

A Service of

ZBW

Leibniz-Informationszentrum Wirtschaft Leibniz Information Centre for Economics

Weber, Axel A.

Working Paper Credibility, Reputation and the Conduct of Economic Policies Within the European Monetary System

Volkswirtschaftliche Diskussionsbeiträge, No. 11-90

Provided in Cooperation with:

Fakultät III: Wirtschaftswissenschaften, Wirtschaftsinformatik und Wirtschaftsrecht, Universität Siegen

Suggested Citation: Weber, Axel A. (1990) : Credibility, Reputation and the Conduct of Economic Policies Within the European Monetary System, Volkswirtschaftliche Diskussionsbeiträge, No. 11-90, Universität Siegen, Fakultät III, Wirtschaftswissenschaften, Wirtschaftsinformatik und Wirtschaftsrecht, Siegen

This Version is available at: https://hdl.handle.net/10419/118709

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



WWW.ECONSTOR.EU

VOLKSWIRTSCHAFTLICHE DISKUSSIONSBEITRÄGE





UNIVERSITÄT - GESAMTHOCHSCHULE - SIEGEN FACHBEREICH WIRTSCHAFTSWISSENSCHAFTEN

Credibility, Reputation and the Conduct of Economic Policies Within the European Monetary System

2

by

Axel A. Weber, University of Siegen and CEPR

Discussion Paper No. 11-90, July 1990

Abstract

Most empirical papers on the importance of credibility and reputation for the conduct of economic policies are based on ad hoc models which bear little resemblence to the theoretical models of policy games which have made these concepts popular in the academic literature. The purpose of the present paper is to review the formal definitions of credibility and reputation in a number of important game-theoretical models of policymaking and to provide some evidence on the empirical relevance of these definitions. This is done by arguing strictly within the context of these models. It is thereby shown that the results derived from this exercise are – at least to some extent – able to 'make the data talk' on how the European Monetary System (EMS) has affected the credibility of economic policies within member countries.

* Paper to be presented at the Economic Policy Panel Meeting, London, 15th to 16th October 1990. This paper was prepared with financial support from the Commission of the European Communities under the Stimulation Programme for Economic Sciences (SPES).

Credibility, Reputation and the Conduct of Economic Policies Within the European Monetary System

Axel A. Weber, University of Siegen and CEPR

Summary

٠

Despite the vast growth in the theoretical literature on the importance of credibility and reputation for the conduct of economic policies, there is little empirical evidence on these issues available to date. This lack of empirical evidence reflects in part a shortcoming in the theoretical literature, which frequently is not very precise with respect to what is actually meant by credibility or reputation and how it may be measured. Furthermore, most empirical papers are based on ad hoc models which bear little resemblence to the theoretical models of policy games which have made the concepts of credibility and reputation popular in the academic literature.

The purpose of the present paper is to review the formal definitions of credibility and reputation in a number of important game-theoretical models of policymaking and to provide some evidence on the empirical relevance of these definitions. This is done by arguing strictly within the context of these models. It is thereby shown that the results derived from this exercise are – at least to some extent – able to 'make the data talk' on how the European Monetary System (EMS) has affected the credibility of economic policies within member countries.

The main finding of the study is that credible commitments to fixed exchange rates, which were the rule under the Bretton Woods system, are the exception under the EMS. In particular the EMS is not found to work like a 'DM-zone', since only for the Netherlands and after 1986 for Ireland are credible commitments towards German mark exchange rates pegging policies to be found. The smaller EMS countries Belgium and Denmark appear to have geared their exchange rate policies more towards credibly pegging to the French franc, whilst the Italian EMS exchange rate commitment is non-credible in all cases. Furthermore, the credibility of the French commitment to targeting the German mark exchange rate is found to have increased recently. Finally, whilst the smaller EMS countries Belgium, Denmark, Ireland and the Netherlands also pursue credible interest rate targeting policies, the interest rate targeting and monetary (credit) quantity targeting policies adopted by the larger EMS countries Germany, France and Italy are found to lack credibility.

Credibility, Reputation and the Conduct of Economic Policies within the European Monetary System

Axel A. Weber¹ University of Siegen and CEPR

1. Introduction

Theoretical macro models which view economic policies as a game between private agents and policymakers are frequently not very precise with respect to what is actually meant by credibility or reputation and how it may be measured. This shortcoming in the theoretical literature is reflected by a lack of empirical evidence on these issues. However, empirical research in this field has recently been started. The aim of this paper is to briefly review this literature and to present new empirical evidence on the relevance of credibility and reputation for the conduct of economic policies within the European Monetary System (EMS).

In principle, the empirical literature on credibility and reputation may be divided into the two broad categories of direct and indirect evidence, as Wyplosz (1989) notes. The *indirect approach* to estimating credibility derives from Fellner's (1979) stabilization policy argument that a 'credible policy' is less costly – in terms of output foregone – than a policy which the public expects to be aborted. In other words, 'credible policies' should imply more favourable output-inflation trade-offs. Specific versions of this 'anti-inflation credibility' proposition are examined in a number of papers: Perry (1983), Blanchard (1985) and Christensen (1987a,b, 1988) and Kremers (1990) examine whether a suspected deflationary policy shift is 'credible' in the sense that actual inflation rates or interest rates are lower than those predicted from structural Phillips curve models estimated over the period prior to the policy shift. These prediction-error type of tests are supplemented by parametric tests on the stability of the regression coefficients in order to evaluate the relevance of the 'Lucas critique' for the suspected policy shifts. A similar

¹Revised version, 12th July 1990. I gratefully acknowledge financial support from the Commission of the European Communities under the Stimulation Programme for Economic Sciences (SPES). I am indebted to George Alogoskoufis, Torben Andersen, Leonardo Bartolini, David Begg, Francesco Giavazzi, Luigi Guiso, Manfred Neumann, Marco Pagano, Mark Salmon, Luigi Spaventa and Ignazio Visco for useful comments on an earlier version of the paper. The usual disclaimer applies.

approach is taken in Giavazzi and Giovannini (1989), where vector autoregressive models of inflation and output growth are estimated, tested for sub-sample stability at suspected policy shift dates, and simulated over the time period after the suspected policy switch. Finally, non-formal evidence is provided by Sachs and Wyplosz (1986), Giavazzi and Spaventa (1989), Dornbusch (1989) and De Grauwe (1989). Sachs and Wyplosz (1986), Giavazzi and Spaventa (1989) and Dornbusch (1989) present estimates of 'sacrifice ratios', that is, the cumulated increase in unemployment rates divided by the total decrease in the rate of inflation, and De Grauwe (1989) compares the history of output-inflation trade-offs between countries. In all studies more favourable sacrifice ratios or output-inflation trade-offs are taken as an indication of more 'credible' deflation policies.

The main problem with all this informal empirical evidence on the relevance of credibility and reputation for economic policies is that it has few direct links to formal game-theoretical models of policymaking as proposed in the literature following the seminal papers of Barro and Gordon (1983a,b). Furthermore, none of the empirical papers in this indirect approach is very precise as to what exactly is meant by credibility or reputation and how it is defined or measured. This shortcoming in the above literature is dealt with in the models discussed below.

5

The *direct approach* to estimating credibility is pursued in papers by Baxter (1985), Hardouvelis and Barnhart (1987), and Weber (1988, 1990a). Baxter (1985) follows McCallum (1985) in using the term 'credibility of policies' to characterize a 'believable policy' rather than a 'believed policy'; she assumes that credibility is obtained to the extent that beliefs concerning a policy conform to the way in which the policy is actually being conducted and to official announcements about its conduct. In this context 'credibility' implies 'precommitment'. Baxter (1985) draws on the Sargent (1982, 1983, 1986) argument that a credible monetary reform implies a path of the fiscal deficit which is compatible with the long-run sustainability of national debt. Credibility is defined as the probability that the estimated coefficients of a reduced form model of government debt and money growth satisfy the parameter restrictions implied by a feasible monetary reform aimed at stabilizing inflation. Note that Baxter (1985) uses Bayesian least-squares regression inference to estimate credibility as a time-varying conditional posterior probability. Bayesian inference is also used in Weber (1988) by applying Bayesian multi-process Kalman filters to estimate the prior probability that observable inflation rates follow stationary stochastic processes. This prior probability is interpreted as an empirical counterpart to the Backus and Driffill (1985a,b)

-2-

measure of the reputation of policymakers for anti-inflation policies and based on these estimates, the empirical relevance of the Giavazzi and Pagano (1988) argument that the EMS in connection with the high counterinflation reputation of the Bundesbank has allowed non-German EMS members to borrow anti-inflation reputation is evaluated. A different formal framework in the direct approach to estimating credibility is applied in Weber (1990a) by using the models of Cukierman and Meltzer (1983, 1986a,c), who derive their credibility measures from the public's expectations about the future course of monetary policy. Credibility here is defined as the weight attached to the money growth announcement signal in the public's money growth expectations. In Weber (1990a) the empirical estimates of these Cukierman and Meltzer (1986c) credibility measures are derived by using Bayesian Kalman filtering and recursive least squares methods. A similar approach without explicit reference to the Cukierman and Meltzer model is pursued in Hardouvelis and Barnhart (1989).

- 3 -

A major drawback of all the above empirical evidence on the importance of credibility and reputation is that it is episodic and a systematic framework for analysing the issues at hand does not exist. However, it is beyond the scope of this paper to provide such a framework. Instead, the purpose of this paper is to review some game-theoretical models of policymaking which give precise formal definitions of what credibility and reputation means within their context and to provide some empirical content to these notions. The remainder of the paper is organized as follows: section 2 briefly reviews the definitions of counterinflation reputation and credibility from the monetary policy game models of Backus and Driffill (1985a,b) and Cukierman and Meltzer (1986a,c), which provide the theoretical background for the present paper and are outlined in more detail in Appendix A. Section 3 then reviews some of the credibility arguments put forward in the context of EMS membership. The relevance of these arguments is evaluated empirically in section 4 by quantifying the measures of reputation and credibility from the above models for the countries participating in the European Monetary System (EMS). A summary of the findings and some conclusions on how the EMS has affected the credibility of policies are presented in the final section of the paper.

2. Theoretical Concepts of Credibility and Reputation

In the theoretical literature the terms 'credibility' and 'reputation' are often used interchangeably,² but for the purpose of the empirical analysis below the following distinction will be made:

- (a) Reputation is defined as the extent to which beliefs concerning a policy conform to the way in which the policy has actually been conducted. Reputation plays a vital role if economic policies, in particular central banking, are subject to a high degree of secrecy or mystique and if economic agents are uncertain – in the sense of Knight – about the objectives and rules which govern the actual conduct of these policies. Under these circumstances policy surveillance, such as central bank watching, provides one potential way of reducing this uncertainty by learning over time. Reputation may thus be viewed as the stock of accumulated knowledge about the 'true' unobservable state of policymakers' preferences as derived from the observable policy outcomes.
- (b) Credibility is defined as the extent to which beliefs concerning a policy conform to official announcements about this policy. In this context obtaining 'credibility' requires 'precommitment'. In contrast to the definition of reputation above, the policymaker himself is assumed to take the initiative in providing information which potentially reduces policy uncertainty on the side of the public. Credibility may therefore also be viewed as the degree to which the public believes that policy announcements reflect the 'true' unobservable state of the policymaker's preferences.

8

Whilst credibility and high reputation are usually unquestioned criteria for a good public policy, in the case of deflation they take on special importance. Credibility about a pre-announced future deflation policy may be able to reduce directly or even eliminate the future output or unemployment costs of deflation by changing deflationary expectations at the point in time when the policy is changed. A similar argument applies for an unannounced future deflation policy: the quicker the policymaker establishes a counterinflation reputation, the shorter will be the transition period during which deflationary expectations adjust. Consequently, all game-theoretic models of policymaking unambiguously predict that policymakers

²See for example Cukierman (1986), p. 8, in his discussion of the Backus and Driffill (1985a,b) model.

interested in preventing inflation will find it advantageous to gain counterinflation credibility or reputation.

This leads us to the question of how credibility or reputation are to be measured. In Appendix A of the paper this question is adressed formally by reviewing a number of well-known models of monetary policy games which give precise definitions of counterinflation reputation and credibility. For the purpose of the empirical analysis below it is sufficient to say that in the Backus and Driffill (1985a,b) model counterinflation reputation is a state variable defined as the subjective prior probability that the central banker is a non-inflationary 'conservative' type. This probability is derived and sequentially updated via Bayesian probability learning and it may be estimated empirically by using suitable Bayesian inference as in Weber (1988). Conversely, reputation in the also well-known Cukierman and Meltzer (1986a) model is a parameter defined as the speed at which the public adapts its expectations to changes in the policymaker's objectives, as reflected by past expectation errors. This speed of expectations adaptation in the error-learning model of Cukierman and Meltzer (1986a) represents a modification of the concept of optimally adaptive expectations of Muth (1960) and may be derived empirically by estimating error-correction models. Furthermore, time-varying specifications of such error-correction models may be derived as in Turnovsky (1969) in the context of Bayesian learning or as in Friedman (1979) and Sargent (1979) on the basis of recursive least-squares learning or Kalman filtering as in Weber (1988). Finally, the concept of credibility may be formalized in the framework of the Cukierman and Meltzer (1986c) model, as outlined in Appendix A, for the credibility of interest rate, exchange rate or monetary target announcements of central banks. It is thereby assumed that the private sector treats policy announcements as one piece of contemporary information which, if credible, is used in forming expectations about policy outcomes. Two measures of credibility are proposed by Cukierman and Meltzer (1986c): average credibility (AC = $- | x_t^2 - Ex_t | \Omega_t |$) is conceived as the extent to which the public's rational expectations $(Ex_t | \Omega_t)$ of the current policy outcome (x_{t}) deviate from the current policy announcement (x_{t}) . The smaller this deviation, the larger is average credibility. Whilst the AC measure focuses on the difference between current policy announcement and beliefs, the concept of marginal credibility (MC) focuses on the ability of the policy announcements to influence the public's expectations. Marginal credibility in the Cukierman and Meltzer (1986c) sense is defined as the extent to which a unit change in the announcement (m^a) affects the public's expectations $(Em_t | \Omega_t)$ and may be thought of as the weight (α) placed on the announcement in the public's

- 5 -

expectations formation process. Note that under rational expectations this weight depends on the magnitude of the variance of the policy control errors (σ_{ϵ}^2) relative to the variance of the announcement bias $(\sigma_{\epsilon}^2 + \sigma_{\eta}^2)$. 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, the announcements will be disregarded in forming expectations since their information content is zero and hence marginal credibility will equal zero. In general, the greater the variance of the policy announcements (σ_{η}^2) , the less credible the announcements become. Note that empirical estimates of these Cukierman and Meltzer (1986a) credibility measures may be derived by adopting a two-stage approach using Kalman filtering and recursive least squares methods, as outlined in Appendix B or in Weber (1990a).

From the above discussion it should be obvious that the Cukierman and Meltzer (1986c) concept of credibility may be applied to all fields of public policy where policymakers issue an imprecise and possibly biased announcement signal of their policy intentions in addition to the observable policy outcomes. In particular, official government budget statements with respect to future taxes, government deficits or public debt may also be compared with the actual outcomes along the lines of the CM framework. However, the present paper will focus exclusively on the role of credibility and reputation in informational games of monetary policy. With respect to interest rate policies it is demonstrated in Appendix A that the official discount rate announcements may be used to evaluate the credibility of the central bank's commitment to interest rate smoothing policies. Alternatively, the credibility of the commitment of policymakers to fixed but adjustable exchange rate systems, such as the Bretton Woods System (BWS), the European Currency Snake (ECS) or the European Monetary System (EMS), may be judged on the basis of the official central bilateral exchange rate parity announcement.

