credibility of monetary policy announcements in detail, some comments on the problems of empirical policy evaluation, frequently labeled the 'Lucas critique', are in order, especially as shift in government's policy objectives are a building block of the Cukierman & Meltzer (1986a) model, which underlies the estimates. According to the 'Lucas critique', the structure of the econometric model used for evaluating policies in general is not invariant to changes in real world policy objectives, operating procedures or policy constraints in the course of time, especially if these models involve the public's rational expectations of policy outcomes. Hence econometric models frequent exhibit structural breaks, if policy changes are of the once-and-for-all type, or structural parameters that follow stationary or non-stationary processes if policy changes occur more gradually. In the sample period analysed here, the Humphrey-Hawkins Act of 1978 in the United States, the institution of the EMS in March 1979 in France, Germany, Italy and the Netherlands or the change in the Fed's operating procedures in October 1979 and again in October 1982 in the United States, to mention but a few examples, represent such policy induced structural breaks. It therefore has to be checked whether or not the above results are subject to the 'Lucas critique'.[10]

In table 2 the coefficient estimates and parametric stability tests of the unrestricted model for $\lambda=1$ are reported at the most likely point of structural break, which is estimated by switching regression on the basis of the likelihood ratio test ($-2\ln\lambda_s$) of Quandt [(1958), (1960)] and Goldfeld & Quandt [(1973), (1976)].[11] In addition, the test $F_{k,t-2k}$ of Chow (1960) for the constancy of the regression coefficients with k and t–2k degrees of freedom is performed.[12] Furthermore, two versions of the CUSUM–of–Squares test[13] of Brown, Durbin & Evans (1976), a forward test CF^2 and a backward test CB^2, as well as two F–tests for heteroscedastisity, $H_{n,m}$ and $H_{s,n-k}$, are reported.[14] The relevance of the 'Lucas critique' can therefore be judged on a variety of tests and is accepted only if the majority of the parametric tests indicate significant instabilities.

Significant structural breaks in the estimated relation are indicated by the majority of tests for Germany, Switzerland and the United States. For Germany, the most likely point of structural break is September 1977. Even though the null

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[10]At the present stage, only one major structural break in the sample period is tested for by applying a variety of parametric stability tests under the null hypothesis of 'no change in the estimated relation', which covers both constant regression coefficients and homoscedastisity. Tests for time–varying parameter models such as random coefficient or random walk coefficient models as derived on the basis of the Kalman filter in Weber (1988b) from Cooley (1971), Cooley & Prescott [(1973a), (1973b), (1973c), (1976)] or Harvey (1981b) are planned in a subsequent paper.

[11]As analysed in Quandt (1960), the test statistic $-2\ln\lambda_s$ does not follow a χ^2 distribution. However, Lehner & Möller (1981) demonstrate that a modified χ^2 distribution can be used to construct a conservative test for s structural break points. This modified χ^2 distribution is used here to evaluate the significance of $-2\ln\lambda_s$.

[12]Toyoda (1974) demonstrates that the F–test of Chow (1960) is biased in the presence of heteroscedastisity. See also Jaytissa (1977) and Schmidt & Sickles (1977) on this point. For problems of the Chow test under misspecification see Thursby (1982).

[13]See Brown, Durbin & Evans (1975), pp. 152. The forward (backward) tests CF^2 (CB^2) are based on a plot of the cumulated sum or recursive least squares residuals from the Kalman filter run against upper and lower significance bounds for different significance levels, as reprinted in Harvey (1981a), pp 364.

[14]$H_{m,n}$ is the Goldfeld & Quandt (1965) heteroscedastisity test based on a division of the sample of t observations into two sub–samples of m and n (=t–m) observations and the assumption that the variance of residuals increases over time. It corresponds to the test of Harvey & Phillips (1974) if no central observations are ommitted. Alternatively, the heteroscedastisity test $H_{s,t-k}$ assumes the variance of the residuals to be proportional to the fitted values and is based on a regression of squared residuals on squared fitted values.

Table 2: Parametric Stability Tests and Ordinary Least Squares Estimates at the Most Likely Point of Structural Break of the Regression Equation in the Unrestricted Model

	Start End	β_1 $t(\beta_1)$	β_2 $t(\beta_2)$	R^2 $R^2_{adj.}$	DW SQR	Parametric Stability Test
D (CBM) t=155	75M2 87M12	**0.1010** (4.19)	0.9116 (45.66)	0.963 0.963	2.250 31.00	$F_{2,151}$ = 4.51* $-2\ln\lambda_1$ = 6.12
D (CBM) n= 32	75M2 77M9	**0.2929** (3.23)	0.7255 (8.76)	0.719 0.710	1.865 8.249	CF^2 =0.261* CB^2 =0.677*
D (CBM) m=123	77M10 87M12	**0.0932** (3.73)	0.9223 (46.65)	0.971 0.971	2.333 21.01	$H_{n,m}$ =0.626 $H_{1,153}$ =2.786
F (M2) t=131	77M2 87M12	**0.1027** (2.97)	0.9102 (28.87)	0.903 0.902	2.236 75.12	$F_{2,127}$ = 8.43** $-2\ln\lambda_1$ = 8.15*
F (M2) n= 81	77M2 83M10	**0.1772** (3.18)	0.8305 (15.27)	0.650 0.646	2.293 37.18	CF^2 =0.495 CB^2 =0.388
F (M2) m= 50	83M11 87M12	**0.3999** (3.89)	0.7465 (11.15)	0.859 0.856	2.149 29.13	$H_{n,m}$ =1.263 $H_{1,129}$ =0.402
I (TDC) t=130	77M2 87M11	**0.1031** (4.20)	0.8896 (35.00)	0.898 0.897	2.133 440.7	$F_{2,126}$ = 0.47 $-2\ln\lambda_1$ = 1.28
I (TDC) n= 53	77M2 81M6	**0.0847** (2.42)	0.9025 (25.20)	0.909 0.907	2.540 217.0	CF^2 =0.492 CB^2 =0.500
I (TDC) m= 77	81M7 87M11	**0.1300** (3.56)	0.8669 (22.65)	0.880 0.878	1.552 220.5	$H_{n,m}$ =0.682 $H_{1,129}$ =3.659
NL (M2) t=107	79M2 87M12	**0.2111** (3.69)	0.7796 (14.29)	0.537 0.533	2.268 234.2	$F_{2,103}$ = 0.52 $-2\ln\lambda_1$ = 7.43
NL (M2) n= 4	75M5 79M3	**0.2548** (5.76)	0.3724 (2.52)	0.761 0.641	1.883 40.92	CF^2 =0.001 CB^2 =0.990
NL (M2) m=103	79M6 87M12	**0.2411** (3.63)	0.7545 (12.25)	0.484 0.479	2.227 231.8	$H_{n,m}$ =72.61** $H_{1,105}$ =5.292*
J (M2+CD) t=113	78M8 87M12	**0.2730** (4.10)	0.7319 (11.10)	0.950 0.950	1.676 14.70	$F_{2,109}$ = 6.16** $-2\ln\lambda_1$ = 6.63
J (M2+CD) n= 33	78M8 81M4	**0.0228** (0.20)	0.9699 (8.75)	0.966 0.965	2.048 3.75	CF^2 =0.255 CB^2 =0.643
J (M2+CD) m= 80	81M5 87M12	**0.3950** (5.11)	0.6172 (8.05)	0.917 0.916	1.780 9.458	$H_{n,m}$ =0.990 $H_{1,111}$ =0.239

Key: numbers in parenthesis below parameters are absolute t–values, * (**) indicates significant instability at 5% (1%) levels.

Table 2 continued

CH (MBA) t= 83	81M2 87M12	**0.2482** (2.83)	0.6081 (8.07)	0.382 0.374	1.805 274.8	$F_{2,79}$ $-2\ln\lambda_1$	= 4.21* =10.18*
CH (MBA) n= 24	81M2 83M1	**0.1108** (0.70)	0.7512 (5.16)	0.524 0.502	1.873 144.7	CF^2 CB^2	=0.527** =0.377**
CH (MBA) m= 59	83M2 87M12	**0.5734** (5.20)	0.3374 (3.73)	0.194 0.180	1.703 103.6	$H_{n,m}$ $H_{1,81}$	=0.272 =0.366
USA (M1) t=155	75M2 87M12	**0.1637** (4.56)	0.8836 (38.24)	0.893 0.892	2.030 135.6	$F_{2,151}$ $-2\ln\lambda_1$	= 0.74 =10.62*
USA (M1) n= 60	75M2 80M1	**0.1127** (2.31)	0.9093 (24.53)	0.810 0.810	2.620 21.98	CF^2 CB^2	=0.162** =0.828**
USA (M1) m= 95	80M2 87M12	**0.1934** (3.79)	0.8710 (28.49)	0.888 0.886	1.911 112.3	$H_{n,m}$ $H_{1,153}$	=3.152** =3.628
USA (M3) t=155	75M2 87M12	**0.0712** (3.62)	0.9390 (60.00)	0.947 0.947	1.998 24.45	$F_{2,151}$ $-2\ln\lambda_1$	= 2.95 =11.12*
USA (M3) n= 57	75M2 79M10	**0.0353** (2.11)	0.9698 (67.31)	0.964 0.964	2.363 4.029	CF^2 CB^2	=0.165** =0.798**
USA (M3) m= 98	79M11 87M12	**0.1348** (3.56)	0.8883 (29.52)	0.930 0.930	1.839 19.50	$H_{n,m}$ $H_{1,153}$	=2.745** =2.464
GBR (M3) t=131	76M5 87M3	**0.1268** (3.36)	0.9224 (39.75)	0.913 0.912	2.058 331.5	$F_{2,127}$ $-2\ln\lambda_1$	= 5.18** = 8.56*
GBR (M3) n= 79	76M5 82M11	**0.0783** (1.76)	0.9355 (35.13)	0.912 0.911	1.811 235.2	CF^2 CB^2	=0.710 =0.215
GBR (M3) m= 52	82M12 87M3	**0.3638** (4.26)	0.7964 (14.36)	0.937 0.936	2.402 71.33	$H_{n,m}$ $H_{1,129}$	=0.458 =1.210
CAN (M1) t=152	75M5 87M12	**0.2288** (5.91)	0.7744 (23.95)	0.834 0.833	1.835 642.6	$F_{2,148}$ $-2\ln\lambda_1$	= 2.32 = 3.46
CAN (M1) n= 97	75M5 83M5	**0.2751** (5.57)	0.7162 (15.92)	0.819 0.817	1.738 457.5	CF^2 CB^2	=0.712 =0.258
CAN (M1) m= 55	83M6 87M12	**0.1620** (2.49)	0.8524 (19.41)	0.877 0.874	2.023 165.6	$H_{n,m}$ $H_{1,150}$	=0.637 =2.445
AUS (M3) t=101	76M9 85M1	**0.2076** (4.87)	0.8197 (22.25)	0.823 0.822	2.119 59.46	$F_{2,97}$ $-2\ln\lambda_1$	= 7.82** = 7.29
AUS (M3) n= 37	76M9 79M9	**0.1074** (2.29)	0.9045 (21.99)	0.912 0.910	1.818 18.13	CF^2 CB^2	=0.305 =0.556
AUS (M3) m= 64	79M10 85M1	**0.4571** (6.09)	0.6070 (9.42)	0.459 0.451	1.935 33.08	$H_{n,m}$ $H_{1,99}$	=1.014 =4.969*