۲

8

3. Credibility and the EMS

The Cukierman and Meltzer (1986) approach, which in the last example above is designed to give empirical content to the notion of credibly fixed exchange rates, may be used to empirically evaluate the Giavazzi and Pagano (1988) view of the EMS as an institutional framework for borrowing counterinflation reputation from the 'conservative' Bundesbank by credibly pegging the bilateral exchange rate relative to Germany. This view of the benefits from EMS membership is rephrased more precisely in Giavazzi and Spaventa (1989), who argue that "to convince price setters that an announced deflation will be lasting and credible, and to gain reputation, a monetary authority can proceed in two ways. The first is to show that, even in the debth of a recession, the announced monetary targets are not reneged on. ... Alternatively, monetary authorities can seek to influence expectations with some institutional reform, such as a change in the exchange rate regime. ... In the private sector, wage and price setters will appraise the credibility of this institutional reform in terms of the probability they assign to the consistent pursuit by the authorities of the exchange rate target. If, and only if, the target is a credible one, expectations will adjust and the process of disinflation will be eased." Giavazzi and Spaventa (1989) furthermore state that "the argument that joining the EMS has helped Italy in its disinflation efforts of the 1980s rests crucially on the assumption that the exchange rate targets are more credible than the monetary targets." The testing of the empirical relevance of this hypothesis for Italy and for the remaining EMS member countries is the key issue of the following section of the paper.

A second important aspect of the analysis concentrates on whether or not potential U-turns in monetary policy during the EMS period have led to more credible deflation efforts. It is thereby interesting to note that references to such policy shifts in connection with the EMS are frequently made in the literature and it is argued that the EMS has progressively tightened during the first decade of its existence. Wyplosz (1987, 1988) for example states that the commitment towards the EMS has tipped the scale toward monetary restraint in France with the adoption of the austerity programme after March 1983. Artis (1987) reports that Denmark seems to have used the EMS initially more as a 'crawling peg' and only later moved to a more counter-inflationary policy stance by adopting 'level-pegging' policies. In Andersen and Risager (1983) and Christensen (1987a,b, 1988) this Danish policy switch is related to the adoption of stabilization policies under the Liberal-Conservative government after October 1982. Finally, in discussing Irish stabilization policies Dornbusch (1989) notes that not taking advantage of the EMS realignment in February and June 1982 for devaluations signifies a shift from accommodating exchange rate policy to a determined effort to squeeze inflation. Summarizing these arguments, it can therefore be stated that policy shifts in connection with EMS membership appear to be have occurred in a number of EMS countries and that these policy shifts should have led to more credible exchange rate commitments by central banks within the EMS. In particular, it may be argued that the post-March-1983 EMS has worked differently from the pre-1983 system.

-7-

4. The Empirical Relevance of Credibility and Reputation for the EMS

The EMS credibility hypothesis is examined below by presenting estimates for the average and marginal credibility of official interest rate, exchange rate and monetary quantity target announcements for all EMS countries in selected time periods. Furthermore, it is tested whether or not the onset of the EMS had a significant impact on expectations about monetary policies, in particular on the credibility of policy target announcements. The exact timing of these shifts in expectations are estimated by switching regression and the estimated most likely points of structural break are compared to the above statements from the literature. Finally, the time-variability of the credibility estimates is analysed by using a variety of parametric stability tests.

4.1. The Credibility of the Exchange Rate Commitment of Central Banks

In order to judge the credibility of a central bank's commitment to the official bilateral exchange rate parities – the parity grid – and to their relative European currency unit (ECU) parities in selected time periods, reference is made to Table 1. For the overall EMS period (79M3-89M12) and the Bretton Woods period (60M1-72M4) these average credibility (AC) measures, which reflect the (negative) cumulated sum of the percentage deviations of the expected exchange rate from the announced official parity targets, are also plotted Figure 1. Three main results are obvious from this figure: first, only the German-Dutch (gn) exchange rate peg, which has the highest AC of all bilateral EMS exchange rates, is more credible under the EMS than under the Bretton Woods system, despite the fact that the official bilateral fluctuation margins were higher under the EMS.³

<u>e</u>.

Ľ

³The Smithonian agreement of the 'Group of Ten' of December 1971 widened the bilateral fluctuation margins against the U.S. dollar from $\pm 1\%$ to $\pm 2.25\%$. In the Basle agreement of April 1972 the central banks of the EC countries Germany, France, Italy, the Netherlands, Belgium, and Luxembourg agreed on narrower bilateral fluctuation margins of $\pm 1.125\%$ ($\pm 0.75\%$ between the Netherlands and the Belgian-Luxembourg Economic Union, BLUE) around their spot parities. In this 'snake in the tunnel' arrangement the narrow bilateral margins (the 'snake') were equal to half the size of the U.S. dollar margins (the 'tunnel'). In May 1972 Denmark, the United Kingdom and Ireland joined the snake, but the latter two countries withdrew from both the snake and the tunnel in June 1972. Denmark withdrew from the snake in June 1973 the remaining snake countries decided to let their currencies float jointly against the U.S. dollar, which terminated the period of the 'snake in the tunnel'. France withdrew from the system in January 1974 (French sample Period considered here for the European currency snake system covers both the 'snake' and the 'snake in the tunnel' and runs from March 1972 to February 1979 with the exceptions indicated above.

Second, the exchange rate link between the three Benelux countries Belgium-Luxembourg and the Netherlands (nb), which was relatively close under the Bretton Woods system, has dissolved in the EMS due to the close peg of the Dutch guilder to the German mark. Third, all bilateral exchange rate pegs of the Italian lira to EMS currencies (gi, fi, in, ib, id, ie) have the lowest ACs during the EMS period and are much less credible under the EMS than under the Bretton Woods system.

The above judgement based on the AC measure, which reflects the difference between exchange rate expectations and parity announcements, is supplemented in Table 2 and Figure 2 by the evidence from the MC measure, which reports the influence of parity announcements on exchange rate expectations. Note that for the MC measure the relative variability rather than the levels of both exchange rate parity announcements and exchange rate realizations play a vital role. A first result obvious from Table 2 is that all significant MC estimates fulfill the theoretical coefficient restriction and lie in the interval between zero and one, and that most estimates are significantly different from zero. Comparing the MCs for the periods of Bretton Woods, the European currency snake and the EMS reveals that in most cases the credibility of the exchange rate commitment of central banks declines over time. The main exception here is the Netherlands, where the MC measure relative to all other 'snake' participants (qn, fn, nd, nd) takes its highest values during the 'snake' period (72M2-79M2) and declines only in the EMS period. Furthermore, the only significant increase in the credibility of the fixed but adjustable exchange rate parity announcements in the EMS relative to the Bretton Woods period is found for the German-Belgian (gb) case,⁴ whilst the MC credibility measures for the remaining bilateral rates decline, in most cases significantly. Finally, whilst credibly fixed exchange rates (MC±.5) are the rule under the Bretton Woods system (23 out of 27 MCs) and the European currency snake system (8 out of 10 MCs), they are the exception under the EMS arrangement (7 out of 21 MCs). Note that this result is consistent with the evidence on the AC credibility measure from Figure 1, which shows that the (negative) average absolute deviation of the expected bilateral exchange rate from its parity target is typically lower under the Bretton Woods system than under the EMS, as indicated by their position below the 45 degree line. This may be explained by the higher degree of exchange rate flexibility in the EMS, as compared by the wider fluctuation margins of $\pm 2.25\%$ as opposed to $\pm 1\%$ under

٠,

-9 -

⁴This statement applies when the significance of the change in the credibility measure is judged on the basis of ± 2 two standard errors of the credibility measure from the Bretton Woods period.



Figure 1: AC Credibility Measure, Exchange Rate Commitment

Figure 2: MC Credibility Measure, Exchange Rate Commitment

ð



the Bretton Woods system or $\pm 1.125\%$ under the European currency snake system. Furthermore, the EMS exhibited both a much higher frequency and size of parity realignments than the Bretton Woods system.

Taking a closer look at the results for the overall EMS period (79M3-89M12) and the three EMS sub-periods (79M3-83M2, 83M2-86M12, 87M1-89M12), which are reported below the diagonal of Table 1 and Table 2, allows a number of additional statements with respect to the credibility of the EMS exchange rate commitment of central banks: first, the MC credibility measure of the bilateral EMS central parity announcements for the British pound are not significantly different from zero in any of the cases reported in Table 2 and also exhibit the lowest AC credibility measure in Table 1. This result confirms the fact that such 'shadow' parities of the British pound are non-credible since they do not constrain the conduct of monetary policy in the United Kingdom.

Second, whilst the MC credibility estimates for the Italian lira exchange rates, which prior to January 1990 were allowed to fluctuate with wider margins of $\pm 6\%$, are significantly different from zero in Table 2, the EMS exchange rate commitment of the Banca d'Italia is not credible (in the sense of $MC \ge .5$) in any of the cases reported. Figure 4 and Figure 6, which display the MC estimates for the three EMS sub-periods, further indicate that the credibility of the Italian exchange rate commitment relative to the French franc (fi) and the Irish pound (ie) increased in the intermediate EMS period (83M3-86M12), but declined again in the late EMS period (87M1-89M12). This relatively low credibility of the Italian exchange rate commitment is in general also confirmed by the AC credibility measure in Figure 3 and Figure 5, but here some evidence of increasingly credible pegs relative to France, Belgium, Denmark and Ireland (fi, ib, id, ie) are found for the late EMS period. This suggests that the tightening of the fluctuation margins of the Italian lina in January 1990 to $\pm 3\%$ may be viewed as an attempt by the Banca d'Italia to increase the credibility of its exchange rate commitment by signalling its willingness to accept the disciplinary effects of narrower bands.

Third, the MC estimates in Table 2 report credible commitments to fixed exchange rate parities in the EMS in the overall period and in the two pre-1987 sub-periods for the French franc exchange rates of the smaller EMS participants Belgium (fb), Ireland (fe), Denmark (fd) and for the bilateral rates between these smaller EMS participants (be, de). This result is highlighted in Figure 4, where the highest MCs in the early and intermediate EMS period are found in this French franc dominated group. At the same time, the credibility of the exchange rate commitment of the former 'snake' participants Belgium and Denmark towards the German mark (gb, gd) and the closely linked Dutch guilder (nb, nd) is found to



Figure 3: AC Credibility Measure, Exchange Rate Commitment

3

8

e

Figure 4: MC Credibility Measure, Exchange Rate Commitment





Figure 5: AC Credibility Measure, Exchange Rate Commitment

Figure 6: MC Credibility Measure, Exchange Rate Commitment



£

decline drastically and become insignificant between the early and the intermediate EMS period. These results therefore indicate that during the EMS period both Belgium and Denmark appear to have geared their exchange rate policies increasingly towards the French franc instead of the German mark, suggesting that this 'soft' currency option of the EMS, which after 1975 was no longer available in the 'snake' arrangement, was obviously preferred to the 'hard' currency option of pegging credibly to the German mark. However, these close French franc linkages of Denmark (fd) and Ireland (fe) and to a lesser extent of Belgium (fb) dissolve after 1987, as is illustrated clearly in Figure 6. At the same time the MC credibility measures of the Belgian and Danish commitment towards the German mark exchange rate (gb, gd) remain relatively low, whilst the Irish commitment towards the German mark exchange rate (ge) remains relatively high. Note that the evidence from the AC credibility measure in Figure 3 is less clear on this point, since throughout the EMS sub-periods a relatively homogeneous grouping of the AC measures is to be found.

Finally, Table 2 as well as Figure 4 and Figure 6 report significant and credible commitments to fixed exchange rates relative to the German mark in both post-1983 sub-samples for Ireland (ge) and the Netherlands (gn), for which the German mark exchange rate parity announcement has the highest MC and AC credibility measure. The outstanding credibility of the Dutch-German (gn) exchange rate peg is thereby most obvious when judged on the basis of the AC credibility measure in Figure 3 or Figure 5, where in particular for the late EMS period it is close to being perfect. This suggests that the step to Economic and Monetary Union with irrevocably fixed exchange rates (perfectly credible peg) would only involve a minor change in the credibility of this bilateral peg. However, credibility is significantly smaller than one and hence far from being perfect when judged on the basis of the MC estimates in Figure 4 and Figure 6.

Summarizing the above evidence it can be stated that the EMS may not be judged as a 'DM-zone' in the sense that de facto the n-th degree of freedom for monetary policy is assigned to Germany and that all non-German EMS members are primarily concerned with pegging their bilateral exchange rates to the German mark. Instead, for most smaller EMS countries their commitment to relatively fixed French franc exchange rates appears to play a more important role, at least in the early stages of the EMS. These findings may be justified on the grounds of strategic behaviour: should a small EMS member country with limited stocks of foreign exchange reserves and inflation rates initially higher than Germany's consider fixed bilateral exchange rates relative to Germany to be unsustainable, it may find it advantageous to peg its exchange rate relative to a large non-German ŝ,

8

œ.

EMS country – with levels of inflation also higher than Germany's – in order to reduce the adjustment pressure and intervention burden or to share it with the large country. Furthermore, such a policy may reduce exchange rate uncertainty relative to at least one major trading partner of the small economy. The evidence discussed above suggests that France, at least for some time at the start of the EMS, played this role for Belgium, Denmark and Ireland. However, recently Ireland appears to have moved more to level pegging policies with respect to the German mark and the Dutch guilder.

4.2. Policy Shifts, Exchange Rate Expectations and the 'Lucas Critique'

According to the famous 'Lucas critique' the structure of econometric models is in general not invariant to changes in policy objectives, operating procedures, or policy constraints over time, especially if these models incorporate the expectations of economic agents conditional on policy actions. Since this is the case in the class of policy game models considered here, the reduced forms of these models are typically policy variant, meaning that they change whenever policy is changed. As a result, the MC credibility estimates are likely to exhibit structural breaks at points in time when there are major changes in exchange rate policies. This type of policy induced structural change is analysed below by using 'switching regression' in order to test for significant shifts in exchange rate expectations as a result of policy shifts. Table 3 summarizes this evidence and reports the estimated most likely points of policy induced shifts in exchange rate expectations during the EMS period. A first result of Table 3 is that most (15 out of 21) policy shifts occurred relatively late in the EMS period, predominantly between the realignment in July 1985 and the so-called Basle-Nyborg Agreement of September 1987.⁵ This result is not too surprising since both the June 1985 and September 1987 resolutions involved some changes in the functioning of the system, in particular a strengthening of the role of the ECU and the role of inframarginal interventions as well as the wider use of the fluctuation bands.

A closer look at the results in Table 3 reveals that significant policy shifts toward credible German mark exchange rate policies occurred for the Netherlands in July 1985, for Ireland in July 1986 and for France in September 1987.

The majority of the most likely policy switches in the French EMS exchange rate commitment in Table 3 are found for the year 1987, either around the January 1987 realignment (Italy, Belgium, Ireland), or just after the Basle-Nyborg

8

⁵The dates reported in Table 6 are those of the last month of the old policy regime. Since end of month exchange rates are used, the policy shift must therefore have occurred during the following month.

Agreement (Germany, Netherlands). Whilst the credibility of the commitment to fixed exchange rates relative to Germany and the Netherlands increases slightly but insignificantly, it declines significantly for the exchange rates relative to Belgium, Denmark and Ireland.

The credibility of the Italian central bank's commitment to fixed exchange rates relative to Germany, the Netherlands and Belgium is found to decrease significantly after the July 1985 devaluation of the Lira against all other ERM currencies. However, the credibility of the French franc commitment at the most likely break point January 1987, which was the last general EMS realignment in the sample period, remains almost constant and has the highest value of all Italian MC credibility estimates. Note that this evidence of an orientation of Italian EMS exchange rate policies towards the French franc is consistent with and may explain the findings of French–Italian policy interactions reported in De Grauwe (1988), Fratianni and von Hagen (1989a,b,c) and Weber (1990b), which in the first two studies are taken as indications of a symmetrical working of the EMS.

For the Irish central bank's exchange rate policies the most likely policy switches are found for the second half of 1986 (Netherlands, Germany and Italy) and after the January 1987 EMS realignment (France, Belgium, Denmark). During this episode, which Dornbusch (1989) refers to as a period of consolidation, the Irish pound was relatively weak in the EMS, largely due to a loss in Irish competitiveness following the sharp depreciation of the British pound, the currency of a major Irish trading partner. This Irish pound weakness, which after April 1986 frequently fell below its lower intervention limits whilst the German mark and the Dutch guilder were frequently above their upper intervention limits, forced the Irish central bank to initiate the relatively large devaluation of the Irish pound in the August 1986. However, pressure on the pound stopped only when the British post–1987 period has very high MC credibility estimates with respect to both the German mark and the Dutch guilder thereby supports the view of Dornbusch that the Irish pound recently has become one of the harder EMS currencies.