hypothesis of homoscedastisity cannot be rejected, the majority of the remaining stability tests indicate a structural break at a 5 percent significance level. For Switzerland the estimated most likely point of structural break is January 1983. Like in the German case above there is no indication of heteroscedasticity, but all remaining stability tests are significant at least at the 5 percent level. For the United States two monetary aggregates are considered. The most likely point of structural break in estimated relation for the broader aggregate M3 is October 1979, when the Fed announced the adoption of new operating procedures and a stricter adherence to announced monetary targets. For the narrower aggregate M1 the estimated structural break is slightly later in January 1980, when for the first time after the adoption of the new policy stance the actual rate of money growth fell within the newly announced target range. All relevant stability tests are significant at least at the 5 percent level[15], indicating that the October 1979 change of the Fed's operating procedures was indeed a major structural break in the conduct of United States monetary policy.

Given the above evidence on the relevance of the 'Lucas critique' for Germany, Switzerland and the United States, a closer look at the estimates of marginal credibility is now in order. For this purpose the coefficient restriction $\beta_1+\beta_2=1$ is imposed on the data and the adequacy of this restriction is tested. Table 3 presents the restricted least squares estimates of the theoretical model with $\lambda=1$ at the most likely points of structural break from table 2 with the F–test and marginal significance level for the restriction reported in the last column.

The null hypothesis of $\beta_1+\beta_2=1$ in the overall period can not be rejected at the 5 percent level for Germany, France, Italy, the Netherlands, Japan, Switzerland and Canada and additionally at the 1 percent level for the United States M3. In addition, with the exception of the Netherlands all countries fulfill the above

[15]The significance of the heteroscedastisity test $H_{m,n}$, which indicates that the variance of the residuals increases over time, is responsible for the bias in the F–test of Chow (1960), which is therefore not considered here for reasons indicated in Toyoda (1974).

Table 3: Mean Square Estimate of Marginal Credibility by Restricted Least Squares at the Estimated Most Likely Point of Structural Break

	Start End	β_1 $t(\beta_1)$	β_2 $t(\beta_2)$	R^2 $R^2_{adj.}$	DW SQR	F–TEST SIG.
D (CBM) n=155	75M2 87M12	**0.0695** (4.09)	0.9305 (54.78)	0.964 0.964	2.324 30.41	3.471 0.064
D (CBM) n= 32	75M2 77M9	**0.2160** (3.27)	0.7839 (11.86)	0.747 0.747	2.171 7.430	1.852 0.184
D (CBM) n=123	79M4 87M12	**0.0567** (3.47)	0.9433 (57.68)	0.971 0.971	2.363 20.54	3.818 0.053
F (M2) n=131	77M2 87M12	**0.0719** (2.46)	0.9281 (31.75)	0.906 0.906	2.203 72.52	3.123 0.080
F (M2) n= 81	77M2 83M10	**0.1602** (2.99)	0.8398 (15.69)	0.640 0.640	2.227 37.25	0.595 0.444
F (M2) n= 50	83M11 87M12	**0.0426** (1.17)	0.9574 (26.22)	0.845 0.845	2.230 32.01	13.70 0.001
I (TDC) n=130	77M2 87M11	**0.1053** (4.51)	0.8947 (38.36)	0.906 0.906	2.282 407.4	0.491 0.485
I (TDC) n= 53	77M2 81M6	**0.0898** (2.82)	0.9102 (28.62)	0.921 0.921	2.880 189.2	0.596 0.443
I (TDC) n= 77	81M7 87M11	**0.1305** (3.77)	0.8695 (25.10)	0.890 0.890	1.586 201.4	0.051 0.822
NDL (M1) n=107	79M2 87M12	**0.2188** (4.17)	0.7812 (14.87)	0.565 0.565	2.317 220.1	0.195 0.659
NDL (M1) n= 22	79M2 80M11	**0.1395** (1.74)	0.8605 (10.73)	0.398 0.398	2.564 43.83	4.571 0.045
NDL (M1) n= 85	80M12 87M12	**0.2789** (3.97)	0.7210 (10.27)	0.511 0.511	2.199 177.3	1.064 0.305
J (M2CD) n=113	78M8 87M12	**0.2569** (3.94)	0.7431 (11.40)	0.950 0.950	1.649 14.74	1.722 0.192
J (M2CD) n= 33	78M8 81M4	**0.0489** (0.45)	0.9511 (8.84)	0.966 0.966	1.875 3.71	1.601 0.215
J (M2CD) n= 81	81M5 87M12	**0.3233** (4.26)	0.6767 (8.92)	0.912 0.912	1.676 10.15	7.652 0.007

Key: numbers in parenthesis below parameter estimates are absolute t–values

Table 3 continued

CH (MB)	81M2	**0.3478**	0.6522	0.382	1.815	3.908
n= 83	87M12	(4.86)	(9.12)	0.374	274.8	0.051
CH (MB)	81M2	**0.1883**	0.8117	0.520	1.952	0.607
n= 24	83M1	(1.55)	(6.70)	0.520	146.0	0.444
CH (MB)	83M2	**0.6580**	0.3420	0.188	1.658	1.796
n= 59	87M12	(7.32)	(3.80)	0.188	104.5	0.185
USA (M1)	75M2	**0.0774**	0.9226	0.890	2.053	7.841
n=155	87M12	(4.14)	(49.39)	0.890	140.0	0.006
USA (M1)	75M2	**0.0658**	0.9342	0.817	2.619	1.563
n= 60	80M1	(2.16)	(30.71)	0.817	21.11	0.216
USA (M1)	80M2	**0.0794**	0.9206	0.892	1.930	6.308
n= 95	87M12	(3.49)	(40.45)	0.982	108.0	0.014
USA (M3)	75M2	**0.0400**	0.9600	0.947	1.977	4.233
n=155	87M12	(3.20)	(76.88)	0.947	24.39	0.041
USA (M3)	75M2	**0.0222**	0.9778	0.970	2.200	1.477
n= 57	79M10	(1.90)	(83.57)	0.970	3.42	0.229
USA (M3)	79M11	**0.0539**	0.9461	0.930	1.940	6.075
n= 98	87M12	(2.89)	(50.80)	0.930	19.17	0.015
GBR (M3)	76M5	**0.0386**	0.9614	0.910	2.002	7.081
n=131	87M3	(2.11)	(52.63)	0.910	344.1	0.009
GBR (M3)	76M5	**0.0559**	0.9441	0.912	1.800	0.334
n= 79	82M11	(2.55)	(43.13)	0.912	233.1	0.565
GBR (M3)	82M12	**–0.025**	1.025	0.923	2.318	23.42
n= 52	87M3	(0.79)	(32.16)	0.923	87.83	0.00001
CAN (M1)	75M5	**0.2257**	0.7743	0.840	1.814	0.021
n=152	87M12	(7.14)	(24.49)	0.840	619.4	0.885
CAN (M1)	75M5	**0.2819**	0.7181	0.826	1.745	0.104
n= 97	83M5	(6.49)	(16.54)	0.826	438.3	0.748
CAN (M1)	83M6	**0.1447**	0.8553	0.891	2.192	0.127
n= 55	87M12	(3.60)	(21.28)	0.891	146.5	0.723
AUS (M3)	76M9	**0.1218**	0.8782	0.826	2.153	8.556
n=101	85M1	(3.98)	(28.71)	0.826	58.66	0.004
AUS (M3)	76M5	**0.0850**	0.9150	0.919	1.841	0.769
n= 37	79M9	(2.29)	(24.62)	0.919	16.66	0.386
AUS (M3)	79M10	**0.1640**	0.8360	0.294	2.191	22.52
n= 64	85M1	(3.39)	(17.26)	0.294	43.20	0.00001

coefficient restriction at least at the 5 percent level in the first sub–period. Thus, the evidence in table 3 suggests that in most cases unbiased estimates of the marginal credibility of monetary target announcements can be obtained by applying restricted least squares.[16] In imposing the coefficient restriction consistent estimates of the marginal credibility measure of Cukierman & Meltzer (1986a) can be derived by estimating the regression equation:

$$m_t - Em_t|\Omega_{t-1} = \beta_1 (m^a_t - Em_t|\Omega_{t-1}) + v_t , \quad (27)$$

which results in identical estimates of β_1 as the restricted least squares regression with $\beta_1=(1-\beta_2)$ from table 3 above.

4. The Empirical Estimates of Average and Marginal Credibility.

In order to compare briefly the credibility measures between countries, table 4 and table 5 summarize the estimates of the marginal and average credibility of monetary target growth announcements for each country in the overall sample period and additionally in three pre–specified sub–samples.

Among the countries with freely fluctuating exchange rates throughout the sample period the estimated **marginal credibility** in the overall period is highest for Switzerland (0.35) and Japan (0.26) and lowest for the United Kingdom (0.04) and the United States (0.04 for M3, 0.07 for M1). A similar ranking can be derived from the **average credibility** measure, which in the overall period is highest in Japan (–0.32) and Switzerland (–1.22) and lowest in the United Kingdom (–5.70). Furthermore, with the exception of M3 for the United States and MBA for Switzerland the marginal credibility of monetary announcements declined in most countries with freely floating exchange rates between the early and late 1980s.

[16]The evidence from table 3 however does not suggest in cases where the coefficient restriction $\beta_1+\beta_2=1$ is rejected, that the theoretical model is rejected by the data, which would be the case for $\beta_1=0$ and $\beta_2=0$. It rather points towards the fact that additional policy objectives, such as exchange rate considerations, matter in those cases.

Table 4: Marginal Credibility of Money Growth Target Announcements in Selected Periods	Start End	Start 79M3	79M4 83M12	84M1 End
D (CBM)	0.0695 (*9*)	0.0655 (*8*)	0.1066 (*8*)	0.0486 (*8*)
F (M2)	0.0719 (*8*)	0.4688 (*1*)	0.1034 (*9*)	0.0421 (*9*)
I (TDC)	0.1053 (*6*)	0.0677 (*7*)	0.1810 (*4*)	0.0970 (*5*)
NL (M1)	0.2188 (*4*)	—— (–)	0.1776 (*5*)	0.2947 (*2*)
J (M2CD)	0.3111 (*2*)	0.3111 (*2*)	0.3163 (*1*)	0.0575 (*7*)
CH (MBA)	0.3478 (*1*)	—— (–)	0.2925 (*2*)	0.7095 (*1*)
USA (M1)	0.0774 (*7*)	0.0858 (*6*)	0.1622 (*6*)	0.0396 (*10*)
USA (M3)	0.0400 (*11*)	0.0313 (*9*)	0.0275 (*11*)	0.0901 (*6*)
GBR (M3)	0.0386 (*10*)	0.1672 (*4*)	0.0412 (*10*)	–0.021 (*11*)
CAN (M1)	0.2257 (*3*)	0.2851 (*3*)	0.2558 (*3*)	0.1410 (*3*)
AUS (M3)	0.1218 (*5*)	0.1080 (*5*)	0.1378 (*7*)	0.1043 (*4*)

Table 5: Average Credibility of Money Growth Target Announcements in Selected Periods	start end	start 79M3	79M4 83M12	84M1 end
D (CBM)	–1.48 (*3*)	–1.88 (*4*)	–1.15 (*2*)	–1.50 (*3*)
F (M2)	–1.64 (*5*)	–0.72 (*2*)	–1.25 (*3*)	–2.58 (*7*)
I (TDC)	–4.54 (*10*)	–7.83 (*9*)	–3.81 (*10*)	–3.41 (*9*)
NL (M1)	–1.62 (*4*)	— (–)	–1.55 (*4*)	–1.60 (*5*)
J (M2CD)	–0.30 (*1*)	–0.21 (*1*)	–0.37 (*1*)	–0.23 (*1*)
CH (MBA)	–1.22 (*2*)	— (–)	–2.07 (*6*)	–0.60 (*2*)
USA (M1)	–2.94 (*8*)	–1.86 (*3*)	–2.75 (*8*)	–4.27 (*10*)
USA (M3)	–2.15 (*7*)	–2.31 (*6*)	–2.51 (*7*)	–1.59 (*4*)
GBR (M3)	–5.70 (*11*)	–3.32 (*8*)	–7.39 (*11*)	–5.22 (*11*)
CAN (M1)	–3.04 (*9*)	–2.52 (*7*)	–3.43 (*9*)	–3.11 (*8*)
AUS (M3)	–1.79 (*6*)	–2.15 (*5*)	–1.57 (*5*)	–2.01 (*6*)

Among those countries participating in the fixed exchange rate system of the EMS after March 1979 the estimate of **marginal credibility** of monetary target announcements in the overall sample period is highest for the Netherlands (0.22) and lowest for Germany (0.07), France (0.07) and Italy (0.11). On the other hand the **average credibility** of monetary announcements in the overall period is highest for Germany (–1.48) and the Netherlands (–1.62) and lowest for Italy (–4.54) and France (–1.64). Furthermore, with the exception of M2 for the Netherlands the marginal credibility of monetary announcements declined in the EMS member countries between the early and late 1980s.

Summarizing it can be stated that the evidence suggests that regardless of whether judgement is made on the basis of the relative success of past monetary targeting in meeting the pre–announced policy objectives (AC measure) or by the impact of announcements on the public's expectation formation processes (MC measure), the central banks of Japan and Switzerland were able to built up some credibility, while the British central bank was not successful in doing so. All remaining cases are less clearcut and will therefore be discussed in more depth below.

The United States.

In the United States the implementation of monetary policy underwent three major changes with respect to the role of monetary growth target announcements in the sample period. The first, though minor change resulted from the Humphrey–Hawkins Act of 1978, which required the Fed to establish calendar year growth targets to prevent the phenomenon of intra–year 'base drift'. Secondly, on October 6, 1979, the Fed announced its intention to adopt a more monetarist policy stance with strict adherence to M1 targets (and the abandonment of interest rate targets) in order to reduce the inflation rate. Three years later, on October 5, 1982, this strict monetarist policy was officially changed and the Fed decided to 'de–emphasis' M1 in favour of the broader aggregates, M2 and M3, but re–iterated its commitment to low inflation. Thus, as postulated in the paper of Loeys (1984), October 1979 and

October 1982 should have produced opposite movements in the estimates of the (marginal) credibility measure.

Figures 1 and figure 2 show the actual (m_t), expected ($Em_t | \Omega_t^{\bullet}$) and announced ($m_t^a$) growth rates for M1 and M3, while the time–paths of the marginal credibility of the M1 and M3 growth rate announcements is depicted in figure 3.

The credibility measure for M1 increases in 1975 and 1976, when M1 grew inside the announced target range and falls drastically between early 1977 and late 1979, when M1 accelerated and consistently grew above the announced target range. The estimate in figure 3 therefore is consistent with Axilrod's (1985) judgment that in 1977 and 1978 "*the credibility of policy was being eroded by the consistency at which M1 growth came in above adopted target ranges*".[17] In October 1979 this downward trend of the credibility of M1 announcements is brought to a standstill by the adoption of the new policy stance with closer adherence to the announced target paths. Despite some wavering in 1980, the record shows that M1 on the whole followed the target path until mid 1982.[18] As a result, the credibility measure rises between early 1980 and mid 1982. This supports Axilrod's (1985) view that "*the willingness to stick to the new procedure through a very difficult and volatile period greatly increased the Federal Reserve's credibility in fighting inflation*".[19] The estimates clearly indicate these credibility effects arising from the Fed's October 1979 commitment to monetary targeting. Furthermore, they show that these credibility effects are only minor in the period between October 1979 to December 1980, but relatively large in the first half of 1981, when the new Reagan administration was elected.[20] This in turn supports the views of Blanchard [(1984), (1987)], who states that "*while monetary disinflation was set in motion under Carter, the role of Reagan*

[17]Axilrod (1985), p. 15.

[18]This conclusion is also reached by Duesenberry (1983), P. 135.

[19]Axilrod (1985), p. 18.

[20]This corresponds to the "direct evidence" on financial market beliefs, a set of comments of market participants and analysts found in the *Business Week*, quoted by Blanchard (1984).

Figure 1: Actual, Expected and Announced Money Growth for the United States of America, M1 (% p.a.)

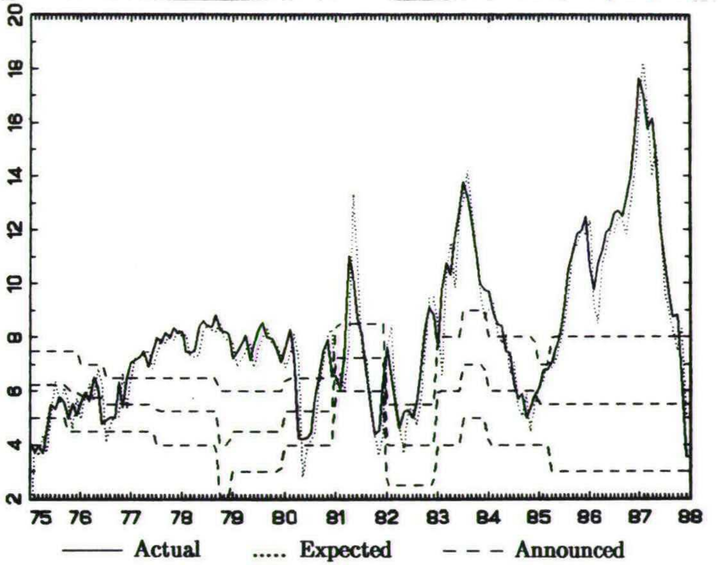


Figure 2: Actual, Expected and Announced Money Growth for the United States of America, M3 (% p.a.)

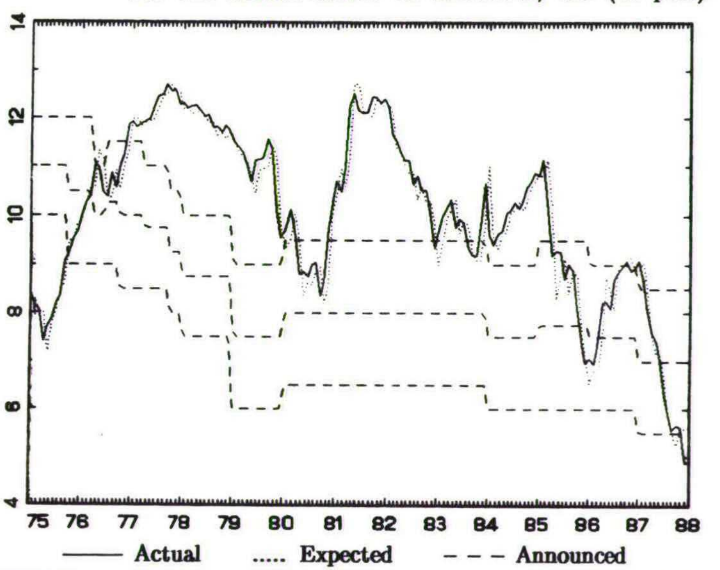
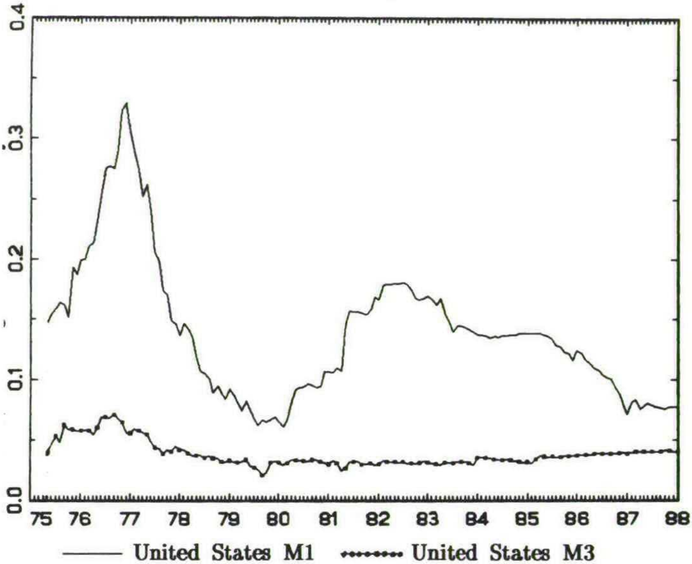