Another important result from Table 3 is that the most likely dates of shifts in the exchange rate commitment of central banks which already had participated in the European currency snake system are found predominantly in the early EMS period (1982/83). In order to test for the influence of the EMS on exchange rate credibility, the above estimates of the most likely policy switch dates were re-run for Germany, the Netherlands, Belgium and Denmark by using a longer sample

9

 $(75M1-98M12).^{6}$ A striking feature of these results, which are displayed in Table 4, is that all policy shifts occur just after the two realignments of June 1982 (gd,gn,nb) and March 1983 (gb,nd,bd). The formerly credible commitments to relatively fixed exchange rates between the three smaller 'snake' participants, in particular the tight Benelux linkages, decline drastically. Furthermore, whilst the Dutch central bank after March 1983 moved towards credibly pegging the guilder to the German mark, the Belgian and Danish monetary authorities switched to credibly pegging their currencies to the French franc, as can be seen in Table 2. As discussed above, this choice between the 'hard currency' option of level pegging to the German mark or the 'soft currency' option of pegging to the French franc, which implied accepting a 'crawling peg' relative to the German mark, may have been influenced by strategic considerations and trade stabilization arguments on the side of the smaller EMS participants.

Summarizing the evidence on the timing of policy shifts in the conduct of exchange rate policies within the EMS, it can be stated that two major periods of change in the EMS are identified. The early period of change is between the realignments of June 1982 and March 1983, when the relatively credible pegs between the former 'snake' participants Germany and the Netherlands on the one side and Belgium and Denmark on the other side dissolve. Whilst the Netherlands take the 'hard currency' option of pegging to the German mark, both Belgium and Denmark adopt the 'soft currency' option of pegging their exchange rates to the French franc. The second major period of change in the EMS lies between the realignment of April 1986 and the Basle-Nyborg Agreement of September 1987. During this period Ireland has moved from the 'soft currency' option of pegging to the French franc to adopting the 'hard currency' option of pegging to the German mark. In addition, the more recent improvements of the intervention rules in the exchange rate mechanism of the EMS appear to have allowed France to increase its commitment to credibly pegging its exchange rate relative to the German mark. This together with the wider use of the fluctuation bands has reduced the close French franc linkages of the smaller EMS participants, in particular of Belgium. The June 1990 announcement of the Belgian central bank to now officially target the exchange rate relative to the German mark thereby suggests that the French franc peg was dissolved in favour of a 'hard currency' option.

⁶The more turbulent exchange rate episodes of the 'snake in the tunnel' and the early snake period are excluded from the sample since they strongly bias the results toward structural breaks in 1973 or early 1974.

After having analysed the credibility of the exchange rate commitment of central banks participating in the exchange rate mechanism of the EMS in some depth, I now turn to the question of whether or nor the EMS may have helped central banks to deflate simply because their exchange rate targets were more credible than their interest rate or monetary quantity targets. In order to discuss this issue, the credibility of interest rate targets and monetary quantity targets has to be evaluated first.

ġ,

8

Î

4.3. The Credibility of Official Interest Rate Target Announcements

In the theoretical models of Appendix A interest rate targeting policies are viewed as an operational procedure to control and reduce inflation, so credibility here is related to the deflation efforts of central banks. This may be illustrated by referring to a stylized example of such an inflation control procedure: assume inflation is a purely monetary phenomenon and monetary policy is in principle orientated towards an annual money growth target corridor. This annual target implies monthly targets, which, combined via a stable hypothetical money demand function with projections of real income, can be translated into an appropriate target corridor for the nominal interest rate. In this case the central bank's interest rate smoothing policies are a short-run operational procedure, which assures that the nominal quantity of money and hence the price level grow on target. Alternatively, assume that domestic monetary policy is primarily orientated towards keeping fixed exchange rates with a foreign country in a system of adjustable exchange rate target bands. In this case foreign interest rate movements combined with projections of potential exchange rate movements within the band can again be translated into a target corridor for the nominal interest rate, and interest rate smoothing policies are an operational procedure for keeping the exchange rate on target. By assuming in both cases discount rates to be set consistent with, but not necessarily always identical to, the average target level of the interest rate, the central banks commitment to interest rate targeting policies can be evaluated by using the Cukierman and Meltzer (1986c) framework from Appendix A in connection with realizations of short-term interest rates (money market rates and three month treasury bill rates) or long-term interest rates (government bonds yields).⁷ The evidence from these estimates, which is reported

⁷In discussing the credibility of these announcements only the estimated marginal credibility measure is reported. The full regression results, as reported in Weber (1990a) for the case of monetary target announcements, are available from the author on request.

in Table 5 and Table 6 for the AC and MC credibility measures respectively, allows a number of general conclusions to be drawn.

First, it should be noted that again most credibility estimates fulfill the theoretical coefficient restriction of lying in the interval between zero and one and that most estimates are significantly different from zero. Furthermore, changes in discount rates appear to be of particular relevance for predicting movements of interest rates at the short end of the maturity range, in particular of money market rates through which short-term monetary policy is primarily operated. In Table 5 this is reflected by the fact that the estimated marginal credibility measures are highest and significantly different from zero for most of the money market rates in all sub-samples. Slightly lower but also significant credibility estimates are obtained for most of the three-month treasury bill rates. Finally, discount rate announcements are also found to help in predicting movements in long-term interest rates. However, despite being significantly different from zero, the MC credibility estimates for long-term interest rates are very low for all countries. In Figure 7 and Figure 8 this result is highlighted by the relatively close grouping of all MC estimates for long-term government bond rates (gg, fg, ig, ng, bg, dg, ig, ug) in the lower left corner of the graph. A similar but less clear grouping may also be derived on the basis of the AC credibility measure in Table 6, which also attaches the lowest credibility to the estimates for the long-term rates. This result may be interpreted as evidence on the lack of credibility of the central banks' anti-inflation policies in the long-run, since under zero inflation short-run and long-run rates should move closely together and hence have similar MC estimates. This view is supported by the fact that for the EMS period, in particular in its early phase, the highest MC estimates are obtained for Germany and the Netherlands, which both had the lowest EMS inflation record during that time.

Ę,

A second important result from Table 5 is that the MC credibility measures vary considerably between countries. Credible interest rate targets, defined here for convenience as an estimate of MC ≥ 0.5 , are found in connection with the Irish and British call money rates (ec, uc) and 3-month treasury bill rates (et, ut) in all sub-samples, as depicted in Figure 7 and Figure 8. Credible interest rate targets during the EMS period are further found in connection with the call money rates of the Netherlands, Belgium and Denmark (nc, bc, dc). This suggests that the central banks of these smaller EMS member countries can credibly signal their short-term monetary policy intentions through discount rate innovations since these signals influence interest rate expectations to a large extent. However, this is not true for the Italian and even less for the German or French monetary authorities, which in particular during the EMS period did not issue credible interest rate signals.

- 19 -



Figure 7: MC Credibility Measure, Interest Rate Commitment

Figure 8: MC Credibility Measure, Interest Rate Commitment

.

1



A third finding in Figure 7 and Figure 8 is that the MC credibility estimates vary considerably over time. Comparing the credibility estimates from the Bretton Woods period (60M2-72M3), the 'snake' period (72M4-79M2) and the EMS period (79M3-89M12) it is obvious that for short-term interest rates the MC measures for the Netherlands, Belgium, Denmark and the United Kingdom (nc, bc, dc, uc)continuously increase over time, since they lie above the 45 degree line in both graphs. However, for Germany and France (qc, fc) the MC estimates are found to be highest during the 'snake' or free floating period, and decline after the onset of the EMS. This result for France is not surprising since the low information content of the French discount rate during the EMS period relative to the 'snake' period arises from the fact that this rate has not been altered after August 1977. It simply reflects a policy shift from interest rate targeting to monetary quantity (M2) targeting by the Banque de France in early 1977 as a consequence of the stabilization efforts under the Barre plan. For Germany the sharp decline in the information content of discount rate movements for money market rates after 1979 is consistent with the view expressed in Neumann (1989) that the Bundesbank during the 1980s has targeted money market interest rates more directly by influencing interest rates on short-term treasury bills.

Taking a closer look at the AC and MC credibility estimates for the EMS period in Table 5 and Table 6, or Figure 9 and Figure 10, reveals that the AC credibility measure has increased for most interest rates between the early and late EMS period. The relatively sharp increase in the AC measure for the French interest rates thereby reflects the fact that in the late EMS period French short-term and long-term interest rates have declined considerably and recently have deviated less from the constant discount rate. As before the MC credibility values, depicted in Figure 10, are lowest for the long-term rates, which are grouped near the origin. Relatively high MC estimates are obtained for the short-term rates, in particular for Ireland (ec, et), the United Kingdom (uc, ut) and Belgium (bc), where all MCs increase in the late EMS period (83M3-89M12). Conversely, the initially high MC estimates for Italy (ic, it), the Netherlands (nc) and Denmark (dc) decline slightly in the late EMS period (83M3-89M12), but are still relatively high for the latter two countries.

A final point to be considered here is to test more formally whether or not the onset of the EMS has had a significant impact on the interest rate targeting policies of EMS member countries. For this purpose again switching regression analysis, which estimates the most likely point of structural break in a regression relationship and tests for the significance of the structural break, was applied.



Figure 9: AC Credibility Measure, Interest Rate Commitment

Figure 10: MC Credibility Measure, Interest Rate Commitment



ي. س

٤,

Table 7 reports the switching regression results for the credibility of the discount rate announcements in the post-1975 period. A first important result from Table 7 is that most (16 out of 23) shifts in the interest rate equations occurred in the early EMS (79M3-83M2) period, frequently \pm two months around the realignment dates.⁸ The German three-month call money rate is the only case for which a significant most likely policy switch point is estimated for March 1979, the onset of the EMS. Most other policy shifts are estimated for later dates, in particular for the years 1982 and 1983, which in Giavazzi and Giovannini (1989) are associated with a crisis of confidence in the EMS. This suggests that interest rate smoothing policies in the EMS are largely orientated onwards stabilizing exchange rate fluctuations within the band.

Summarizing the above results it may be stated that in particular the smaller EMS countries appear to have pursued more credible interest rate targeting policies than the larger EMS countries. This may simply reflect the fact that the small EMS countries have geared their monetary policies more towards exchange rate pegging policies, which are operated through interest rate targeting, whilst the larger EMS countries have a stronger tendency towards more independent monetary policies. Furthermore, the fact that the credibility of the central banks' commitment to interest rate targeting policies increases during the EMS for all smaller EMS member countries points towards a higher degree of controllability of the exchange rate pegs in the EMS through interest rates, since discount rate signals are found to have a stronger impact on market expectations. This result is independent of the central bank's decision to choose the 'hard' or 'soft' currency option of the EMS as this choice only determines the target level of the discount rate and not the transmission of discount rate signals on market expectations. For a more detailed analysis of interest rate interactions in the EMS the analysis in Weber (1990b) may be consulted.

⁸These realignment dates are 79M3, 79M9, 81M3, 81M10, 82M2, 82M6, 83M3, 83M5, 84M9, 85M7,86M4, 86M8, 87M1, and 90M1, which lies outside the sample considered in this paper.

4.4. The Credibility of Monetary Target Announcements

The third issue to be considered here is the credibility of monetary target announcements, which at least for some time in the EMS period were part of the monetary policy stance of the ERM countries Germany, France, Italy and the Netherlands as well as the United Kingdom. A detailed discussion of this issue is to be found in Weber (1990a).

Before discussing the estimates some remarks on the history of monetary targeting in the EMS countries are in order. Note that 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. This example was followed in 1976 by the monetary authorities of the United Kingdom and France. 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. 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 these cases are treated identically, although in the case of the Netherlands it is unclear whether the monetary authority has actively sought to control the monetary aggregate or national income to achieve the desired liquidity ratio in the long run.

1

8

Í

A potential problem of a 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: whilst France and the Netherlands have focused on the monetary aggregate M2, the United Kingdom has targeted the broader monetary aggregate M3 (sterling M3). An intermediate case is the German central bank money (CBM) target, which comprises reserve requirements on the components of M3 and hence is broadly defined but more directly controllable. Finally, Italy has targeted ceilings for total domestic credit (TDC), which is not a monetary but a credit aggregate. A further complication for an empirical comparison is given by the shifts between targeted monetary aggregates. Note that minor changes in the definition of the targeted monetary aggregate were observable in France (M2, M2R) and the United Kingdom (Sterling M3, M3) and were accounted for by using one of these monetary aggregates consistently throughout the sample. Major shifts between different monetary aggregates took place in Germany, Italy and again in the United Kingdom and France. The Banque de France announced targets for M2 from 1977 until 1984, for M2R in 1984 and 1985, for M3 in 1986 and for M2 again after January 1987. In the present study all these target announcements are evaluated on the basis of the growth rate of M2, so some reservations for the

results in the period 1984 to 1986 are justified. The 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. Here growth rates of CBM are used throughout the sample, so again some reservations for the results after January 1988 are appropriate. The Bank of England announced targets for M3 from April 1976 until March 1987 and for M0 from April 1987 onwards, but only the sample with M3 target announcements is considered in the present study. The Banca d'Italia switched from announcing targets for total domestic credit (TDC) ceilings between 1974 and 1987 to additionally announcing targets growth rates for M2 after 1984. The present study only considers the credit target announcements. Finally, the abolition of official monetary target announcements was decided upon by the Dutch central bank, which due to the increasing importance of exchange rate considerations within the EMS has not issued official announcements of M2 targets since December 1981. Nevertheless, the present paper considers an unofficial monetary quantity target for the Netherlands from January 1982 onwards,⁹ but little significance is attached to these estimates.

After having described the volatile history of monetary targeting in EMS member countries, it is hardly surprising that the estimates of the marginal credibility of monetary target announcements in Table 8 are relatively low throughout the sample. The MC credibility estimates in the pre-EMS period are highest and significantly different from zero for Germany (.307), which in Table 9 also has the highest average credibility (AC) estimate. Furthermore, Italy and the United Kingdom have lower but also significant MC credibility estimates, whilst the French MC estimate is insignificant. After the onset of the EMS the credibility of monetary target announcements declines but is still significant for all countries. A number of reasons may explain this move to 'soft' monetary targeting, that is the continuing of monetary targeting despite frequent target misses. First, 'Goodhart's law', a modification of the 'Lucas critique' according to which the attempt to control any monetary aggregate will destabilize the demand for it, may explain the recent switches in the targeted monetary aggregates of the Bank of England, the Banque de France and the Bundesbank. Second, in all ERM member countries the official exchange rate targets and in Germany additionally an implicit exchange rate target relative to the U.S. dollar may have undermined the credibility of the monetary targeting. A possible explanation for such shifts to 'soft' monetary targeting is given in Boissieu (1988), who states that "central banks

⁹The data on this implicit M2 target for the Netherlands are taken from 'International Economic Conditions', Federal Reserve Bank of St. Louis, different volumes from August 1982 onwards.

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."¹⁰ The estimates presented in this paper provide empirical evidence in support of this statement since they show that monetary target announcements despite frequent target misses 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 and significant, yet nevertheless relatively small.

A final point to be considered here concerns the most likely timing of switches in the commitment of central banks to monetary targeting. Table 10 indicates that the most likely structural break in the Bundesbank's commitment to monetary targeting occurred just after the onset of the EMS in November 1979, whilst for France it is March 1987. Furthermore, whilst the credibility of the Bundesbank's monetary target announcements are relatively low due to the massive target overshooting in 1986 to 1988, the Banque de France's monetary target announcements appear to have been relatively credible in the recent EMS period.

4.5. Has the EMS Increased the Credibility of Policies?

After having evaluated empirically the credibility of EMS central banks' commitment to interest rate, exchange rate and monetary quantity targeting policies, the question as to which type of policy is most credible for which individual member country can now be addressed. Note that in the above discussion each type of policy is viewed as an operational procedure to control and reduce inflation, so the question of credibility here is related to the credibility of the deflation efforts of EMS central banks.