Figure 3: **Time Paths of Marginal Credibility Estimates**



was to give it more credibility."[21] It is furthermore consistent with the results of Hardouvelis & Barnhart (1987), who find that "*the October 1979 announcement of a policy change did not provide the Federal Reserve with instant credibility in the market. Inflationary fears appear to have been present for at least a year. The Fed established credibility slowly over time, apparently after markets began verifying that the new Fed policy was successful at reducing the inflation rate.*"[22] The credibility of M1 announcements in figure 1 continues to rise until around July 1982, when M1 growth accelerated above the upper target range and the Fed again appears to have made a major change in its operating procedures, as Friedman (1985) states.[23] This

[21]Blanchard (1987), p 19.

[22]Hardouvelis & Barnhart (1987), p 11.

[23]See Friedman (1985), p. 23 on this point.

change in policy objectives was confirmed by the October 1982 Fed announcement, when the credibility measure for M1 announcements already started to decline. Therefore, the empirical evidence presented here supports the above proposition, that the October 1979 policy change had a positive and the October 1982 policy change had a negative impact on the credibility of M1 growth target announcements. The results presented here therefore supplement the results of Hardouvelis & Barnhart (1987), who suspected but found no evidence on credibility effects arising from this latter policy shift.[24]

A second interesting result from figure 3 is that the credibility of the M3 target announcements remained lower than that of the M1 target announcement even after October 1982, suggesting that until its abolition in 1987 M1 remained the primarily targeted monetary aggregate. However, while the credibility of M1 target announcements decreased after October 1982, when M1 targets were 'de–emphasised', the credibility of the M3 target announcement increased, albeit only slightly. Both findings support the view, that after 1982 the Fed did not replace M1 by M3 targets, but shifted from monetary targeting to interest rate targeting instead.[25]

Canada.

Canadian monetary policy during the late 1970's and early 1980's is usually characterized by the term 'monetary gradualism'. The monetary aggregate the bank chose to control and announce target growth rates for was M1, currency outside banks plus chartered demand deposits. M1 was controlled via alterations in short–term interest rates, implying that the central bank aimed at controlling M1 via a stable demand function for these balances. Furthermore, monetary target rates for M1 were given priority over other policy considerations and M1 growth rate target ranges were gradually reduced in annual intervals from an initial rage of 10–15

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[24]See Hardouvelis & Barnhard (1987), p. 11.

[25]This return of the Fed to its pre–1979 practice of interest rate targeting in late 1982 is stressed in Loeys (1984), p. 22, Friedman (1985), p. 23, and Blanchard (1987), p. 20.

Figure 4: Actual, Expected and Announced Money Growth for Canada, M1 (% p.a.)

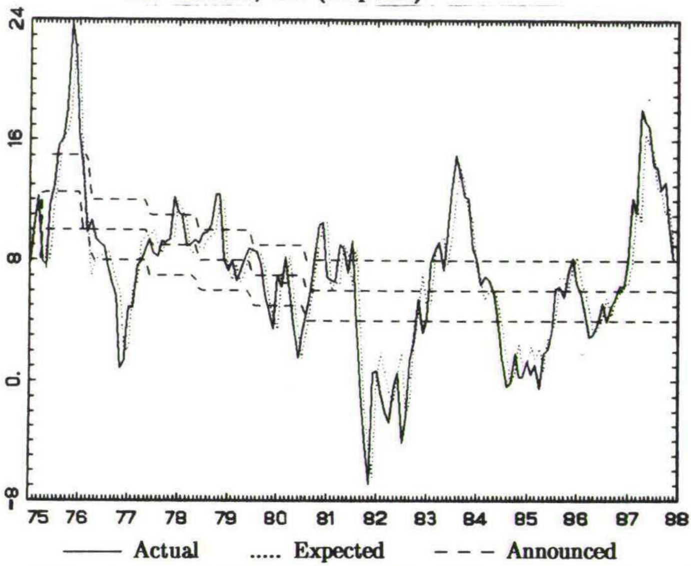
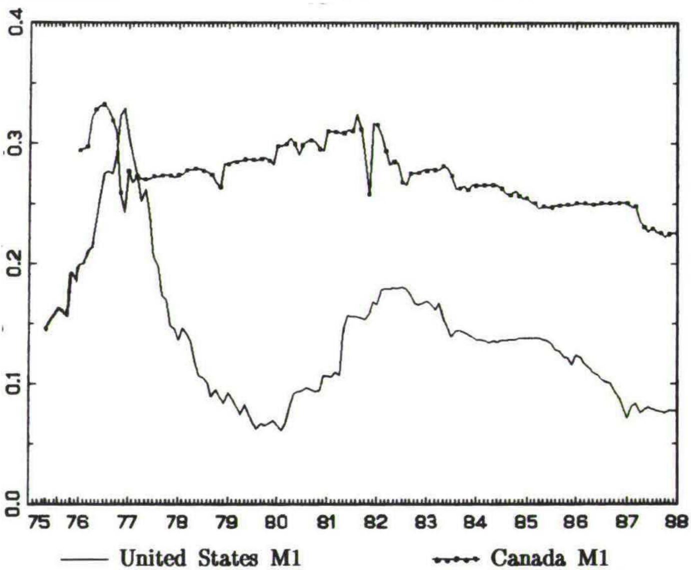


Figure 5: Time Paths of Marginal Credibility Estimates



percent in 1975/1976 down to 4–8 percent in 1980/1981, with a target corridor of two percentage point deviations from the mid–point of the target range, as depicted in figure 4. During the 1981/1982 recession the central bank shifted its policy orientation more and more towards the exchange rate with the U.S. dollar and in November 1982 the official announcement that M1 targets were abandoned was made.[26] To enable some inference for the post 1982 period the present study assumes that the Canadian central bank unofficially continued its 1982 M1 growth targets, which can partly be justified on the grounds that Canadian M1 target announcements were typically made for an indefinite period into the future.[27]

In figure 5 the credibility of Canadian M1 growth target announcements is as high as the credibility of M1 growth announcements in the United States in the year to the end of 1976. The credibility of Canadian M1 announcements then continuously increases during the period of "gradualism" between 1977 and mid 1981. In August 1981 there is a transitory decline in credibility due to a downward shift in the demand for M1, which results in growth rates of M1 well below the lower band of the target for the rest of 1981 and most of 1982.[28] Finally, after mid 1982 the credibility measures of Canadian and American M1–growth target announcements exhibit a similar pattern. Note however that Canada did not officially report a target after 1982, so only little significance is attached to this result, which was derived by assuming that Canada has unofficially continued its 1982 targets. However, the co–movement of both Canadian and American credibility measures are consistent with the co–movements of M1 growth rates in both countries, which resulted from the

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[26]On this point see Howitt (1987), p.641, footnote 6.

[27]Johnson (1983), p. 745 reports that Canadian M1 growth announcements were typically made for an indefinite period into the future. Hence, it could be argued that the latest announced official target is still valid, as indicated by the Federal Reserve Bank of St. Louis, "International Economic Conditions", volume August 1982, page 7 (Targeted Monetary Aggregates), footnote 1.

[28]On the reasons for and effects of this downward shift of demand for M1 in Canada after August 1981 see also Thiessen (1982), p. 104.

Bank of Canada's post 1982 policy stance of targeting the bilateral exchange rate with the U.S. dollar.[29]

United Kingdom

In the United Kingdom monetary targets were used internally by the Bank of England from 1973 onwards, but were first announced publicly for the monetary aggregate M3 in the Budget of 1976 and for Sterling M3 in the Budgets from 1977 onwards. For the 1974–1979 Labour Government these monetary targets, published in six month intervals and instituted in conjuncture with an IMF support arrangement requesting upper ceilings on credit expansion, were, however, only one part of an anti-inflation programme which relied primarily on income policies. After the election of the Conservative Party under Thatcher in May 1979, the new government gave priority to controlling the growth of monetary aggregates, at the time exclusively of Sterling M3, as the centrepiece of its new economic policy. The March 1980 Budget then established the 'Medium Term Financial Strategy' (MTFS), an annually renewed five year forward–looking plan of gradually lowering inflation by limiting the growth of monetary aggregates and subordinating fiscal policy to the achievement of the monetary target. At the same time financial markets were de–regulated and foreign exchange controls and direct credit controls, the so–called 'Corset', were abolished. In the March 1982 Budget a multiplicity of monetary targets was adopted and growth targets were announced for Sterling M3, M1 and Private Sector Liquidity (PSL2). In addition the importance of the exchange rate was explicitly mentioned, indicating a move to a more discretionary policy stance. Then after the March 1984 Budget target ranges for both Sterling M3 and M0 were announced and the Sterling M3 target was finally abolished in March 1987, when the Bank of England switched to announcing target ranges for M0 as the main monetary aggregate. In addition, the Bank of England during most of 1987 held the value of the Pound Sterling in a

[29]See Johnson (1983), pp. 752.

narrow range to the German Mark (close to 3 Deutsche Mark/Pound Sterling), unofficially adopting a policy of 'shadow targeting' the exchange rate.