۹

Ş

03

ź

The first point to be stressed here is that for the majority of EMS countries (Germany, the Netherlands, Belgium, Luxembourg and Denmark) the onset of the EMS in March 1979 did not imply a switch from freely floating exchange rates to fixed but adjustable exchange rate bands, but rather a switch from adjustable bands with four EC countries to adjustable bands with seven EC countries. However, this is found to be more than just a minor change: the new system offered the smaller 'snake' participants an alternative to the 'hard currency' option of pegging to the German mark by providing the 'soft currency' option of pegging to the French franc. Whilst the Netherlands continued their commitment to the 'hard currency' option, the 'soft currency' option appears to have been taken by Belgium-Luxembourg and Denmark in the early EMS period, as indicated by the

¹⁰Boissieu (1988), p. 66.

high credibility of their exchange rate commitment towards the French franc. However, this is unlikely to have increased the credibility of deflation policies in Belgium and Denmark: the claim that the EMS has a deflationary bias only holds if the exchange rate is credibly pegged relative to the 'low-inflation' centre country Germany. A credible peg to a 'high-inflation' centre country like France may well imply an inflationary bias of the EMS under the 'soft-currency' option and may explain why in these countries deflation came about only relatively late.

The EMS has clearly increased the credibility of deflation policies in the Netherlands. This result holds regardless of whether it is judged on the basis of the credibility of the exchange rate target relative to the German mark or the credibility of interest rate targets, which also are set in response to German interest rate policy. Also note that this result supports the evidence reported in Weber (1988) where both Germany and the Netherlands are found to have the highest and almost identical counterinflation reputation of all EMS countries. It may therefore be stated that during the first decade of the EMS the Netherlands and Germany have moved close to a de-facto monetary union with low inflation.

The credibility of the Irish disinflation effort has also increased drastically in the EMS period. Here again the EMS deflation bias from a credible German mark exchange rate peg appears to have been at work. However, these welfare improving benefits from EMS membership were only materialized after a deliberate U-turn of Irish policies late in the EMS period and nowadays Ireland together with Germany and the Netherlands forms the 'hard currency bloc' of the EMS.

The EMS has also increased the credibility of the Italian disinflation effort in the sense of Giavazzi and Spaventa (1989): most bilateral exchange rate targets are found to be more credible than the total domestic credit target. The same holds for the Italian interest rate targets when judged on the basis of short-term interest rates. However, the deflationary bias of the EMS for Italy can be expected to be relatively small since the most credible but nevertheless relatively loose exchange rate peg exists with France, which had only moderately lower inflation than Italy.

For France and Germany the effects of EMS membership on the credibility of their deflation efforts are less obvious. An EMS effect on French monetary policy is only found in the late EMS period: whilst interest rate and monetary quantity targeting policies had little credibility during the EMS period, the credibility of the French commitment to targeting the German mark exchange rate is found to have increased recently. Finally, for Germany the credibility of monetary targeting is found to decline drastically in the post 1979 period. This move to 'soft' monetary targeting is accompanied by a decline in the credibility of interest rate targeting policies after the onset of the EMS. Thus, if anything the EMS appears to have undermined the credibility of the German monetary policy stance. This view is consistent with the evidence reported in Weber (1988), where the counterinflation reputation of the German Bundesbank is found to have reached its all time high in the first quarter of 1979 and declined slightly thereafter.

Summarizing the findings, it can be stated that in terms of credibility some countries appear to have gained more from the EMS than others. Most of the credibility gains are in the group of countries which have adopted the 'hard currency' option of pegging to the German mark. This applies to the Netherlands and to Ireland, but recently France also appears to have increased the credibility of its German mark commitment. The latest Belgian policy statements from June 1990 also point in this direction. It may therefore be stated that the degree of exchange rate fixity and the credibility of the peg increases as the EMS moves towards Economic and Monetary Union (EMU). However, the system is still far from being a de-facto monetary union with perfectly credible exchange rate pegs.

5. Conclusions

The purpose of the paper has been to provide some empirical evidence on the question of whether or not the EMS has affected the credibility of monetary policies within member states. In deriving this evidence the concept of credibility from Cukierman and Meltzer (1986c) was applied and credibility was measured by comparing official statements about policy intensions with policy outcomes. In particular, exchange rate parity announcements and exchange rate realizations, discount rate announcements and market interest rates as well as money growth target announcements and actual money growth rates were compared in this way. The main finding of the paper is that in EMS member countries credible policy announcements are limited to interest rate policies for the majority of countries and additionally to exchange rate policies for the smaller EMS member countries. Monetary target announcements are not found to be credible in EMS member countries.

Ø

8

٤

The high credibility of the exchange rate commitment of central banks in some of the smaller EMS countries is thereby consistent with the findings in Weber (1988) that only some of the smaller EMS member countries appear to have gained anti-inflation reputation from the Bundesbank during the EMS period. In particular, the present paper identifies credible German mark exchange rate commitments for the Netherlands and Ireland, whereby the shifts towards German mark exchange rate targeting occurred in the Netherlands in the early EMS phase (November 1982) and in Ireland in the later EMS phase (July 1986). Based on the estimates of their post-1987 exchange rate commitment these three countries (Germany, the Netherlands and Ireland) may therefore be viewed as the 'hard currency' bloc of the EMS, which although dominated by German monetary policy but far from being a 'DM-zone' with perfectly credible commitments to fixed bilateral exchange rates. Also note that for the Netherlands and Ireland the credible exchange rate commitments relative to the German mark are found to be signaled to the public in the form of credible interest rate announcements.

A further important finding of the present paper is that the smaller EMS countries Belgium and Denmark, which together with Germany and the Netherlands participated in the pre-EMS currency snake system, appear to have shifted from non-credible German mark pegging policies in the snake towards credible French franc pegging policies in the early EMS. It is argued that this choice may be influenced by strategic considerations and trade stabilization arguments on the side of the smaller EMS countries. Based on the estimates of their pre-1987 exchange rate commitments France, Belgium and Denmark may therefore be viewed as a second, 'soft' currency bloc in the EMS. However, this currency bloc dissolves after 1987. The two major factors which attribute to this are the French move toward more credible level pegging policies with respect to the German mark and the option of the Basle-Nyborg Agreement to make wider use of the fluctuation bands. In this context the June 1990 announcement of the Belgian central bank to adopt the German mark exchange rate as the main official policy target may be viewed as an attempt to increase the credibility of its new policy stance of adhering to the 'hard currency' bloc in the EMS.

3

For the credibility of the exchange rate commitment of the Banca d'Italia the present study reveals non-credible parities with respect to both the first and the second currency bloc above. This result is consistent with the observation that the cumulated devaluation of the lira since the onset of the EMS has been higher than that of any other currency participating in the exchange rate mechanism and may be attributed to the fact that the wider fluctuation bands allowed a trend devaluation of the lira in the EMS. The January 1990 move of the Banca d'Italia to reducing the width of the fluctuation band to half its size may therefore be viewed as a step in the right direction for establishing exchange rate credibility.

Finally, note that an important shortcoming of the present analysis is that the information content of the three announcements signals, which are discussed separately above, are not combined by the public despite the fact that they are clearly interrelated. Whilst such an extension of the analysis is clearly desirable, the approach taken here may nevertheless be justified by the interesting insights into the working of the EMS derived in the context of the present framework.

<u>Appendix A:</u> Credibility and Reputation in Models of Policy Games

The basic model of monetary policy games, as borrowed from Cukierman (1986), assumes that the monetary authority and the public are engaged in a policy game which determines the equilibrium level of output and inflation. Inflation is a monetary phenomenon (1.1) and output is determined by a Lucas-type supply function (1.2).¹¹ The central banker's objective function - possibly identical to the social welfare function – assumes that he dislikes inflation π_t and likes economic stimulus, defined by a level of output y_t above its natural level y^n (1.3 or 1.4 in terms of m). The public's move in the game is to form expectations which are defined to be of the least-squares error type (1.6) and are assumed to be formed rationally on the basis of all available information in equation (1.7).¹² As a result, the optimal rate of inflation or monetary expansion under discretionary policymaking and rational expectations is some positive constant b ϕ , which characterizes the inflationary bias of the Nash solution of the policy game in (1.4). The temptation of policymakers to aim at the unsustainable first-best solution (with $m_t = b\phi$ and $Em_t | \Omega_{t-1} = 0$) drives the economy away from the second-best incentive incompatible solution $(m_t = Em_t | \Omega_{t-1} = 0)$ to the inferior but stable third-best Nash solution $(m_t = Em_t | \Omega_{t-1} = b\phi)$. Note that rates of inflation lower than $b\phi$, say zero, are only achievable if the monetary authority can issue a credible commitment to zero inflation, i.e via a constitutional amendment.

	······································	
$\pi_t = m_t$	Inflation caused by Money Growth	(1.0)
$\mathbf{y}_{t} = \mathbf{y}^{n} + \phi \left(\pi_{t} - \pi_{t}^{e} \right)$	Output Relationship	(1.1)
$W_t = -\pi_t^2/2 + b(y_t - y^n)$	Policymaker's Objective Function	(1.2)
$W_t = -m_t^2/2 + b\phi(m_t - m_t^2)$	Policymaker's Objective Function in m_t	(1.3)
$m_t = b\phi$	Optimal Monetary Policy Outcome	(1.4)
$U_t = -(m_t - m_t^e)^2$	Public's Objective Function	(1.5)
$m_t^e = Em_t \Omega_t = b\phi$	Public's Rational Expectations	(1.6)

A stylized version of the basic static model of monetary policy games

D.

1

¹¹Note that here unexpected inflation rates π_t ($\pi_t \equiv p_t - p_{t-1}$), instead of unexpected price levels as in Lucas (1973), explain the deviation of output from its natural level.

¹²Since the public cannot observe m_t and there are no contemporary information signals available, $Em_t | \Omega_t$ is identical to $Em_t | \Omega_{t-1}$ in this simple version of the basic game.

Alternative ways of introducing credibility or reputation into the above one-shot game arise when the game is played repeatedly, as demonstrated by Barro and Gordon (1983a,b). In infinitely repeated full information games the second best solution $(m_t=Em_t|\Omega_{t-1}=0)$ may be sustained by reputational forces which operate through credible threats and pre-specified punishment strategies on the side of the public. These essentially arbitrary trigger mechanisms, however, imply no empirically testable hypotheses with respect to the concept of reputation.¹³ Empirically meaningful concepts of credibility and reputation are only derived in policy games with imperfect information, as discussed below.

A prominent finite horizon monetary policy game with incomplete information is the sequential equilibrium model of Backus and Driffill (1985a,b), which is described in equations (2.1) to (2.7). The important feature of this informational game is that the public faces two potential types of policymaker, with preferences described in (2.3a) and (2.3b), and is uncertain as to which type of policymaker is in office until the end of the game in a known terminal period τ . This uncertainty in connection with strategic behaviour (disguise) on the part of the policymaker prevents the public from inferring the true state of the central bankers' preferences from the observable money growth process. This is formalized in equations (2.5a) and (2.5b) by noting that the observation of zero money growth may be due to the move of a 'hard-nosed' policymaker who always plays $m_t=0$ with probability one, but may also represent the

Reputation in a stylized Backus and Driffill (1985a,b)

$\pi_t = m_t$			(2.1)
$\mathbf{y}_t = \mathbf{y}^n + \phi \left(\pi_t - \pi_t^e \right)$			(2.2)
$W_{t}^{w} = \sum_{t=0}^{t} \beta^{t} \left[-\pi_{t}^{2}/2 + b(y_{t} - y^{n}) \right]$	(2.3a)	$W^{h}_{t} = \sum_{t=0}^{t} \beta^{t} \left[-\pi_{t}^{2}/2 \right]$	(2.3b)
$W_{t}^{w} = \sum_{t=0}^{t} \beta^{t} \left[-m_{t}^{2}/2 + \phi b(m_{t} - m_{t}^{2}) \right]$	(2.4a)	$W^{h}_{t} = \sum_{t=0}^{t} \beta^{t} \left[-m_{t}^{2}/2\right]$	(2.4b)
$\mathbf{m}_{\mathbf{t}} = (1 - \delta_{\mathbf{t}}) \mathbf{b} \phi + \delta_{\mathbf{t}} 0$	(2.5a)	$m_t = 0$	(2.5b)
$U_t = -(m_t - m_t^e)^2$			(2.6)
$\mathbf{m}_{\mathbf{t}}^{\mathbf{e}} = \mathrm{Em}_{\mathbf{t}} \Omega_{\mathbf{t}} = (1 - \psi_{\mathbf{t}}) (1 - \delta_{\mathbf{t}}) \mathbf{b} \phi,$			(2.7)
with Bayesian probability learning	$\psi_{\rm t} = \psi_{\rm t-1} / [\psi]$	$t_{t-1} + (1 - \psi_{t-1}) \delta_{t-1}$ and $\delta_r = 0$.	

¹³Also note that these reputational equilibria unravel backwards in finitely repeated games with the full information and the above discretionary Nash equilibrium $(m_t=Em_t|\Omega_{t-1}=b\phi)$ is obtained in all periods.

move of a 'wet' policymaker who disguises as a 'hard-nosed' one with a time-varying probability ψ_t . Consequently the public's rational expectation of money growth in (2.7) is given by the expectation of the discretionary outcome b ϕ multiplied by the joint probability that the policymaker is 'wet' $(1-\psi_t)$ and does not disguise as a 'hard-nosed' one $(1-\delta_t)$. Reputation in the sense of Backus and Driffill (BD hereafter) is thereby a state variable, conceived as the subjective probability ψ_t that the central banker is a non-inflationary 'conservative' type. This reputation measure is updated continuously via Bayesian probability learning, as indicated below equation (2.7).

The second class of incomplete informational policy games derives from the model of Cukierman and Meltzer (1986a) outlined in equations (3.1) to (3.7). The important feature of the Cukierman and Meltzer (1986a) model is that a combination of incomplete monetary control (3.5) in connection with gradually and persistently changing policy objectives b_t in (3.3) prevents the public from inferring the true state of the central banker's preferences from the actual money growth process. However, central bank watching gradually reveals the unobservable state of the policymaker's preferences since it provides information on the degree of monetary noise attributed to the shifting policy objectives. Reputation in the sense of Cukierman and Meltzer (CM hereafter) is conceived as the speed λ with which the public recognizes that a change in the policymaker's objectives has actually occurred, as outlined formally in (3.7).

$\pi_t = m_t$		(3.1)
$\mathbf{y}_{t} = \mathbf{y}^{n} + \phi\left(\pi_{t}\right)$	- # {}	(3.2)
$W_t = \sum_{t=0}^{\infty} \beta^t \left[-\pi^t \right]$	${t^2/2} + b_t (y_t - y^n)$]	(3.3)
with $b_t = b + \gamma_t$, $\gamma_t = \rho \gamma_{t-1} + v_t$, b>0, 0< ρ <1, v_t ~N(0, σ_v^2),	
$W_t = \sum_{t=0}^{\infty} \beta^t [-m]$	$k^{2}/2 + \phi b_{t} (m_{t} - m_{t}^{2})]$	(3.4)
$m_t = m_t^2 + \mu_1 \zeta_1$	$t, \zeta_t \sim N(0, \sigma_{\xi}^2),$	(3.5)
$U_t = -(m_t - m_t^2)$)2	(3.6)
$m_t^e = Em_t \Omega_t$	$= (1-\rho)b\phi\mu_0 + (\rho-\lambda)m_{t-1} + \lambda Em_{t-1} \Omega_{t-2}$	(3.7)
	$=\sum_{i=0}^{\infty}\lambda^{j}\left[(1-\rho)b\phi\mu_{0}+(\rho-\lambda)m_{t-j-1}\right],$	•
	with $\lambda = \frac{1}{2} \left[\frac{1+r}{\rho} + \rho \right] - \sqrt{\frac{1}{4} \left\{ \frac{1+r}{\rho} + \rho \right\}^2 - 1}, r = (\sigma_v^2 / \sigma_\zeta^2),$	

Reputation in a stylized Cukierman and Meltzer (1986a) model

6

.8

A similar informational game to the one outlined above is played in the Cukierman and Meltzer (1986c) analysis of credibility, which is presented in equations (4.1) to (4.7). This model has the same basic structure as Cukierman and Meltzer (1986a), but now the central bank is assumed to issue a noisy monetary announcement signal (4.5a) in addition to the information derived by the public from watching the actual money growth process (4.5b). Consequently, the public treats the announcement as one piece of contemporary information which, if credible, is used in forming expectations in (4.7).¹⁴ Two measures of credibility are proposed by Cukierman and Meltzer (1986c): **average credibility** (AC= - | m_t^a -Em_t | Ω_t |) is conceived as the extent to which the public's rational expectations (Em_t | Ω_t) of current planned money growth (m \mathfrak{P}) deviate from the current monetary announcement (m_t^a). Marginal credibility (MC) is defined as the extent to which a unit change in the announcement (m_t^a) affects the public's money growth expectations (Em_t | Ω_t) and may be thought of as the weight (α) placed on the announcement in the public's expectations formation process in (4.6).

Credibility in a stylized Cukierman and Meltzer (1986c) model

$\pi_{i} = m_{i}$	1	(4 1)
74 — 111f		(1.1)
$\mathbf{y}_{t} = \mathbf{y}^{n} + \phi \left(\pi_{t} - \pi_{t}^{e} \right)$		(4.2)
$W_{t} = \sum_{t=0}^{\infty} \beta^{t} \left[-\pi_{t}^{p2}/2 + b_{t} \left(y_{t} - y^{n} \right) \right]$		(4.3)
with $b_t=b+\gamma_t$, $\gamma_t=\rho\gamma_{t-1}+v_t$, $b>0$, $0<\rho<1$, $v_t\sim N(0,\sigma_v^2)$,		
$W_{t} = \sum_{t=0}^{\infty} \beta^{t} \left[-m\xi^{2}/2 + \phi b_{t} (m_{t} - m\xi) \right]$	-	(4.4)
$\mathbf{m}_{t} = \mathbf{m}_{t}^{\mathbf{p}} + \mu_{1}\zeta_{t}, \ \zeta_{t} \sim \mathbf{N}(0, \sigma_{\zeta}^{2}),$		(4.5a)
$m_t^a = m_t^p + \mu_1 u_t, u_t \sim N(0, \sigma_u^2),$		(4.5b)
$\mathbf{m}\mathbf{f} = \mu_0 \phi \mathbf{b} + \mu_1 \gamma_t$		(4.6c)
$U_t = -(m_t - m_t^e)^2$		(4.6)
$\mathbf{m}_{t}^{e} = \mathrm{Em}_{t} \Omega_{t} = \frac{(\rho - \lambda)(1 - \theta)}{\lambda + (\rho - \lambda)(1 - \theta)} \mathbf{m}_{t}^{a} + \frac{\lambda}{\lambda + (\rho - \lambda)(1 - \theta)} \mathrm{Em}_{t} \Omega_{t-1}$		(4.7)
with $\lambda = \frac{1}{2} \left[\frac{1+r}{\rho} + \rho \right] - \sqrt{\frac{1}{4}} \left\{ \frac{1+r}{\rho} + \rho \right\}^2 - 1,$		

 $\mathbf{r} = (\sigma_v^2/\sigma_\ell^2) \{1 + (\sigma_\ell^2/\sigma_u^2)\}, \qquad \theta = \sigma_u^2/(\sigma_\ell^2 + \sigma_u^2).$

¹⁴Note that the coefficients μ_0 and μ_1 in the reduced form for the optimal money growth rate (4.4c) are determined by the requirement of rational expectations in the solution of the public's signal extraction problem (4.5). See Cukierman and Meltzer (1986c) for the details of these coefficient restrictions. From the above analysis it should be obvious that the Cukierman and Meltzer (1986c) concept of credibility must not be limited to monetary target announcements; the CM framework is more general and allows a formal definition of credibility to be derived in the context of interest rate and exchange rate policies.

With respect to interest rate policy the credibility of the official interest (discount) rate announcements may provide evidence on the central bank's commitment to interest rate smoothing policies, as is outlined in equations (5.1) to (5.7). Short-run inflation control is exercised through open market operations and causes deviations of the nominal interest rate (i_t) from the real interest rate (iⁿ) in equation (5.1). Given the gradual changes in the policymaker's preferences (5.3) and the imprecise control of the monetary authority over the market determined interest rate in (5.5a), the public is uncertain about the true planned level of interest rate (i**p**). To reduce this uncertainty the policymaker is assumed to issue a noisy interest rate announcement signal (5.5b) in addition to the information derived by the public from observing past interest rates. The public treats the announcement as contemporary information which, if credible, is used forming expectations in (5.7). As before, this defines average credibility (AC=-| i_t-Ei_t | Ω_t |) and marginal credibility (MC= α).

Credibility in a stylized model for interest rates

$$\begin{aligned} \overline{\pi_{t} = i_{t} - i^{n}} & (5.1) \\ y_{t} = y^{n} + \phi \left(\pi_{t} - \pi_{t}^{e} \right) & (5.2) \\ W_{t} = \sum_{t=0}^{e} \beta^{t} \left[-(i_{t}^{e} - i^{n})^{2}/2 + b_{t} \left(y_{t} - y^{n} \right) \right] & (5.3) \\ \text{with } b_{t} = b + \gamma_{t}, \ \gamma_{t} = \rho \gamma_{t-1} + v_{t}, \ b > 0, \ 0 < \rho < 1, \ v_{t} \sim N(0, \sigma_{v}^{2}), \\ W_{t} = \sum_{t=0}^{e} \beta^{t} \left[(i_{t}^{e} - i^{n})^{2}/2 + \phi b_{t} \left(i_{t} - i_{t}^{e} \right) \right] & (5.4) \\ i_{t} = i_{t}^{e} + \mu_{i} \zeta_{t}, \ \zeta_{t} \sim N(0, \sigma_{z}^{2}), & (5.5a) \\ i_{t}^{a} = i_{t}^{e} + \mu_{i} u_{t}, \ u_{t} \sim N(0, \sigma_{u}^{2}), & (5.5b) \\ i_{t}^{e} = \mu_{0} \phi b + \mu_{i} \gamma_{t} & (5.5c) \\ U_{t} = -(i_{t} - i_{t}^{e})^{2} & (5.6) \\ i_{t}^{e} = \operatorname{Ei}_{t} \left| \Omega_{t} = \frac{\left(\frac{\rho - \lambda}{\lambda} \right) \left(1 - \theta \right)}{\lambda + \left(\frac{\rho - \lambda}{\lambda} \right) \left(1 - \theta \right)} i_{t}^{a} + \frac{\lambda}{\lambda + \left(\rho - \lambda \right) \left(1 - \theta \right)} \operatorname{Ei}_{t} \left| \Omega_{t-1} & (5.7) \\ \text{with} \qquad \lambda = \frac{1}{2} \left[\frac{1 + r}{\rho} + \rho \right] - \sqrt{\frac{1}{4}} \left\{ \frac{1 + r}{\rho} + \rho \right\}^{2} - 1, \\ r = (\sigma_{v}^{2}/\sigma_{c}^{2}) \left\{ 1 + (\sigma_{c}^{2}/\sigma_{u}^{2}) \right\}, \qquad \theta = \sigma_{u}^{2}/(\sigma_{c}^{2} + \sigma_{u}^{2}). \end{aligned}$$

In the field of exchange rate policy the commitment of policymakers to fixed but adjustable exchange rates may be judged on the basis of the average or marginal credibility of some official central bilateral or multilateral exchange rate parity announcement, as is outlined in equations (6.1) to (6.7). The nominal exchange rate (ϵ_t) in equation (6.1) is assumed to be determined by a purchasing power parity condition. This allows the central bank of the small open economy to implement inflation control by pegging its bilateral exchange rate ϵ_t with the foreign country, which is assumed to have zero inflation (π^*) . As before the policymaker is assumed to like economic stimulus (y_t-y^n) and to dislike inflation (π_t) , here equivalent to deviations of the exchange rate (ϵ_t) from its long-run purchasing power parity level (ϵ^n) .¹⁵ This then allows the average credibility $(AC = -|\epsilon_t-E\epsilon_t|\Omega_t|)$ and marginal credibility $(MC=\alpha)$ of the central bank's exchange rate commitment to be measured.

Credibility in a stylized model for exchange rates

$p_t = e_t p^*, p^* = 1, \pi^* = 0$	(6.1)
$\mathbf{y}_{t} = \mathbf{y}^{n} + \phi \left(\mathbf{p}_{t} - \mathbf{p}_{t}^{e} \right)$	(6.2)
$W_{t} = \sum_{t=0}^{\infty} \beta^{t} \left[-(\epsilon_{t}^{p} - \epsilon^{n})^{2}/2 + b_{t} (y_{t} - y^{n}) \right]$	(6.3)
with $b_t = b + \gamma_t$, $\gamma_t = \rho \gamma_{t-1} + v_t$, $b > 0$, $0 < \rho < 1$, $v_t \sim N(0, \sigma_v^2)$,	•••
$W_{t} = \sum_{t=0}^{\infty} \beta^{t} \left[-(\epsilon_{t}^{p} - \epsilon^{n})^{2} / 2 + \phi b_{t} \left(\epsilon_{t} - \epsilon_{t}^{p} \right) \right]$	(6.4)
$\epsilon_{t} = \epsilon_{t}^{p} + \mu_{1}\zeta_{t}, \ \zeta_{t} \sim N(0, \sigma_{\zeta}^{2}),$	(6.5a)
$\epsilon_{t}^{a} = \epsilon_{t}^{p} + \mu_{1} u_{t}, u_{t} \sim N(0, \sigma_{u}^{2}),$	(6.5b)
$\epsilon_{\rm t}^{\rm P} = \mu_0 {\rm b}\phi + \mu_1 \gamma_{\rm t}$	(6.5c)
$\mathbf{U}_{\mathbf{t}} = -(\epsilon_{\mathbf{t}} - \epsilon_{\mathbf{t}}^{\mathbf{e}})^2$	(6.6)
$\epsilon_{t}^{e} = \mathrm{E}\epsilon_{t} \Omega_{t} = \frac{\left(\frac{\rho - \lambda}{\lambda + (\rho - \lambda)(1 - \theta)}\right)}{\left(\frac{\rho - \lambda}{\lambda - (1 - \theta)}\right)} \epsilon_{t}^{a} + \frac{\lambda}{\lambda + (\rho - \lambda)(1 - \theta)} \mathrm{E}\epsilon_{t} \Omega_{t-1}$	(6.7)
with $\lambda = \frac{1}{2} \left[\frac{1+r}{\rho} + \rho \right] - \sqrt{\frac{1}{4} \left\{ \frac{1+r}{\rho} + \rho \right\}^2 - 1},$	•
$\mathbf{r} = (\sigma_{\mathbf{v}}^2 / \sigma_{\zeta}^2) \{ 1 + (\sigma_{\zeta}^2 / \sigma_{\mathbf{u}}^2) \}, \qquad \theta = \sigma_{\mathbf{u}}^2 / (\sigma_{\zeta}^2 + \sigma_{\mathbf{u}}^2).$	•

¹⁵In fixed but adjustable exchange rate systems like the EMS a realignment typically leads to new exchange rate parities which are the outcome of a bargaining process amongst the participants and frequently are not fully indexed to the cumulated past inflation differentials. This fact justifies the formulation in (6.3) according to which a central bank's PPP target of the exchange rate ϵ^n may differ from the officially announced new central exchange rate parity ϵ^a .

Appendix B: The Empirical Implementation of the Credibility Hypotheses

In order to derive an empirical counterpart to the credibility measures from Appendix A, the modelling of the public's expectations formation process is required. In the present study a two-step approach is adopted: first the optimal time series expectations of the unobservable planned policy targets conditional on past information $(\text{Emp}|\Omega_{t-1}, \text{Eip}|\Omega_{t-1}, \text{Eep}|\Omega_{t-1})$ are derived by using signal extraction methods. Second, the rational expectations of these policy targets under incomplete contemporary information $(\text{Emp}|\Omega_t, \text{Eip}|\Omega_t, \text{Eep}|\Omega_t)$ are derived by incorporating the current announcement into the above time series expectations by using least-squares regression.

In implementing the money growth, interest rate and exchange rate expectations conditional on past information a time series model for these policy variables is required. The theoretical models for monetary quantity, interest rate and exchange rate announcements imply the time series models (7.1a,b) and (7.2a,b) for the actual observable policy outcomes ($x_t = \{m_t, i_t, \epsilon_t\}$) and the policy announcements ($x_t^a = \{m_t^a, i_t^a, \epsilon_t^a\}$) respectively, but for the purpose of an empirical evaluation a slightly modified version of these dynamic linear models has been employed.¹⁶ By applying the multi-process Kalman filter, a signal extraction

Time Series Model for Observable Policy Outcome $\mathbf{x}_t = \{\mathbf{m}_t, \mathbf{i}_t, \epsilon_t\}$: $\mathbf{x}_t = \mathbf{x}_t^p + \xi_t$, $\xi_t \equiv \mu_1 \zeta_t$, $\mathbf{E} \xi_t | \Omega_{t-1} = 0$, $\mathbf{E}(\xi_t \xi_t) | \Omega_{t-1} = \sigma_{\xi}^2$ (7.1a) $\mathbf{x}_t^p = \rho \mathbf{x}_{t-1}^p + \gamma_t$, $\gamma_t \equiv \mathbf{v}_t / \mu_1$, $\mathbf{E} \gamma_t | \Omega_{t-1} = 0$, $\mathbf{E}(\gamma_t \gamma_t) | \Omega_{t-1} = \sigma_{\gamma}^2$ (7.1b) Time Series Model for Policy Announcement $\mathbf{x}_t^q = \{\mathbf{m}_t^q, \mathbf{i}_t^q, \epsilon_t^q\}$: $\mathbf{x}_t^a = \mathbf{x}_t^p + \omega_t$, $\omega_t \equiv \mathbf{u}_t \mu_1$, $\mathbf{E} \omega_t | \Omega_{t-1} = 0$, $\mathbf{E}(\omega_t \omega_t) | \Omega_{t-1} = \sigma_{\omega}^2$ (7.2a) $\mathbf{x}_t^p = \rho \mathbf{x}_{t-1}^p + \gamma_t$, $\gamma_t \equiv \mathbf{v}_t / \mu_1$, $\mathbf{E} \gamma_t | \Omega_{t-1} = 0$, $\mathbf{E}(\gamma_t \gamma_t) | \Omega_{t-1} = \sigma_{\gamma}^2$ (7.2b) Optimal Prediction of Planned Policy under Past Information Ω_{t-1} : $\mathbf{E} \mathbf{x}_t^p | \Omega_{t-1} = \theta \mathbf{E} \mathbf{x}_t | (\mathbf{x}_{t-1}, \mathbf{x}_{t-2}, ...) + (1 - \theta) \mathbf{E} \mathbf{x}_t^q | (\mathbf{x}_{t-1}^a, \mathbf{x}_{t-2}^a, ...)$ (7.3) Optimal Prediction of Planned Policy under Contemporary Information Ω_t : $\mathbf{E} \mathbf{x}_t^p | \Omega_t = \alpha \mathbf{x}_t^q + (1 - \alpha) \mathbf{E} \mathbf{x}_t^p | \Omega_{t-1}$ (7.4)

Influence of Announcement on Expectations under Contemporary Information: $E(xp-Exp|\Omega_{t-1})|\Omega_t = \alpha (xp-Exp|\Omega_{t-1})$ (7.5)

٤

¹⁶In particular I assume $\rho=1$ and allow the changes in policymakers objectives γ_t to follow a nonstationary process by replaying γ_t by $\gamma_t = \gamma_t + s_t$, where s_t is determined by a random walk $s_t = s_{t-1} + w_t$, $Ew_t | \Omega_{t-1} = 0$, $E(w_t w_t') | \Omega_{t-1} = \sigma_w^2$, which adds a third equation to (7.1a,b) and (7.2a,b).

algorithm outlined in Weber (1988), the optimal predictions from these time series models were calculated and used as input for the rational expectations equation (7.4). These rational expectations were derived as the fitted values of a least-squares regression of the actual observable policy outcome $(x_t = \{m_t, i_t, \epsilon_t\})$ on the policy announcements $(x_{i}^{2}=\{m_{i}^{2},i_{i}^{2},\epsilon_{i}^{2}\})$ and on the expected policy outcome conditional on past information $(Exp|\Omega_{t-1})$, which in principle may be calculated by iterating θ in the weighted average of the two univariate time series expectations from (7.3) between zero and one and selecting that value of θ which minimizes the overall sum of squared residuals of the regression equation. Since all three types of announcements are low frequency signals, that is change infrequently, the information content of past announcements is typically found to be very low and θ is close to one in many cases.¹⁷ Consequently, for the results discussed in this paper the restriction $\theta=1$ was imposed and the influence of the announcement on expectations was estimated directly from equation (7.5), which states that the change in expectations due to new information is proportional to the unexpected bias $(x_{t-1}^2 - Exp|\Omega_{t-1})$ revealed by the current announcement signal.