In figure 6 the marginal credibility measure of the Sterling M3 target growth announcement is relatively high in the initial period, when in 1976 and during the first half of 1977 money growth stayed well within the specified target range, as can be seen from figure 5. The credibility measure then falls sharply during the second half of 1977, when money growth was well below the announced target range, but then stabilizes again at a lower level during 1978 and early 1979. The election of the Conservative Government under Thatcher in May 1979, the implementation of monetary targets as the prime policy objective in June 1979 and the adoption of the MTFS in March 1980 had little impact on the credibility measure. However, the credibility measure falls drastically to almost zero after the abolition of the 'Supplementary Special Deposits' Scheme, commonly known as the 'Corset', in June 1980. This system of direct credit controls, which constrained banks' liability expansion, was, since its introduction in 1973, used by the Bank of England to achieve its monetary targets. Its abolition caused massive transgressions of the Sterling M3 target in 1980 and 1981.[30] As a result, the credibility of Sterling M3 target announcements reaches its minimum in late 1981 and remains at an almost constant low level thereafter. This time profile is consistent with the official downgrading of the Sterling M3 target, which started with the March 1982 Budget, when the massive overshooting of the Sterling M3 target ranges was officially sanctioned by revising upwards the future targets and adopting a multiplicity of targets. The downgrading of the Sterling M3 target growth announcements finally came to an end with the March 1987 Budget, when the Bank of England abolished Sterling M3 and switched to announcing target ranges for M0 as the main monetary aggregate.

On the whole, the time path of the marginal credibility measure for Sterling M3

[30]See Thygessen (1984), p. 276, Minford (1988), p. 42, Goodhart (1989), p. 303 and also figure 6 of this paper.

Figure 6: Actual, Expected and Announced Money Growth for the United Kingdom, M3 (% p.a.)

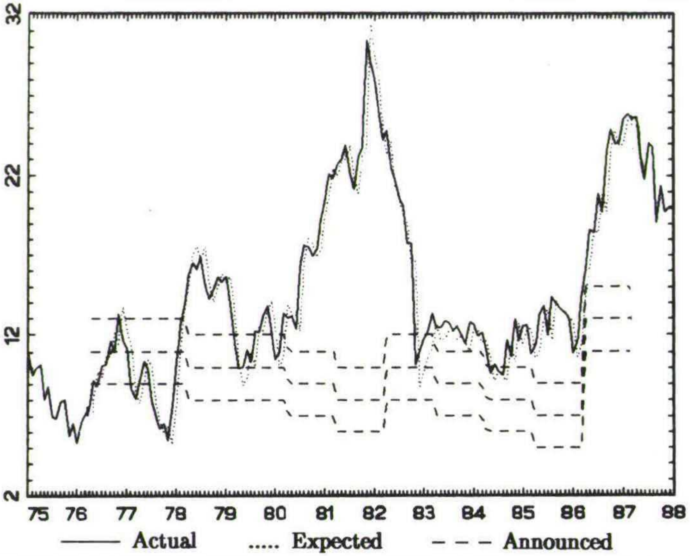
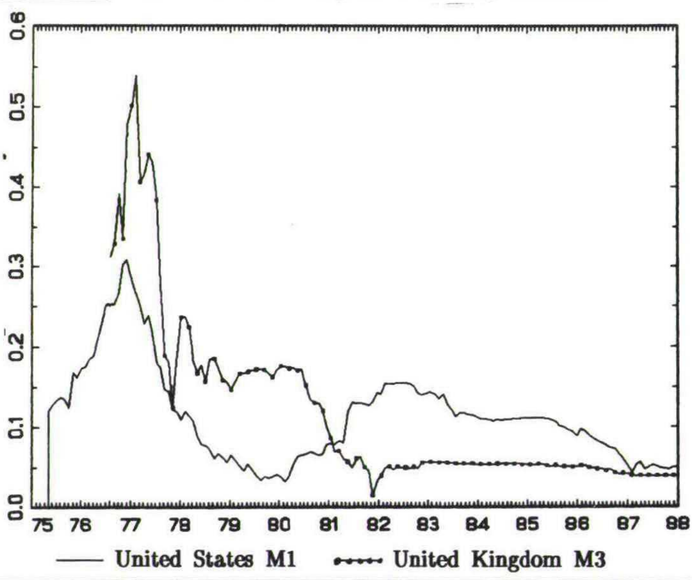


Figure 7: Time Paths of Marginal Credibility Estimates



announcements presented above supports the view of Fischer (1988), that "*the Bank of England lacked credibility*",[31] and of Minford (1988) that "*the MTFS not only failed to command credibility, fully or even to a significant extent, it also failed to be carried out in its own literal terms.*"[32]

Japan

In early 1975 the Bank of Japan abandoned most of its discretionary, activist policies adopted after the collapse of the Bretton Woods system of managed exchange rates and the first oil price shock in 1973 and moved to a new policy stance with monetary targeting. Broad money, M2(+CDs)[33], was chosen as the most important intermediate target for monetary policy and the achievement of price stability was adopted as the first policy priority.[34] In the actual management of the money supply, the Bank of Japan's main operating targets were the interbank interest rates (call and bill rates), and monetary control was implemented by maniputating the discount rate, reserve ratios, and through open market operations, occasionally supplemented by the use of 'window guideance', that is, direct controls of bank lending to the private non–bank sector.

Even though the Bank of Japan has a monetary target, which is set for the period of a year, not the monetary target itself but 'forecasts' of the targeted aggregate M2(+CDs) are announced to the public. The publication of these money growth projections, which are announced quarterly in terms of the percentage increase over the previous year in the average money stock of the quarter concerned, began in

[31]Fischer (1988), p. 23.

[32]Minford (1988), p. 42.

[33]In May 1979 banks were permitted to issue negotiable certificates of depostits (CDs) and secondary trading in these instruments started in April 1982. The CD component in Japan is under quantitative restrictions and relatively small. The error of using growth rates of M2 instead of growth rates of M2+CD can therefore be expected to be only minor.

[34]See Suzuki (1985). For details of monetary targeting in Japan see also Shimamoto (1983), and for comparitive studies see Dotsey (1986) or Wagner (1989).

July 1978, as depicted in figure 8.[35] During 1978 Japanese monetary policy was eased as the yen appreciated relative to the U.S. dollar. As inflationary pressure re-emerged in the wake of the depreciation of the yen and the marked increase in oil and other international commodity prices during the first half of 1979, monetary policy was tightened. Money growth rates started falling after mid 1979 and declined drastically during 1980, leading to a quicker disinflation with much less extra unemployment in Japan relative to other OECD countries. Once inflation was under control, the Bank of Japan eased its restrictive course in 1981 with severe cuts in the discount rate, a reduction of compulsory reserve requirements and an easing of 'window guidance' ceilings on bank lending. Money growth accelerated in 1981, but declined again during 1982 and 1983, when monetary policy was dominated by the authorities' objective not to weaken the yen. Between early 1984 and late 1986 M2(+CDs) growth fluctuated around 8 percent and in 1987 accelerated again. During this more recent period exchange rate as well as domestic demand considerations, in addition to the concern over inflation, have progessively influenced the conduct of Japanese monetary policy.

The average credibility measure for the Bank of Japan's M2(+CDs) projections are displayed in figure 9 together with the corresponding credibility measure for the Fed's M1 announcements. Japanese credibility is higher than US credibility in 1978 and declines slightly at the start of the announcement period. With the monetary contraction setting in after the second oil price shock in June 1979 the credibility of M2(+CDs) announcements increases drastically and remains relatively high for the rest of 1979. This result is consistent with the statement by Fisher (1988) that "*the Bank of Japan clearly had achieved credibility by 1980*".[36] The relatively large deviations of the projections from the actual growth rates during the sharp monetary contraction of 1980, which are also reported in Meltzer (1986b), furthermore explain

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[35]Suzuki (1985) explains that the use of projections rather than targets is giving the central bank flexibility and freeing it from political preasure. See also Fischer (1988).

[36]Fischer (1988), p. 15.

Figure 8: Actual, Expected and Announced Money Growth for Japan, M2(+CDs) (% p.a.)

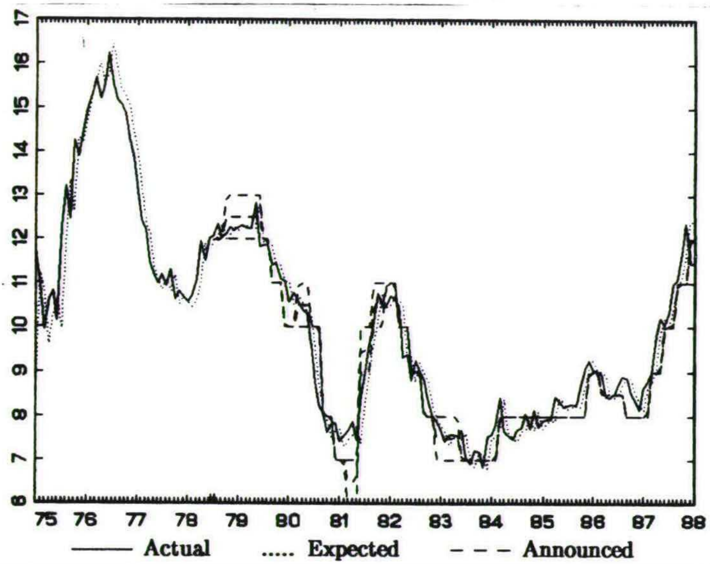
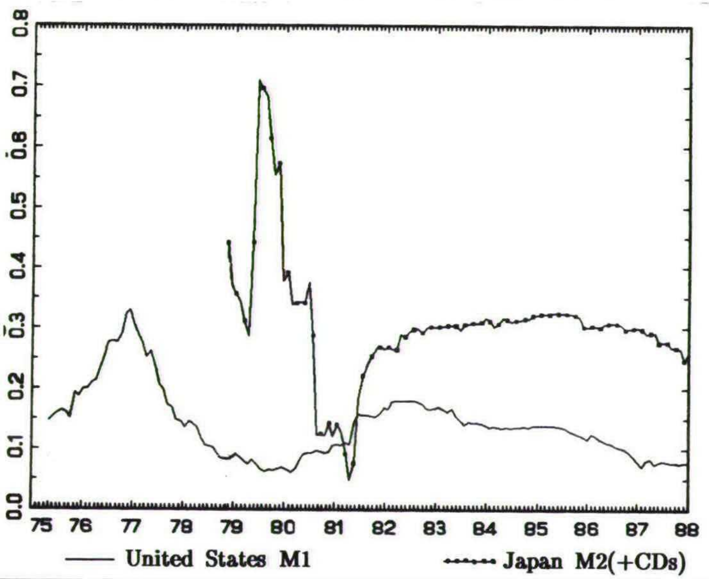


Figure 9: Time Paths of Marginal Credibility Estimates



the decline in credibility of monetary announcements during that year and in early 1981. As monetary policy was eased around mid 1981, the Bank of Japan again achieved rates of growth close to its projections, thereby again enhancing credibility. Until September 1985 this credibility was not undermined by the Bank of Japan's increasing concern over the exchange rate since purchases and sales of foreign exchange were not used to change the rate of money growth or to produce large differences between projected and actual money growth rates.[37] However, after September/October 1985, when the Bank of Japan massively intervened in foreign exchange markets, there is a first decline in the credibility of M2(+CDs) announcements.[38] Credibility then declines further during 1987, when monetary policy was relaxed significantly as a result of renewed heavy exchange market interventions and continuing financial market liberalization.

Switzerland

In 1975 the Swiss National Bank first announced a target for money growth. The chosen aggregate was M1, currency in circulation plus sight deposits held by residents, although a target for equal growth in the monetary base (MB) was implied.[39] In this early phase of monetary target announcements the adjusted monetary base was chosen as an instrument for controlling the growth of M1. However, in response to the sharp appreciation of the Swiss Franc against the dollar and the German Mark in autumn 1978, the Swiss monetary authority formally abandoned the M1 growth target in favour of an explicit exchange rate target floor (of 0.8 Swiss Francs per German Mark) and stated its intentions to intervene in the foreign exchange markets as necessary. For 1979 no formal money growth target was

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[37] On this point see also Meltzer (1986b), p. 670.

[38] Meltzer [(1986b), (1987a)] also reports this policy switch to a system of less freely fluctating exchange rates in Japan after the September 1985 Plaza agreement of the G5 countries.

[39] On this point see Johnson (1983), p. 749.

announced, but after the situation in foreign exchange markets had markedly improved in spring 1979, the Swiss National Bank returned to a policy stance of actively targeting monetary aggregates. This return of the Swiss National bank to a policy of monetary targeting was publicly announced in 1980. The new aggregate chosen, however, was the monetary base, that is the sum of currency in circulation plus deposits at the Swiss National Bank held by Swiss banks and by commercial and industrial firms. In 1981 there was an additional minor change in the targeted aggregate with the adoption of the adjusted monetary base (MBA), which is defined as the monetary base adjusted for transitory fluctuations in banks' balance sheets. Again the overriding policy objective for monetary policy was the preservation of price stability. As depicted in figure 10 MBA growth targets were gradually lowered over the following years from 4 percent in 1980–1981 to 3 percent in 1982–1985 and finally to 2 percent in 1986–1987.

The estimate of the credibility of the Swiss National Bank's adjusted monetary base (MBA) growth announcements is displayed in figure 11 relative to the corresponding measure for the Fed's M1 announcements. In 1981 and during the first half of 1982 the Swiss National Bank's credibility was relatively low while MBA growth was negative and thus well below the 4 and 3 percent target. MBA growth then accelerated during the rest of 1982 and credibility increases. After early 1983 MBA growth fluctuates around the 3 percent target and the variability of target deviations is progressively reduced during 1984 and 1985. As a result the credibility of money growth announcements is further increased and stabilizes considerably after 1984. With the reduction of the MBA growth target to 2 percent in 1986 and 1987 credibility again increases in two minor steps in these two years and is relatively high at the end of the sample period.

Figure 10: Actual, Expected and Announced Money Growth for Switzerland, MBA (% p.a.)

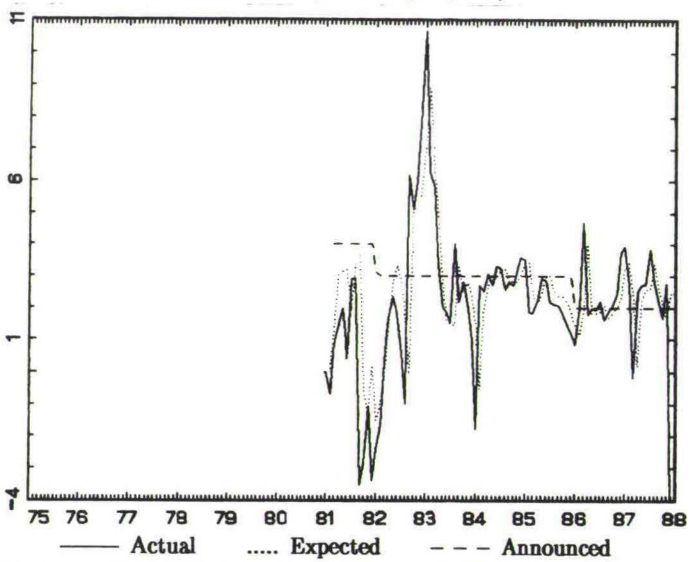
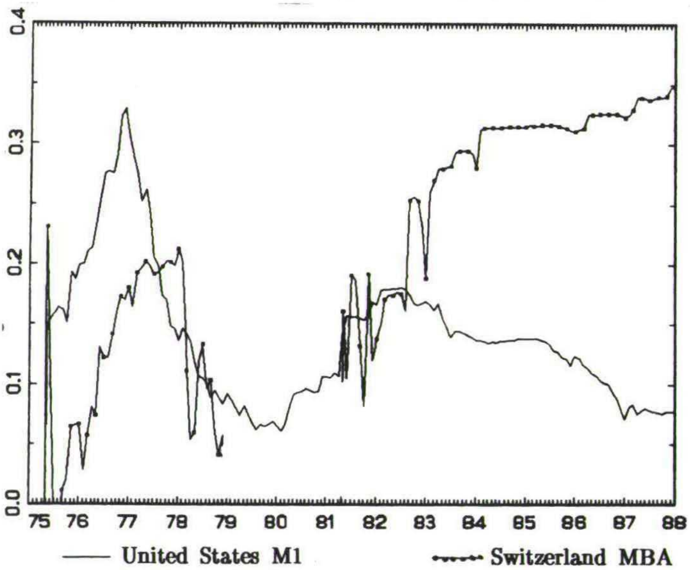


Figure 11: Time Paths of Marginal Credibility Estimates



Germany

Since December 1974 the Bundesbank once a year announced an annual growth target for the adjusted central bank money stock (CBM), an aggregate consisting of currency in circulation[40] and required reserves on domestic bank deposits at constant reserve ratios.[41] Following Trehan (1988), the German experience with CBM targeting will be discussed here for three sub–periods, the pre–EMS phase 1975–1978, the early EMS period 1979–1985 and the late phase 1986–1987.

Central bank money growth overshoot the fixed 8 percent target from 1975 to 1978, with increasing overshooting towards the end of this period. The overshooting in 1978, when cash held by banks was first recognized as part of required reserves, is admitted by the Bundesbank to have been the year with the largest target misses. The Bundesbank attributed these target misses to both imperfect control and as well as a deliberate reaction on external developments, mainly interventions to damp the appreciation of the D–Mark.[42] Furthermore, monetary targeting at that time was still considered to be at an experimental stage, and the constant fix–point target was only regarded as being of limited practical relevance. After the 1975–1978 experience with a constant fix–point target for CMB growth the Bundesbank adopted target ranges[43] for 1979–1987 in order to allow some flexibility to address unexpected economic developments, such as exchange rate movements. Furthermore, the upper bound of the target range was lowered during 1979–1985 from 9 to 5 percent as part of the

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[40]Before March 1978 currency held by banks was included in the currency position and afterwards was accepted as part of required reserves. Thus, in March 1978 CMB under the new reserve requirement was equal to 131.8 Mrd. German Mark, while CMB under the old reserve requirement would have been 136.2 Mrd German Mark. This structural break in the reported series was accounted for here by pre–multiplying all data prior to March 1978 by a factor 131.8/136.2 in order to derive more consistent growth rates for CMB.

[41]The constant reserve ratios are those effective in January 1974.

[42]See Deutsche Bundesbank (1985), p. 25 or Schlesinger (1983), p. 9, who states that "in 1977–1978 it (the Bundesbank) accepted substantial 'overshooting' of monetary growth in order to counteract excessive 'real' appreciation of the D–Mark".

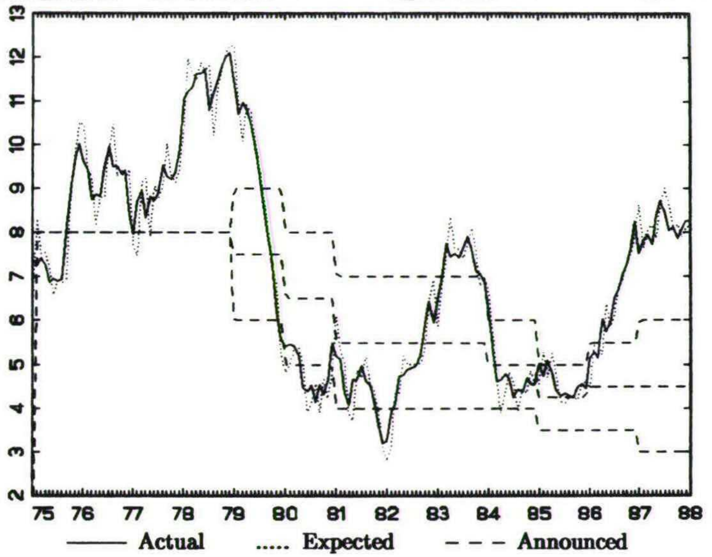
[43]From 1979–1983 a 3 percent range, from 1984–1986 a 2 percent range and for 1987 again a 3 percent range was adopted.

Bundesbank's anti–inflation policy stance. In addition, to clearly indicate its policy intentions while adopting target ranges, the Bundesbank between 1979 and 1983 in mid–year announced where within the target range it would aim monetary growth.[44] With the onset of the EMS and the second oil price shock in 1979 the Bundesbank tightened monetary policy and CMB growth came down to within the target range in the second half of 1979, and fluctuated around the lower bound of the target range in 1980 and 1981. CBM growth then moved from the lower to the upper bound of the range in 1982, stayed at the upper bound during 1983 and lay at the core of the target range during 1984 and 1985. After 1985 monetary policy was driven largely by developments in foreign exchange markets. As the mark appreciated against the dollar, monetary growth exceeded the upper bound of the target range in 1986 and 1987, despite the fact that the Bundesbank increased the upper bound of the target range by half a percentage point each year. CMB targeting finally terminated in January 1988, when the Bundesbank announced a 3–6 percent range for the monetary aggregate M3.