¹⁷See Weber (1990a) for further details on these estimates.

Appendix C: Data Descriptions

All data used in this study are monthly data. A brief description of the data definitions and data sources is found below.

exchange rates

exchange rates ECU exchange rates IMF-International Financial Statistics, line rf. Eurostatistics.

prices

consumer price indices

IMF-International Financial Statistics, line 64, exceptions: for Ireland data on wholesale price indices from IMF-International Financial Statistics, line 63, were used.

interest rates:

call money rates

3-month rates

3-month euro market rates government bond rates official discount rates IMF-International Financial Statistics, line 60b, exceptions: for Ireland data from OECD-Main Economic Indicators were used. OECD-Main Economic Indicators, exception: for Italy a six month rate was used. IMF-International Financial Statistics, line 60ea. IMF-International Financial Statistics, line 61. OECD Main Economic Indicators, exception: for the United Kingdom London money market clearing rates were used.

8

monetary aggregates:

central bank money stock base money narrow money (M1)

quasi money (M2,M3)

total domestic credit

monetary targets

CBM Germany M2 France TDC Italy

M2 Netherlands

M3 United Kingdom

OECD-Main Economic Indicators. IMF-International Financial Statistics, line 14. OECD-Main Economic Indicators, index (1985=100) of seasonally adjusted money. OECD-Main Economic Indicators, index (1985=100) of seasonally adjusted quasi money. OECD-Main Economic Indicators.

taken from Fischer (1988), p. 19. taken from Wyplosz (1988), p. 57. taken from OECD Country Surveys: Italy, various volumes. taken from Federal Reserve Bank of St. Louis International Economic Conditions, various volumes. taken from Fischer (1988), p. 20.

References

- Anderson, T.M. and O. Risager, 1983, Stabilization Policies, Credibility and Interest Rate Determination in a Small Open Economy, European Economic
- Review 32, pp. 669-679. Artis, J.M., 1987, The European Monetary System: An Evaluation, Journal of Policy Modelling 9, pp. 175–198.
- Artis.M. and Taylor, M.P., 1988, Exchange Rates, Interest Rates, Capital Controls and the European Monetary System: Assessing the Track Record, in: Giavazzi, F., S. Miccossi and M. Miller, edit., The European Monetary System, Cambridge University Press.
- Backus, D. and J. Driffill, (1985a), Inflation and Reputation, American Economic Review 75, pp. 530–538.
- Backus, D. and J. Driffill, (1985b), Rational Expectations and Policy Credibility Following a Change in Regime, Review of Economic Studies 52, pp. 211–221.
- Barro, R.J. (1986), Reputation in a Model of Monetary Policy with Incomplete Information, Journal of Monetary Economics 17, pp. 3-20.
- Barro, R.J. and D.B. Gordon (1983a), A Positive Theory of Monetary Policy in Natural Rate Model, Journal of Political Economy 91, pp. 589-610.
- Barro, R.J. and D.B. Gordon (1983b), Rules, Discretion and Reputation in a Model of Monetary Policy, Journal of Monetary Economics 12, pp. 101-121.
 Baxter, M. (1985), The Role of Expectations in Stabilization Policy, Journal
- of Monetary Economics 15, pp.343–362.
- Baxter, M. (1988), Towards an Empirical Assessment of Game-Theoretic Models of Policymaking, Carnegie-Rochester Conference Series on Public Policy 28, pp. 141–152.
- Blackburn, K. and M. Christensen (1989), Monetary Policy and Policy Credibility: Theories and Evidence, Journal of Economic Literature 27 (March), pp. 1-45.
- Blanchard, O.J. (1985), The Lucas Critique and the Volcker Deflation, American Economic Review 74, Papers and Proceedings, pp. 211-215.
- Boissieu, C. de (1988), Financial Liberalization and the evolution of the EMS,
- European Economy 36 (May), pp. 53-70. Brown,R.L., J. Durbin and J.M. Evans (1975), Techniques for Testing the Constancy of Regression Relationships over Time, Journal of the Royal Statistical Society, Ser.B 37, pp. 149–192.
- Chow,G.C. (1960), Tests of the Equality Between Two Sets of Coefficients in Two Linear Regressions, Econometrica 28, pp. 561-605.
- Christensen, M. (1987a), Disinflation, Credibility and Price Inertia A Danish Exposition, University of Aarhus Discussion Paper 1987–5, Mimeo.
- Christensen, M. (1987b), Policy Credibility and the Lucas Critique Some New Tests with an Application to Denmark, University of Aarhus Discussion Paper 1987-8, Mimeo.
- Christensen, M. (1988), On Interest Rate Determination, Testing for Policy Credibility, and the Relevance of the Lucas Critique. Some Danish Experience, University of Aarhus Discussion Paper, Mimeo.
- Cohen, D. and C. Wyplosz (1989), The European Monetary Union: An Agnostic Evaluation, CEPR Discussion Paper No. 306, April 1989.
- Collins, S.M. (1987), Infation and the EMS, Paper presented at the Conference on the EMS, Perugia, Version Oct. 1987, Mimeo.
- Cukierman, A. (1986), Central Bank Behavior and Credibility: Some Recent Theoretical Developments, Federal Reserve Bank of St. Louis Review, pp. 5–17.

Cukierman, A. and A.H. Meltzer (1983), A Positive Theory of Credibility and Monetary Inflation, Mimeo.

Cukierman, A. and A.H. Meltzer (1986a), A Theory of Ambiguity, Credibility, and Inflation under Discretion and Asymmetric Information, Econometrica 54, pp. 10–28.

- Cukierman, A. and A.H. Meltzer (1986b), A Positive Theory of Discretionary Policy, the Cost of Democratic Government and the Benefits of a Constitution, Economic Inquiry 24, pp. 367–388. Cukierman, A. and A.H. Meltzer (1986c), The Credibility of Monetary
- Announcements, in: Neumann, M.J.M., edit., Monetary Policy and Uncertainty, Nomos Verlag, Baden-Baden, pp. 39-67.
- De Grauwe, P. (1988), Is the European Monetary System a DM-Zone? CEPS Working Document No 39.
- De Grauwe, P. (1989), The Cost of Disinflation and the European Monetary System, CES Discussion Paper No. 60.

Dornbusch, R. (1989), Credibility, Debt and Unemployment: Ireland's failed Stabilization, Economic Policy (April), pp. 173–209.

Driffill, J. (1988), Empirical Analysis of Models of Credibility and Reputation in Macroeconomic Policy, Mimeo.

Fellner, W. (1979), The Credibility Effect and Rational Expectations: Implications of the Gramlich Study, Brookings Papers on Economic Activity No. 1, pp. 167-178.

Fischer,S. (1988), Monetary Policy and Performance in the U.S., Japan and Europe, 1973–1986, Finanzmarkt und Portfolio Management 2, pp. 8–25.

Fratianni, M. and J. von Hagen (1989a), Asymmetries and Realignments in the EMS, Indiana University Discussion Paper 429.

Fratianni, M. and J. von Hagen (1989b), German Dominance in the EMS: Evidence from Interest Rates, Indiana University Discussion Paper 430.

- Fratianni, M. and J. von Hagen (1989c), The European Monetary System: Ten Years After, Carnegie-Rochester Public Policy Conference April 1989, Mimeo.
- Friedman, B.M. (1979), Optimal Expectations and the Extreme Information Assumption of 'Rational Expectations' Macromodels, Journal of Monetary Economics 5, pp. 12–41.

Giavazzi, F. (1988), Incentives to Fix the Exchange Rate, European Economic Review 32, pp. 382–387.

Giavazzi, F. and A. Giovannini (1987), The EMS and the Dollar, Economic Policy, (October), pp. 456–485.

Giavazzi, F. and A. Giovannini (1988), Can the European Monetary System be Copied Outside Europe? Lessons from ten Years of Monetary Policy Coordination in Europe, National Bureau of Economic Research, NBER Working Paper No. 2786.

Giavazzi, F. and A. Giovannini (1989), Limiting Exchange Rate Flexibility: The European Monetary System, MIT Press.

Giavazzi, F. and M. Pagano (1988), The Advantage of Tying one's Hands, EMS Disipline and Central Bank Credibility, European Economic Review 32, pp. 1055-1082.

Giavazzi, F. and L. Spaventa (1989), Italy: The Real Effects of Inflation and

- Disinflation, Economic Policy, (October), pp. 135–171. Giovannini, A. (1988), How do Fixed-Exchange-Rate Regimes Work: The Evidence from the Gold Standard, Bretton Woods and the EMS, National Bureau of Economic Research Working Paper No. 2766.
- Goldfeld,S.M. and R.E. Quandt (1965), Some Tests for Homoscedasticity, Journal of the American Statistical Association 60, pp. 539-547.
- Goldfeld,S.M. and R.E. Quandt (1973a), The Estimation of Structural Shifts by Switching Regression, Annals of Economic and Social Measurement 2, pp. 475–485.
- Goldfeld,S.M. and R.E. Quandt (1973b), A Markov Model for Switching Regressions, Journal of Econometrics 1, pp. 3-16.
- Goldfeld,S.M. and R.E. Quandt (1976), Techniques for Estimating Switching Regressions, in: Goldfeld,S.M. and R.E. Quandt, Studies in Nonlinear Estimation, Cambridge Mass.

Goodhart, C. (1989), The Conduct of Monetary Policy, The Economic Journal 99,

1

DD. 293-346.

Hardouvelis, G.A. and S.W. Barnhart (1987), The Evolution of Federal Reserve Credibility: 1978-1984, Columbia Business School, Center for the Study of Future Markets Discussion Paper No. 157.

Hellwig, M. and M.J.M. Neumann (1987), Economic Policy in Germany: Was. There a Turnaround?, Economic Policy, Oct. 1987.

Kremers, J.J.M. (1990), Gaining Policy Credibility for a Disinflation: Ireland's Experience in the EMS, IMF Staff Papers Vol. 37, No. 1, pp. 116-256.

Lucas, R.E. (1976), Econometric Policy Evaluation: A Critique, Carnegie-Rochester Conference Series on Public Policy 1 (1976), pp. 19-46.

McCallum, B.T. (1984) Credibility and Monetary Policy, in: Price Stability and Public Policy – A Symposium Sponsored by the Federal Reserve Bank of

Cansas City, Jackson Hole, August 1984, pp. 105–128.
 Muth, J.F. (1960), Optimal Properties of Exponentially Weighted Forecasts, Journal of the American Statistical Association 55 (1960), pp. 299–306.
 Neumann, M.J.M. (1988), Deutsche Geldpolitik: Verfahren und Probleme,

Finanzmarkt und Portfoliomanagement 2, pp. 47-55.

Perry, G. (1983), What have we Learned about Disinflation, Brookings Papers on

Economic Activity no. 2 pp. 587-602. Persson, T. and L.E.O. Svensson (1984), Time-Consistent Fiscal Policy and Government Cash-Flow, Journal of Monetary Economics 14, pp. 365-374.

Quandt, R.E. (1958), The Estimation of the Parameters of a Linear Regression System Obeying Two Separate Regimes, Journal of the American Statistical Association 53, pp. 873-880.

Quandt, R.E. (1960), Test of the Hypothesis That a Linear Regression System Obeys Two Separate Regimes, Journal of the American Statistical Association 55, pp. 324–330.

Sachs, J. and C.Wyplosz 1987, The Economic Consequences of President Mitterand, Economic Policy, (October).

Sargent, T. (1982), The Ends of Four Big Inflations, in: Hall, R. (edit.), Inflation, University of Chicago Press.

Sargent, T. (1983), Stopping Moderate Inflation: The Methods of Poincare and Thatcher, in: Dornbusch, R. and M. Simonsen (eds.), Inflation, Debt and Indexation, MIT Press.

Sargent, T. (1986), Rational Expectations and Inflation, Harper and Row.

Tabellini, G. (1986), Central Bank Reputation and the Monetization of Deficits: The 1981 Italian Monetary Reform, Economic Inquiry, pp. 185–200.

Turnovsky, S.J. (1969), A Bayesian Approach to the Theory of Expectations, Journal of Economic Theory 1, pp.220-227.
 Ungerer, H., O. Evans and P. Nyberg (1983), The European Monetary System: The Experience, 1979-1982, IMF Occasional Paper No. 19.
 Ungerer H. O. Evans O. T. Marco T. and P. Nyberg (1963).

Ungerer, H., O. Evans, O., T. Mayer, T. and P. Young (1986), The European Monetary System: Recent Developments, IMF Occasional Paper No. 48.

Weber, A.A. (1988), The Credibility of Monetary Policies, Policymakers' Reputation and the EMS-Hypothesis: Empirical Evidence from 13 Countries, Center of Economic Research Discussion Paper No. 8803, Tilburg University.

Weber, A.A. (1990a), The Credibility of Monetary Target Announcements: An Empirical Evaluation, Center of Economic Research Discussion Paper No. 9031, Tilburg University,

Weber, A.A. (1990b), European Économic and Monetary Union and Asymmetries and Adjustment Problems in the European Monetary System: Some Empirical

Evidence, University of Siegen Discussion Paper No. 9-90. Wyplosz,C. (1987), Capital Flow Liberalization and the EMS: A French Perspective, European Economy 36.

Wyplosz, C. (1988), Monetary Policy in France: Monetarism or Darwinism, Finanzmarkt und Portfoliomanagement 2, pp. 56-67.

Wyplosz, C. (1989), EMS Puzzles, Mimeo.

Table 1:	Average Credibility Estimates of Bilateral Central Parity Exchange Rate Announcements in Selected Periods									
	GER	FRA	ITA	NDL	BLEU	DNK	IRE	GBR		
CED		-0.935	-0.824	-0.550	-0.707	-0.955	-1.034	-1.035		
GER		-1:099	-1.741	-0.467	-1.318	-1.161	-1.152	-6.059		
FD A	-1.159		-0.641	-0.694	-0.684	-0.888	-0.796	-0.795		
FRA	-0.975		-1.497	-0.965	-0.014 -1.214	-1.003	-1.002	-6.146		
ፐጥ ል	-1.442	-1.658		-0.594	-0.664	-0.587	-0.591	-0.591		
IIA	-2.051	-1.150		-1.834	-1.909	-1.694	-1.682	-6.674		
NDI	-0.787	-0.954	-1.744		-0.469	-0.798	-0.784	-0.784		
NDL	-0.320	-1.173	-2.077		-0.330	-1.166	-1.150	-5.845		
DI FII		-1.440	-1.841	-1.554		-0.748	-0.736	-0.735		
DEC	-1.457	-0.530	-0.959	-1.423		-0.951	-0.813	-6.458		
DNK	-1.166	-1.163	-1.392		-1.107		-0.373	-0.371		
DINK	-1.425	-0.677	-1.348	-1.408	-0.720		-0.950	-6.288		
IDE	-1.188	-1.312 -0.880	-1.575	-1.306	-0.644	-1.119		-0.003		
11012	-1.192	-0.721	-1.407	-1.014	-0.627	-0.185		-6.159		
CBR	-5.309	-4.940	-5.217	-4.959	-5.495	-5.364	-5.148			
ODR	-8.222	-9.116	-10.01	-8.239	-9.508	-9.234	-9.125			
FCII	-1.217	-1.059	-1.820	-0.968	-1.870	-1.510	-0.920	-4.570		
ECU	-0.642	-1.439	-2.202	-0.829	-1.966	-1.659	-1.137	-4.043 -8.372		
Key:	The reported statistics are average credibility estimates (AC) defined as $AC = - \epsilon_t^a - E\epsilon_t \Omega_t $, whereby ϵ_t is defined as the end of month spot exchange rate (EXCE). For the announced exchange rate ϵ_t^a data of the offical bilateral EMS parities were used. Refer to Data Descriptions for further details. The results above the diagonal are for the BWS (60M2-71M7), ECS (72M4-79M2) and EMS (79M2-89M12). The results below the diagonal are for three EMS sub-samples EMS1 (79M3-83M2)									
	EMS2	(83M3–8	6M12) a	nd EMS	53 (79M2	-89M12).	•		

ŝ

0 V

Table 2:	Marginal Credibility Estimates of Bilateral Central Parity Exchange Rate Announcements in Selected Periods								
	GER	FRA	ITA	NDL	BLEU	DNK	IRE	GBR	
GER EMS1\BWS GER EMS2\ECS GER EMS3\EMS		.598* (.054) .589* (.097) .480 (.043)	.347 (.049) .188 (.038)	.457 (.055) .598* (.061) .354 (.062)	.349 (.049) .355 (.054) .497 (.040)	.562* (.048) .449 (.066) .274 (.044)	.748* (.041) .492 (.051)	.748* (.041) 021 (.035)	
FRA EMS1\BWS FRA EMS2\ECS FRA EMS3\EMS	.548* (.072) .589* (.074) .199 (.110)		.827* (.032) .244 (.048)	.902* (.040) .896* (.145) .550* (.041)	.839* (.031) .728* (.180) .725* (.046)	.861* (.033) .614* (.166) .603* (.049)	.889* (.024) .625* (.050)	.889* (.024) .001 (.034)	
ITA EMS1\BWS ITA EMS2\ECS ITA EMS3\EMS	.325 (.084) .228 (.067) .139 (.085)	.227 (.079) .408 (.096) .206 (.097)		.731* (.049) .177 (.038)	.216 (.043) .243 (.043)	.763* (.038) .174 (.043)	.825* (.025) .238 (.050)	.825* (.025) 007 (.030)	
NDL EMS1\BWS NDL EMS2\ECS NDL EMS3\EMS	.278 (.097) .691* (.111) .565* (.154)	.702* (.051) .616* (.079) .193 (.101)	.250 (.069) .254 (.081) .150 (.083)		.641* (.041) .813* (.069) .540* (.040)	.773* (.040) .795* (.065) .327 (.043)	.900* (.026) .497 (.049)	.900* (.026) 031 (.034)	
BLEU EMS1\BWS BLEU EMS2\ECS BLEU EMS2\EMS	.595* (.063) .172 (.063) .133 (.083)	.842* (.057) .749* (.090) .374 (.142)	.412 (.085) .220 (.080) .168 (.096)	.653* (.052) .150 (.083) .176 (.082)		.764* (.038) .500* (.067) .494* (.052)	.876* (.025) .775* (.039)	.876* (.025) 002 (.035)	
DNK EMS1\BWS DNK EMS2\ECS DNK EMS3\EMS	.471 (.074) .072 (.069) .171 (.092)	.706* (.088) .733* (.093) .264 (.115)	.236 (.097) .172 (.096) .204 (.105)	.581* (.048) .088 (.085) .173 (.091)	.725* (.065) .209 (.096) .179 (.100)		.820* (.029) .596* (.043)	.820* (.029) .005 (.034)	
IRE EMS1\BWS IRE EMS2\ECS IRE EMS3\EMS	.348 (.096) .580* (.082) .530* (.154)	.765* (.091) .748* (.079) .177 (.072)	.254 (.082) .450 (.102) .164 (.068)	.423 (.082) .579* (.085) .487 (.152)	.832* (.054) .856* (.076) .358 (.098)	.605* (.086) .790* (.059) .219 (.079)		010 (.032)	

ି

Ĵ

7

R

	Table 2 continued																	
	GER	FRA	ITA	NDL	BLEU	DNK	IRE	GBR										
GBR EMS1\BWS GBR EMS2\ECS GBR EMS3\EMS	042 (.068) .031 (.077) .106 (.081)	$\begin{array}{c}014 \\ (.073) \\ .050 \\ (.079) \\ .102 \\ (.068) \end{array}$	$\begin{array}{c}039 \\ (.059) \\ .085 \\ (.093) \\ .117 \\ (.061) \end{array}$	$\begin{array}{c}069 \\ (.067) \\ .017 \\ (.077) \\ .109 \\ (.083) \end{array}$	004 (.069) .044 (.079) .113 (.074)	007 (.069) .092 (.080) .125 (.072)	$\begin{array}{c}054 \\ (.065) \\ .062 \\ (.081) \\ .091 \\ (.077) \end{array}$											
ECU EMS1 ECU EMS2 ECU EMS3	$\begin{array}{c} .059\\ (.054)\\ .071\\ (.064)\\ .338\\ (.166)\end{array}$.183 (.038) .399 (.062) .145 (.071)	.086 (.028) .279 (.061) .102 (.059)	.180 (.047) .202 (.063) .318 (.106)	.132 (.037) .200 (.058) .191 (.064)	.121 (.031) .188 (.050) .176 (.056)	.275 (.089) .384 (.155) .701 (.166)	.073 (.030) .175 (.065) .147 (.057)										
Key:	The rep estimat least-so $(\epsilon_t - E \epsilon_t$ as the ϵ_t parity Bold nu the 5 p The res ECS (7 the dia EMS2	ported stand juares re- $ \Omega_{t-1}\rangle =$ end of m announc umbers l ercent le sults abo 2M4-79 gonal ar- (83M3-8	atistics lard error c + α (c onth spo ement. 1 nighlight evel and we the d M2) and e for thr 6M12) a	are margors in parameters in	ginal creater renthesis expectation Ω_{t-1} + v nge rate Data Destance of t licate creater are for the '9M2-891 sub-sam 3 (79M2)	dibility below) on form t , $v_t \sim$ and ϵ_t^a scription he estim edible an ne BWS M12). T ples EM -89M12	estimate from an ation equ $N(0,\sigma^2)$ as the of as for de hates at 1 nouncer (60M2- he result [S1 (79M)].	.338 .145 .102 .318 .191 .176 .701 .147 (.166) (.071) (.059) (.106) (.064) (.056) (.166) (.057) The reported statistics are marginal credibility estimates (with estimated standard errors in parenthesis below) from an ordinary least-squares regression of the expectation formation equation $(\epsilon_t - \epsilon_t \Omega_{t-1}) = c + \alpha(\epsilon_t - \epsilon_t \Omega_{t-1}) + v_t, v_t \sim N(0, \sigma^2)$ with ϵ_t as the end of month spot exchange rate and ϵ_t^a as the offical parity announcement. Refer to Data Descriptions for details. Bold numbers highlight significance of the estimates at least at the 5 percent level and stars indicate credible announcements. The results above the diagonal are for the BWS (60M2-71M7), ECS (72M4-79M2) and EMS (79M2-89M12). The results below the diagonal are for three EMS sub-samples EMS1 (79M3-83M2),										

ĸ

Ĉ

ð

٤

<u>Table 3:</u>	Marginal Credibility of Bilateral Central Parity Exchange Rate Announcements at Estimated Most Likely Point of Policy Switch in the EMS Period (79M3-89M12)									
RATE TIME	MC t(MC)	MC ₁ t(MC ₁)	MC ₂ t(MC ₂)	$\begin{array}{c} \text{CHOW} \\ -2 \text{ln} \lambda \end{array}$	CV ² CR ²	H _{m,n} H _{1,130}				
GER-FRA	0.480	0.570	0.662	10.758**	0.787	2.995**				
87M9	(11.13)	(11.62)	(4.390)	19.334**	0.068	22.184^{**}				
GER-ITA	`0.188 ´	`0.239´	`0.098 ´	1.470	0.816**	3.515**				
85M7	(4.933)	(4.172)	(1.987)	1 6.260**	0.161**	9.675**				
GER-NDL	0.354	0.350	0.529	0.527	0.889**	6.401**				
85M5	(5.712)	(4.303)	(4.380)	26.160**	0.103**	22.723**				
GER-BEL	0.497	0.597	0.155	12.921**	0.625**	5.573**				
83M1	(12.43)	(9.427)	(3.271)	36.000**	0.204**	81.624**				
GER-DNK	0.274	0.482	0.083	11.936**	0.380**	1.923**				
82M6	(6.231)	(6.276)	(1.652)	17.899**	0.461**	23.868**				
GER-IRE	0.492	0.348	0.909	20.386**	0.622	2.220**				
86M6	(9.564)	(5.822)	(14.51)	25.075**	0.134**	67.660**				
FRA-ITA	0.244	0.268	0.258	1.845	0.889**	4.110**				
86M12	(5.082)	(4.618)	(2.938)	16.193**	0.082**	22.368**				
FRA-NDL	0.550	0.666	0.683	19.283**	0.683	2.127**				
87M9	(13.34)	(15.11)	(4.523)	23.314**	0.083	11.997**				
FRA-BEL	0.725	0.803	0.428	15.023**	0.719	3.089**				
86M12	(15.92)	(16.57)	(3.234)	24.057**	0.089*	1.993				
FRA-DNK	0.603	0.800	0.382	10.723**	0.391	1.437*				
83M3	(12.27)	(11.47)	(6.156)	15.136**	0.463*	15.145**				
FRA-IRE	0.625	0.740	0.176	14.398**	0.753	4.513**				
87M1	(12.59)	(13.21)	(2.508)	27.387**	0.061**	28.593**				
ITA_NDI	0 177	0.910	0 108	0 749	0.803	3 008**				
85M7	(1657)	(3,816)	(2.004)	13 /06**	0.000	10 557**				
	0.943	0.010	(2.034)	2 167**	0.100	<i>A</i> 111**				
95M7	(5 643)	(5 1 27)	(1.865)	10 065**	0.010	4.111				
	(0.043)	(0.137)	(1.000)	7 101**	0.137	1 270				
	(1.026)	(9 170)	(2 827)	11 220**	0.000	Q 722**				
ITA_IPE	(4.000) 0.938	0 337	0 100	11.009	0.812	3 05/**				
26M0	(1 792)		(1.003)	18 102**	0.040	17 959**				
00113	(4.100)	(4.303)	(1.303)	10.103	0.092	11.202				
NDL-BEL	0.540	0.745	0.191	36.698**	0.250	1.590*				
82M5	(13.34)	(15.34)	(3.925)	32.966**	0.382**	38.789**				
NDL-DNK	`0.327 ´	`0.561 ´	`0.086 ´	20.121**	0.211	1.469				
83M2	(7.681)	(11.65)	(1.523)	22.320**	0.547	25.558**				
NDL-IRE	`0. 4 97´	`0.306 [´]	` 0.897 ´	26.488**	0.536	1.518				
86M5	(10.20)	(5.704)	(14.54)	26.579**	0.168	28.567**				
BEL-DNK	0.494	0.697	0.206	24.900**	0.513	1.427				
86M1	(9.556)	(12.29)	(2.459)	25.419**	0.204	20.205**				
BEL	0.775	0.805	0.356	4.565*	0.822	2.724**				
87M1	(19.91)	(18.79)	(3.640)	14.720**	0.110	5.057**				
	0 500	0.007	0.007	10 100**	0.695	1 700*				
DINK-IKE	U.090			10.100**	0.080	1.100				
0/1VI1	(13.84)	(14.89)	(2.021)	18.149**	0.142	22.385**				

.

ŕ

Table 4:	Marginal Credibility of Bilateral Central Parity Exchange Rate Announcements at Estimated Most Likely Point of Policy Switch in the post-1975 Period (75M1-89M12)										
RATE	MC	MC ₁	MC ₂	$\begin{array}{c} \textbf{CHOW} \\ -2 \ln \lambda \end{array}$	CV ²	H _{m,n}					
TIME	t(MC)	t(MC ₁)	t(MC ₂)		CR ²	H _{1,180}					
GER-NDL	0.247	0.202	0.693*	8.025**	0.753**	$\begin{array}{c} 4.264^{*} \\ 5.484^{**} \\ 5.682^{**} \\ 682.72^{**} \\ 2.316^{**} \\ 15.031^{**} \end{array}$					
82M10	(6.039)	(3.871)	(9.070)	31.334**	0.163**						
GER-BEL	0.364	0.407	0.131	3.562*	0.839**						
83M3	(10.40)	(8.226)	(2.566)	33.950**	0.122**						
GER-DNK	0.288	0.379	0.083	7.590**	0.641*						
82M6	(7.641)	(6.834)	(1.652)	18.641**	0.280**						
NDL-BEL	0.490	0.617*	0.138	18.914**	0.573	2.161^{**}					
82M9	(13.94)	(13.58)	(2.565)	26.683**	0.250**	23.036^{**}					
NDL-DNK	0.392	0.555*	0.094	17.679**	0.575	1.845^{**}					
83M3	(10.01)	(10.59)	(1.824)	23.395**	0.257**	16.139^{**}					
BEL-DNK 83M3	0.482 (10.86)	0.582* (10.24)	0.164 (2.490)	8.712** 20.094**	0.678** 0.232	2.409** 00.348**					
Key:	The repo (with est an ordina $(\epsilon_t - E\epsilon_t S \epsilon_t$ as the offical pa details. I at least a announce CHOW, ratio test forward i Evans (1 Goldfeld scedastic squared i departur Weber (1	rted statis imated statis imated statis ary least-s $\Omega_{t-1} = c +$ end of mo arity annou Bold numb at the 5 pe ements. The the F-test t statistic of and backw 975), H _{m,n} and Quan ity based of fitted valu es from statistics (1990b) for	tics are mandard error quares regi- $\alpha(\epsilon_t^a - E\epsilon)$ incement. ers highlig rcent level incernent level incernent level of Chow (of Quandt ard CUSU , the test f dt (1965) a on a regress es. Here * ability at t	arginal cred ors in parent ression of th $t \Omega_{t-1}) + v_t$ kchange rate Refer to Da ht significant and stars in l stability to 1960), -21n. (1960), CV3 M ² test of H or heterosco and H _{1,180} , a sion of squation (**) indicatto the 5 (1) per- tails on these	ibility esti thesis belo a equation $x, v_t \sim N(0)$ e and ϵ_t^a a ta Descrip nee of the matrix tatisti λ , the likel and CR ² Brown, Du edasticity of a test for h ured residu es significa- cent level. be tests.	mates w) from σ^2 with s the tions for estimate dible cs are lihood- , the rbin and of letero- als on ant See					

ù

1

į.

ď

1" is

Table 5:	Estimated Average Credibility of Discount Rate Announcements in Selected Periods										
	GER	FRA	ITA	NDL	BEL	DNK	IRE	GBR			
RACM,BWS RA3M,BWS RAGB,BWS	-0.687 -1.189 -2.846	-0.930 -0.950 -2.140	-0.557 -0.303 -1.951	-1.301 -1.218 -1.715	-1.456 -0.503 -1.485	-1.499	-0.576 -0.362 -1.169				
RACM,ECS RA3M,ECS RAGB,ECS	-1.341 -1.966 -3.533	-1.216 -1.159 -1.231	-2.630 -2.970 -1.951	-2.202 -2.027 -2.999	-1.533 -1.191 -1.759	-3.893 -6.002	-1.661 -0.741 -4.023	-1.953 -0.838 -2.824			
RACM,EMS RA3M,EMS RAGB,EMS	-1.420 -1.909 -2.656	-2.538 -2.472 -3.127	-1.133 -1.048 -1.371	-1.176 -1.378 -2.335	-1.822 -1.027 -0.918	-3.613 -5.979	-1.772 -0.578 -1.329	-0.899 -0.727 -1.697			
RACM,EMS1 RA3M,EMS1 RAGB,EMS1	-2.028 -2.726 -2.236	-4.004 -4.000 -5.038	-1.453 -1.041 -1.394	-1.524 -1.850 -2.133	-1.593 -1.857 -0.899	-4.863 -8.227	-2.555 -0.675 -1.393	-1.154 -0.879 -2.054			
RACM,EMS2 RA3M,EMS2 RAGB,EMS2	2–1.064 –1.430 –2.902	-1.679 -1.578 -2.008	-0.946 -1.052 -1.357	-0.972 -1.101 -2.453	-1.956 -0.541 -0.929	-2.881 -4.663	-1.314 -0.521 -1.292	-0.738 -0.631 -1.471			
Key:	Key: The reported statistics are average credibility estimates (AC) defined as $AC = - i_t^a - Ei_t \Omega_t $, whereby i_t is defined as call money interest rate (RACM), three month treasury bill rate (RA3M) and long-term government bond rate (RAGB). For the announced interest rate i_t^a data of official discount rates were used. Refer to Data Descriptions for further details.										