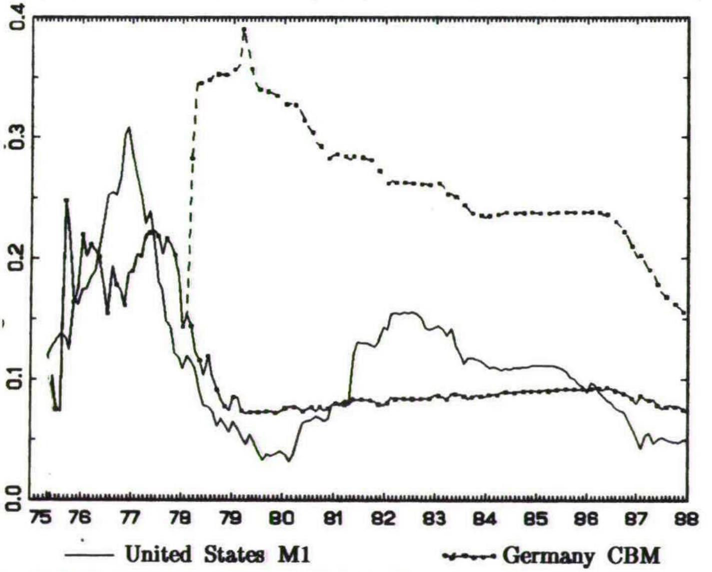
Figure 13 presents two measures of the marginal credibility of German CBM growth announcements. The dashed and dotted line represents the marginal credibility of the original CMB growth series and the solid and dotted line the break–adjusted CMB growth series, which is focused upon in this paper. Note that both credibility measures are identical up to February 1978. With the recognition of cash held by banks as part of required reserves, the credibility measure for non–adjusted CBM more than doubles in March 1978, due to the low and on–target growth rates of non–adjusted CBM. The credibility measure of adjusted CBM, however, declines as a result of the large target overshooting of adjusted CBM during 1978. Thus, the estimate of credibility for adjusted CMB supports the views of Hellwig & Neumann (1987) that the Bundesbank's "*deliberate overshooting of the official monetary target*

[44]In 1979 and 1980 the Bundesbank aimed at the lower bound of the 6–9% and 5–8% target ranges. In 1981 the lower half and in 1982 and 1983 the upper half of the 7–9 % target ranges were announced as revised targets during the year.

<u>Figure 12:</u> Actual, Expected and Announced Money Growth for West Germany, CBM (% p.a.)



<u>Figure 13:</u> Time Paths of Marginal Credibility Estimates



in 1978 had contributed to rekindling inflation and to lessening its credibility."[45] The relative success of the Bundesbank with more flexible monetary targeting between 1979 and 1985, which is also indicated by the average credibility (AC) measure above, is not fully reflected by the marginal credibility (MC) estimate, which increases only slightly but steadily between 1979 and early 1986. With monetary policy being dominated by developments in foreign exchange markets after 1985 the credibility of CBM announcements declines again at the end of the sample period. This latter decline of the credibility of CBM target announcements in 1986 and 1987 is due to the massive target overshooting in these years and finally resulted in the abolition of CBM target announcements in 1988.

The surprisingly low estimate of the marginal credibility of the Bundesbank's CBM target announcements reported above requires some further comments. Firstly, note that the relatively low credibility of CMB target announcements found in the present paper is consistent with Trehan's (1988) finding that the Bundesbank's concern over inflation has not bound it to strict adherence to monetary targets, since targets have been missed frequently and that the Bundesbank has retained a considerable level of discretion in the implementation of monetary targeting. Furthermore, the credibility of monetary target announcements discussed here has to be distinguished from the credibility of the Bundesbank's anti–inflation policy stance. The credibility of this anti–inflation commitment is indisputable and empirical evidence provided in Weber (1988c) shows that the Bundesbank's reputation as an inflation fighter is highest amongst the major OECD countries. Two possible explanations for the low credibility estimate found here are found in the literature: Fischer (1988) suggests that the lack of credibility could perhaps be due to the fact that the Bundesbank had tolerated too high inflation in the late seventies. This argument is supported by the above marginal credibility estimate for unadjusted CBM, which for lower and on–target CMB growth in 1978 results in much higher

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[45]Hellwig & Neumann (1987), p. 112.

credibility. Secondly, the fact that all periods of major target misses and credibility losses are connected to undesired exchange rate developments (1978, 1986–1987) is consistent with the view of Gleske (1987), who fears that at the moment in Germany exchange rate considerations are given too much weight in the formulation and implementation of monetary policy.[46]

France

With the election of Raymond Barre as prime minister in March 1976 and the adoption of the so–called 'Barre Plan', an orthodox deflationary stabilisation policy package, in September 1976 the Banque de France began setting formal monetary targets. In December 1976 this target, a single growth rate for M2 without target bands was first publicly announced and between 1977 and 1981 the target took the form of a single annually declining figure, as depicted in figure 14. Under the Barre Plan monetary policy was more stringent than before and among the three intermediate objectives of French monetary policy, that is money stock growth, exchange rates and interest rates, the money stock target was of primary importance. The achievement of monetary targets was implemented mainly by regulations in the form of selective credit controls and credit ceilings. In March 1979 the onset of the EMS compelled the Banque de France to keep the exchange rate of the Franc in a given parity band with other EMS member currencies. With the election of President Mitterand in May 1981 economic policies were geared towards a reduction of unemployment by expansionary fiscal policies.[47] Monetary policy was relaxed in June 1981 by an unofficial upward revision of the M2 growth target (set by the previous government), by easing credit ceilings and by putting strong official downwards pressure on interest rates, while at the same time introducing foreign exchange

[46]See Gleske (1987), pp. 28–29.

[47]Public expenditure and the budget deficit were increased, consumption was stimulated through increased social security benefits and the raising of the minimum wage (*SMIC*) and investment was encouraged by larger interest rate subsidies (*bonification*).

controls. Reflation, the October 1981 devaluation of the Franc and speculative pressure on the Franc in early 1982 then led to a tightening of policy, with the reduction of inflation being restored as the main policy objective after the second Franc devaluation in June 1982. In addition, prices and wages were frozen from June until the end of October 1982 and the freeze was gradually phased out during 1983. After the third devaluation of the Franc in March 1983 there was a turnaround in French macro policy with the austerity program introduced under Prime Minister Mouroy shortly afterwards. Fiscal and monetary policy were severely tightened and even stricter foreign exchange controls were adopted. The monetary contraction of 1983 and 1984 was mainly achieved by keeping interest rates so high that credit ceilings were not binding. During the calendar years 1985 and 1986 the credit ceiling system was then replaced by a system of progressive reserve requirements. By January 1987 capital controls were finally removed and reserve requirements are now proportional to bank deposits.

In figure 15 the estimate of the marginal credibility measure of French M2 target growth announcements is relatively high in the early Barre period, when M2 growth rates fluctuated around the announced rates in 1977 and 1978. This indicates the initial success of the Banque de France, whose "*main reason for announcing publicly a monetary growth target was ... to strengthen the credibility of their anti–inflation policy*".[48] Marginal credibility then falls drastically during 1979, when the M2 target of 11 percent was vastly overshot[49] as a result of an accommodative monetary policy at the time of the second oil price shock of late 1978/ early 1979, which caused a rise in world inflation, interest rates (as a result of inflationary expectations) and money demand (due to higher short–term than long–term interest rates). The credibility of monetary announcements then stabilizes again at a lower level between 1980 and 1984 and shows no major credibility effects of the early reflationary Mitterand period (1981–1982) or the 1983 adoption of the deflationary

[48]OECD (1979).

[49]Average actual M2 growth was 14.4 percent p.a. in 1979, see Raymond (1989), p. 113.

Figure 14: Actual, Expected and Announced Money Growth for France, M2 (% p.a.)

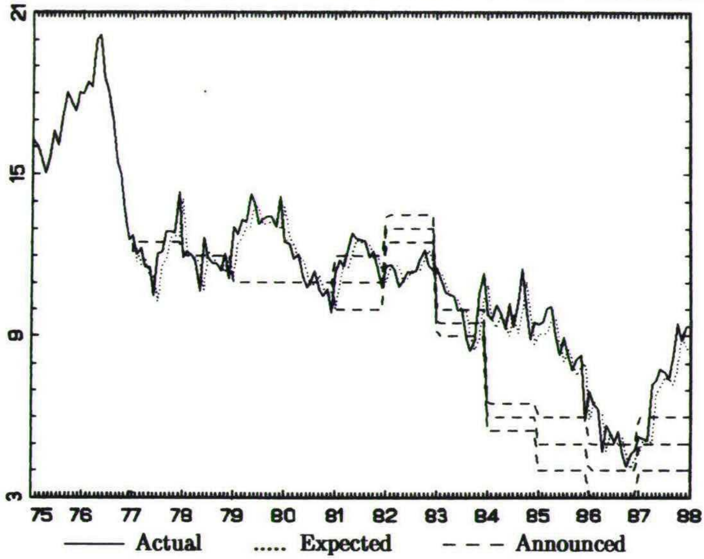
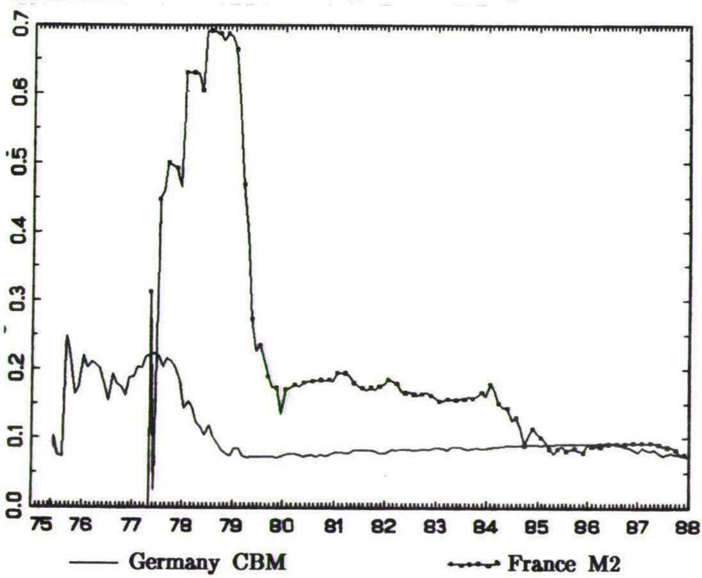