Ŧ

Ĩ

Ø

<u>Table 6:</u>	Estimated Marginal Credibility of Discount Rate Announcements in Selected Periods									
	GER	FRA	ITA	NDL	BEL	DNK	IRE	GBR		
RACM, BWS	.456	.146	.490	.262	.474		1.061**			
60M2-72M3	(.065)	(.038)	(.115)	(.062)	(.068)		(.191)			
RA3M,BWS	.257	.209	.025	`.121 ´	.157		`.896 **			
60M2-72M3	(.043)	(.080)	(.040)	(.027)	(.027)		(.053)			
RAGB,BWS	.018	.059	.133	.122	.024	.065	.047			
60M2–72M3	(.016)	(.026)	(.026)	(.031)	(.015)	(.018)	(.019)			
RACM.ECS	.489	.224	.201	.481	.497	.431	.912**	.581*		
72M4-79M2	(.117)	(.051)	(.035)	(.074)	(.087)	(.087)	(.113)	(.105)		
RA3M,ECS	`.076 ´	`.250 ´	`.15 1´	`.399 ´	`.366 ´		.671 *	.637 *		
72M4–79M2	(.028)	(.048)	(.052)	(.052)	(.045)		(.080)	(.097)		
RAGB,ECS	.073	.055	.056	.087	.037	.104	.142	`.108 ´		
72M4–79M2	(.025)	(.020)	(.023)	(.035)	(.017)	(.028)	(.055)	(.046)		
RACM.EMS	.167	.083	.257	.623*	.683*	.548*	.809*	.773*		
79M3-89M12	(.046)	(.021)	(.031)	(.052)	(.073)	(.063)	(.087)	(.059)		
RA3M,EMS	`.173 ´	`.073 ´	`.165 ´	`.418 ´	`.273 ´		`.964 **	.855 *		
79M3-89M12	(.032)	(.020)	(.044)	(.047)	(.038)		(.043)	(.055)		
RAGB,EMS	`.11 3 ´	`.019´	`.093 ´	`.097 ´	`.056 ´	.066	– .033´	`.020 ´		
79M3-89M12	(.026)	(.012)	(.023)	(.028)	(.027)	(.022)	(.041)	(.022)		
RACM,EMS1	.264	.168	.489	.660*	.673*	.668*	.013	.876*		
79M3-83M2	(.076)	(.045)	(.049)	(.085)	(.122)	(.110)	(.154)	(.114)		
RA3M,EMS1	.223	.158	.571*	.469	.435		.873*	.743*		
79M3-83M2	(.056)	(.046)	(.093)	(.080)	(.067)		(.066)	(.109)		
RAGB,EMS1	.174	.067	.149	.165	002	.163	032	.047		
79M3-83M2	(.049)	(.030)	(.042)	(.056)	(.040)	(.075)	(.084)	(.042)		
RACM,EMS2	.217	.043	.260	.517*	.799*	.452	.794*	.786*		
83M3-89M12	(.087)	(.022)	(.040)	(.070)	(.099)	(.072)	(.117)	(.055)		
RA3M,EMS2	.263	.057	.255	.429	.409	• •	1.044**	.995**		
83M3-89M12	(.052)	(.022)	$(.053)^{-1}$	(.076)	(.063)		(.055)	(.037)		
RAGB,EMS2	.091	.042	.164	.047	.092	.094	040	.002		
83M3-89M12	(.033)	(.015)	(.040)	(.027)	(.035)	(.034)	(.046)	(.022)		
Key:	The rep	ported st	atistics	are marg	ginal cre	dibility	estimate	3 (with		
	estimat	ed stand	lard erro	ors in pa	renthesis	below)	from an	ordinary		
	least-so	quares re	gression	of the e	xpectati	on form	ation equ	lation		
	$(i_t - Ei_t)$	$(\Omega_{t-1}) =$	$c + \alpha$ (i	t ^a -Ľit Ω	$(t_{t-1}) + v$	$t, v_t \sim I$	$N(0,\sigma^2)$ w	vith it		
	as call	money in	nterest r	ate (RA	CM), th	ree mon	th treasu	ry bill		
	rate (R	A3M) a	nd long-	term go	vernmen	t bond r	ate (RA)	GB). For		
	the ann	iounced	interest	rate ita	data of c	omcal di	scount ra	ltes		
	were us		er to Dal	a Descri	ptions fo	or iurthe	r details			
	the 5 p	ercent le	evel and	signific stars inc	licate cr	edible ar	iates at l inouncen	east at nents.		

*

Ų

4

<u>Table 7:</u>	Table 7:Marginal Credibility of Discount Rate Announcements at the Estimated Most Likely Point of Policy Switch in the post-1975 Period (75M1-89M12)						
RATE	MC	MC ₁	MC ₂	$\begin{array}{c} \text{CHOW} \\ -2\text{ln}\lambda \end{array}$	CV ²	H _m ,n	
TIME	t(MC)	t(MC ₁)	t(MC ₂)		CR ²	H ₁ ,180	
RACM,GER	0.188 (3.902)	0.138	0.260	1.829	0.869**	9.731**	
81M9		(1.697)	(6.391)	47.307**	0.111**	0.209	
RACM,FRA 82M5 RACM,ITA	(4.277) 0.256	0.095 (3.415) 0.510	0.034 (1.974) 0.272	$1.341 \\ 27.421^{**} \\ 46.147^{**}$	0.827** 0.158** 0.247	5.425** 30.477** 4.752**	
76M10	9.799	7.350	9.067	46.872**	0.409**	6.406*	
RACM,NDI	0.563	0.587	0.413	1.750	0.905**	22.379**	
80M4	(12.34)	(7.524)	(8.556)	83.492**	0.075**	1.660	
RACM,BEL	0.587	0.594	0.818	6.374**	0.709**	4.218**	
81M6	9.685	6.424	9.676	25.259**	0.223**	20.378**	
RACM,DNF	0.477	0.504	0.218	1.760	0.968**	36.678**	
85M3	(8.458)	(7.244)	(2.649)	62.957**	0.012**	3.625	
RACM,IRE	0.819	0.904	0.780	4.462*	0.881**	10.274**	
83M3	(11.23)	(7.843)	(14.84)	45.411**	0.071**	0.617	
RACM,GBF	t` 0.721	0.890	0.796	19.868**	0.676**	5.085**	
82M1	(12.76)	(9.566)	(16.04)	39.269**	0.135**	0.863	
RA3M,GER 79M3 RA3M FRA	0.152 (6.055)	0.375 (6.762) 0.083	0.173 (5.424) 0.042	5.537** 21.977** 0.785	0.067** 0.874* 0.826**	5.001** 14.481** 4 845**	
82M8 RA3M,ITA	(4.148) 0.158 (4.826)	(3.249) 0.974 (5.202)	(2.106) 0.094 (2.565)	23.666** 55.599**	0.165** 0.109	29.513** 6.029**	
RA3M,NDL 81M8	0.429 (12.03)	(3.203) 0.442 (8.035)	(3.303) 0.347 (8.719)	43.013 0.448 54.139**	0.901** 0.094**	12.180** 17.691**	
RA3M,BEL	0.330	0.423	0.723	19.990**	0.764	8.301**	
84M8	(10.18)	(10.26)	(8.672)	47.071**	0.051**	6.251*	
RA3M,IRE	0.885	0.684	1.030	8.976**	0.578**	4.209**	
79M6	(19.70)	(6.773)	(25.73)	27.143^{**}	0.330**	1.696*	
RACM,GBR	2 0.771	0.678	1.000	7.104^{**}	0.850**	9.745**	
82M11	(15.65)	(9.191)	(27.48)	46.133^{**}	0.073**	0.787	
RAGB,GER	0.080	0.164	0.111	4.750**	0.031**	3.790**	
76M10	(4.076)	(3.326)	(4.634)	11.709**	0.918**	1.799	
79M6 RAGB,ITA	0.016 (1.525) 0.063	0.012 (0.521) 0.097	0.020 (1.543) 0.508	0.720 32.342** 28.460**	0.039** 0.953** 0.552	10.261** 0.124 1.462*	
84M9	(3.956)	(4.090)	(8.683)	24.640**	0.204*	0.543	
RAGB,NDL	0.071	0.066	0.095	0.428	0.816**	3.502**	
83M6	(3.289)	(2.141)	(3.456)	15.548**	0.179**	0.012	
RAGB,BEL	0.037	0.084	0.057	5.156**	0.164**	2.500**	
80M3	(2.138)	(3.851)	(1.983)	12.893**	0.780	0.022	
RAGB,DNK	0.074	0.096	0.401	3.355*	0.956**	14.941**	
88M4	(3.997)	(4.318)	(5.661)	20.292**	0.008**	1.338	
RAGB,IRE	0.024	0.584	-0.028	17.717**	0.339**	3.993**	
77M4	(0.907)	(3.584)	(1.088)	26.916**	0.493**	2.032	
RAGB,GBR	0.027	0.029	-0.002	0.511	0.857**	4.778**	
83M3	(1.756)	(1.298)	(0.097)	21.200**	0.137**	19.234**	

初代

Table 8:	Estimated Marginal Credibility of Money Growth Target Announcements in Selected Periods					
	GER	FRA	ITA	NDL	GBR	
ECS+EMS start-end	0.099 (0.024)	0.123 (0.030)	0.175 (0.030)	,	0.082 (0.024)	
ECS start–79M2	0.307 (0.081)	0.194 (0.120)	0.225 (0.053)	•	0.166 (0.053)	
EMS 79M3-end	0.075 (0.024)	0.127 (0.037)	0.141 (0.036)	0.163 (0.047)	0.101 (0.030)	
EMS1 79M3-83M2	0.156 (0.065)	0.123 (0.054)	0.166 (0.050)	0.258 (0.085)	0.100 (0.042)	
EMS2 83M3-end	$0.052 \\ (0.030)$	0.211 (0.059)	0.109 (0.053)	0.167 (0.063)	0.115 (0.059)	

Key: The reported statistics are the marginal credibility estimates $MC = \alpha$ (with estimated standard error in parenthesis below) from an ordinary least-squares regression of the expectation formation equation $(m_t-Em_t | \Omega_{t-1}) = c + \alpha(m_t^a-Em_t | \Omega_{t-1}) + v_t, v_t \sim N(0, \sigma^2),$ where m_t and m_t^a are the actual and announced growth rates of the primarily targeted monetary (or credit) aggregate (central bank money stock in Germany, M2 in France and the Netherlands, M3 in the United Kingdom, total domestic credit in Italy). Bold numbers highlight significance at least at the 5 percent level.

<u>Table 9:</u>	Estimated Average Credibility of Money Growth Target Announcements in Selected Periods						
	GER	FRA	ITA	NDL	GBR		
ECS+EMS	-1.647	-2.131	-4.415		-5.967		
ECS	-1.073	-2.154	-5.832		-3.613		
EMS	-1.868	-2.127	-3.815	-2.572	-6.817		
EMS1	-1.415	-1.497	-4.492	-2.061	-8.569		
EMS2	-2.134	-2.495	-3.350	-2.871	-5.100		

Key: The reported statistics are the average credibility estimates (AC) defined as $AC = -|m_t^a - Em_t|\Omega_t|$, whereby m_t and m_t^a are the actual and announced growth rates of the primarily targeted monetary (or credit) aggregate (central bank money stock in Germany, M2 in France and the Netherlands, M3 in the United Kingdom, total domestic credit in Italy). ¥

Ĺ

٤

<u>Table 10:</u>	Marginal Credibility of Money Growth Rate Announcements at the Estimated Most Likeli Point of Policy Switch in the post-1975 Period (75M1-89M12)						
RATE	MC	MC ₁	MC ₂	$\frac{CHOW}{-2\ln\lambda}$	CV ²	H _{n,n}	
TIME	t(MC)	t(MC ₁)	t(MC ₂)		CR ²	H _{1,t-k}	
GER	0.099	0.315	0.059	8.611**	0.586**	3.794**	
79M11	(4.092)	(3.862)	(3.178)	24.518**	0.325**	0.009*	
FRA	0.123	0.122	0.657	7.977**	0.746	1.245	
87M3	(4.147)	(3.950)	(4.603)	7.800*	0.159	2.438	
ITA	0.173	0.302	0.139	2.477	0.310*	2.623**	
77M3	(5.826)	(3.184)	(4.671)	6.863*	0.661**	1.462	
NDL	0.179	0.230	0.466	8.923**	0.727	1.129	
88M1	(3.686)	(3.949)	(3.724)	7.500*	0.147	0.587	
GBR	0.082	0.195	0.111	5.934**	0.251	1.618*	
80M6	(3.427)	(3.975)	(3.272)	6.759*	0.664	0.558	
Key:	(3.427) (3.975) (3.272) 6.759^* 0.664 0.558 The reported statistics are marginal credibility estimates (with estimated standard errors in parenthesis below) from an ordinary least-squares regression of the equation $(m_t-Em_t \Omega_{t-1}) = c + \alpha(m_t^a-Em_t \Omega_{t-1}) + v_t, v_t \sim N(0, \sigma^2)$ with m_t as actual money growth rate and m_t^a as the official money growth announcement. Refer to Data Descriptions for details. Bold numbers highlight significance of the estimate at least at the 5 percent level and stars indicate credible announcements. The reported stability test statistics are CHOW, the F-test of Chow (1960), $-2\ln\lambda$, the likelihood- ratio test statistic of Quandt (1960), CV^2 and CR^2 , the forward and backward CUSUM ² test of Brown, Durbin and Evans (1975), $H_{m,n}$, the test for heteroscedasticity of Goldfeld and Quandt (1965) and $H_{1,180}$, a test for hetero- scedasticity based on a regression of squared residuals on squared fitted values. Here * (**) indicates significant departures from stability at the 5 (1) percent level. See Weber (1990b) for further details on these tests.						

- 51 -

1

Į

5

Ť

Seit 1989 erschienene Diskussionsbeiträge: Discussion papers released as of 1989/1990:

1-89: Klaus Schöler, Zollwirkungen in einem räumlichen Oligopol

чc

Ł

Ŷ

à

- 2-89 **Rüdiger Pethig**, Trinkwasser und Gewässergüte. Ein Plädoyer für das Nutzerprinzip in der Wasserwirtschaft
- 3-89 **Rüdiger Pethig**, Calculus of Consent: A Game-theoretic Perspective. Comment
- 4-89 **Rüdiger Pethig**, Problems of Irreversibility in the Control of Persistent Pollutants
- 5-90 Klaus Schöler, On Credit Supply of PLS-Banks
- 6-90 **Rüdiger Pethig**, Optimal Pollution Control, Irreversibilities, and the Value of Future Information
- 7-90 Klaus Schöler, A Note on "Price Variation in Spatial Markets: The Case of Perfectly Inelastic Demand"
- 8-90 Jürgen Eichberger and Rüdiger Pethig, Constitutional Choice of Rules
- 9-90 Axel A. Weber, European Economic and Monetary Union and Asymmetries and Adjustment Problems in the European Monetary System: Some Empirical Evidence
- 10-90 Axel A. Weber, The Credibility of Monetary Target Announcement: An Empirical Evaluation