Figure 15: Time Paths of Marginal Credibility Estimates



austerity period. The credibility of monetary announcements however declines again with the massive target misses in 1984 and 1985,[50] when the Banque de France adopted a program of financial market liberalization and implemented new monetary control procedures based on open market operations rather than direct credit control through quantitative restrictions. At the same time, French monetary policy was primarily directed towards the exchange rate[51] instead of the rate of money growth as intermediate target in order to achieve the central bank's ultimate target, the reduction of the inflation rate. The decline in the credibility of monetary target announcements found here is therefore consistent with this downgrading of M2 target announcements and the increasing commitment towards the EMS in the conduct of French monetary policy.[52]

Italy

In 1974 the Banca d'Italia decided to set a monetary objective in terms of a 'total domestic credit' (TDC) ceiling as an intermediate target, after having targeted the monetary base before. This decision to target credit aggregates was supplemented by recourse to a progressively more sophisticated system of direct credit controls. By the end of 1976 bank credit ceilings were reintroduced as part of a stabilization package adopted after the exchange rate crisis of 1976. After the onset of the EMS in March 1979 and the second oil price shock 1979 monetary policy turned more restrictive towards the end of 1979 and remained restrictive throughout 1980. A

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[50]An additional problem here is that the 1984 and 1985 money growth targets were expressed for M2R, that part of M2 held by residents, while for 1986 only a growth target for M3 was issued by the Banque de France. This discontinuety in the definition of the relevant monetary aggregate suggests a downgrading of the importance of monetary targeting by the Banque de France and the adoption of a 'softer' approach to monetary targeting. Note that at this stage of the paper these 1984–1986 target announcements are simply treated as equivalent to M2 targets, while for a more adequate treatment some form of adjustment would be desirable.

[51]See Wyplosz (1988b), p. 62 for this interpretation of French post 1983 monetary policy.

[52]Empirical evidence on an increasing credibility of the French exchange rate commitment towards the EMS is provided in Weber (1989).

Figure 16: Actual, Expected and Announced Credit Growth for Italy, TDC (% p.a.)

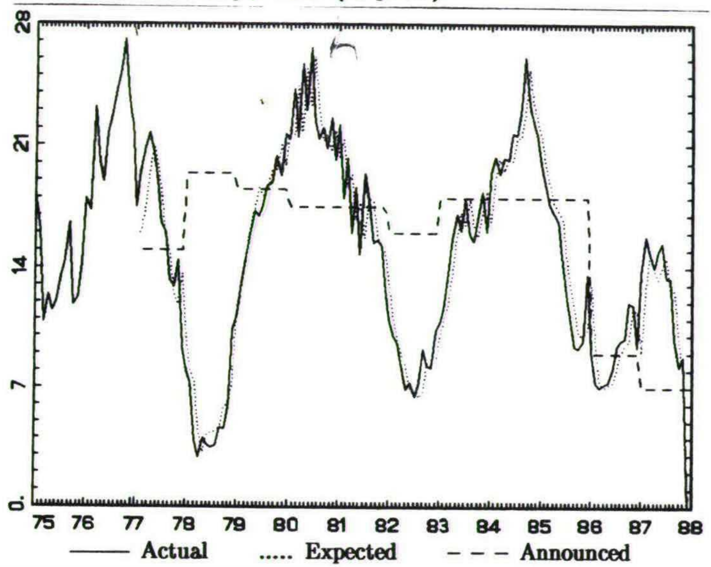
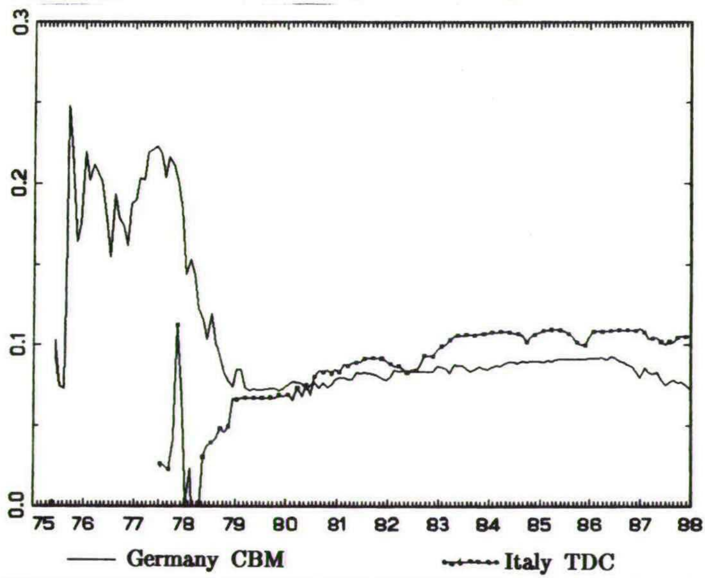


Figure 17: Time Paths of Marginal Credibility Estimates



system of compulsory reserves on deposits and a limit on the increase of financing in foreign exchange for imports were introduced. In July 1981 the Banca d'Italia was freed from the obligation to purchase all the unsold public debt of the Treasury. Until the abolition of ceilings on loans in mid 1983 the Banca d'Italia continued to frame its monetary policy mainly in the form of credit targeting and interest rate objectives, while at the same time a policy of strictly targeting some monetary aggregate was publicly rejected by the Italian central bank. However, explicit monetary targets were adopted from 1984 onwards, when the Banca d'Italia started announcing growth targets for M2. Furthermore, the conduct of monetary policy was shifted towards an open market operation modus as the normal monetary policy instrument.

The estimate of the marginal credibility of the Italian total domestic credit expansion target in figure 17 increases continuously after 1978 and shows only minor declines in times of massive target deviations, such as the overshooting of 1984 and 1987 and the undershooting of 1978, 1982 and 1985, as depicted in figure 16.[53] During the EMS phase there is a strong similarity between the time paths of the German and Italian credibility measures. Note, however, that Italian credit ceiling targets are qualitatively different from monetary targets, since the Banca d'Italia exercises direct control over total domestic credit. This is supported by the finding that a similar regression for M2 growth over the period 1984 to 1987 resulted in a marginal credibility estimate for Italian M2 target announcements of MC=0.0262, which is considerably lower than the corresponding estimate of MC=0.097 for Italian TDC announcements in the last column of table 4. This result is also consistent with the

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[53]Note that these credit ceiling targets are qualitatively different from the monetary targets (or target ranges) analysed above since any rate of growth below the ceiling is to be identified as the achievement of the target. Therefore, monetary authorities will only aim at pushing the actual growth rate towards the target if it is overshot, which implies an asymmetrical objective function as opposed to the symmetrical type used in equation (5). Furthermore, least–squares inference is unable to extract such non–symmetric information from these type of targets and different estimation methods would be necessary for a more adequate treatment.

fact that for credit ceilings as opposed to monetary targets any rate of growth below the ceiling is identified as the achievement of the target and hence as a credible policy since the central bank will only aim at pushing the actual growth rate towards the target if it is overshot.

5. Summary and Conclusions

The evidence on the credibility of monetary target announcements presented above suggests that, with the exception of Switzerland, a downgrading of monetary targeting is experienced in all major industrialized countries in the late 1980s relative to the 1970s and early 1980s. Indications of 'soft' monetary targeting are manifold.

The most rigorous changes in the conduct of monetary policy were made in the Netherlands, Canada and Australia, where monetary targets were abolished altogether. In Australia a variety of additional policy indicators was used to determine the course of monetary policy whilst in Canada and the Netherlands exchange rate targets were adopted. Evidence on an increasing importance of exchange rate considerations in the conduct of monetary policy is however not limited to these countries. Within the EMS system of managed exchange rates also France, Italy and Germany are compelled to keep their bilateral exchange rates in the given parity bands. Furthermore, exchange rate considerations relative to the U.S. Dollar had a strong impact on monetary policy in both Japan and Germany recently, while explicit exchange rate targets relative to the D–mark caused the temporary abolition of monetary targeting in Switzerland in the late 1970s. Finally, implicit exchange rate targets relative to the D–mark supplemented monetary targeting in the United Kingdom during 1987 and 1988. In all cases the commitment of the central bank to monetary targeting is undermined by their increasing commitment towards the exchange rate, which in turn resulted in a decline of the credibility of monetary target announcements. One possible explanation for the accentuation of 'soft' monetary targeting, which is now prevailing in most countries is given in Boissieu

(1988), who states that "*central banks prefer to keep some fixed points, even if they overshoot announced targets. The loss of credibility and reputation would be greater in the case of abolition than it is with overshooting.*"[54]

Evidence of policy switches to 'soft' monetary targeting are also given independent of exchange rate considerations. In the United States and the United Kingdom a 'soft' approach to monetary targeting was adopted by announcing targets for a variety of monetary aggregates. Failures in achieving the target for one monetary aggregate were easily excused if targets for other monetary aggregates were achieved and 'Goodhard's law', a modification of the 'Lucas critique' according to which the attempt to control any monetary aggregate will destabilise the demand for it, was frequently referred to in this context.

An argument in favour of 'soft' monetary targeting, that is the continuing of monetary targeting despite frequent target misses, is that even if monetary targets are not perfectly credible, they nevertheless provide the public with useful information about the future course of monetary policy. The impact of this information on expectations is found to be positive in the present paper. The two central banks most successful in this respect are the Swiss National Bank and the Bank of Japan. Note that both central banks subscribe to completely different philosophies of monetary targeting: whilst the Bank of Japan in principle follows an annual monetary target, it nevertheless provides the public with a quarterly signal of its short–run money growth intentions. The Swiss National Bank on the contrary understands its monetary announcement signal more as a medium–term (two–year) signal which effectively constrains future money growth decisions. In both cases the announcement signal is relatively credible and the information content of both forms of target announcements is found to be relatively high.

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[54]Boissieu (1988), p. 66.

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