UNIVERSITA' CATTOLICA DEL SACRO CUORE
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QUADERNI DELL'ISTITUTO DI ECONOMIA E FINANZA

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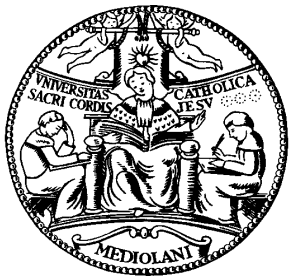
n. 51 – marzo 2003



Quaderni dell'Istituto di Economia e Finanza
numero 51 marzo 2003

The Reputation of a newborn Central Bank

Zeno Rotondi (*) Giacomo Vaciago (**)

(*) Capitalia, Funzione Studi, 00144 Roma, e-mail: zeno.rotondi@capitalia.it

(**) Direttore dell'Istituto di Economia e Finanza, Università Cattolica del Sacro Cuore, Via Necchi 5 – 20123 Milano, e-mail: giacomo.vaciago@unicatt.it

Redazione

Istituto di Economia e Finanza
Università Cattolica del S. Cuore
Via Necchi, 5
20123 Milano
tel.: 0039.02.7234.2976
fax: 0039.02.7234.2781
e-mail: ist.ef@unicatt.it

* La Redazione ottempera agli obblighi previsti dell'art. 1 del D.L.L. 31.8.1945, n. 660 e successive modifiche.

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Abstract

The Reputation of a newborn Central Bank

The effectiveness of monetary policy – i.e. its capacity to maintain a low rate of inflation without adverse effects on employment – crucially depends on the credibility of the Central Bank. According to Blinder (2000), this amounts to the reputation that has been earned through a consistent track record: "a history of matching words with actions".

Therefore, almost by definition a newly born central bank will lack any credibility, unless…. Unless, it can inherit the reputation of a pre-existing central bank, like in the case of the ECB.

In this paper, we test the hypothesis – for which we find strong evidence – that not only in terms of institutional structure (and location: Frankfurt), but also in terms of the weights in its preference function, the ECB has so far closely resembled the Bundesbank. It is somewhat ironic that it has been the German economy which has not taken any benefit from that set up.

JEL classification: E42, E52, E58.

Keywords: Bundesbank, Central Bank, ECB, EMU, Interest Rate Rule, Lexicographic Preferences, Monetary Policy.

1. Introduction

The debate on monetary policy has by en large focused on comparing different views of its effectiveness, especially in terms of the benefits of price stability compared to the likely costs in terms of unemployment. The "rational expectations" revolution led to a radical change in this perspective: long run equilibrium did not consider any trade-offs between inflation and unemployment. Even in the short run this outcome could be obtained, given the appropriate conditions in terms of *credibility* of the central bank. This theoretical result has been confirmed by the several alternative ways through which central banks have in practice tried to enhance their credibility. One, or more, of the following ideas have been practised: hire a "conservative" (i.e. inflation-adverse) central banker; define some degree of pre-commitment (by "tying one's hands", as with inflation targeting); or adopt some incentive-compatible contract for the central banker (like in UK's case, after the Bank of England's reform.)

In the case of a newly-born central bank – like the European Central Bank, born in 1999 – these problems do not have an easy solution. Institutional and practical choices can help (like the location in Frankfurt and the degree of independence assured by the Maastricht Treaty). Although it might have been more important to show Governments and financial markets that there was strong continuity with the pre-existing central bank that had established the best anti-inflationary reputation, i.e. the Bundesbank. This argument has already been discussed in the theoretical literature but so far it has not been, to the best of our knowledge, tested empirically. This is therefore the main goal of the following analysis: first to develop a model of a central bank like the Bundesbank, which has *price stability* as its primary aim and *output stability* as a secondary target. Then test the hypothesis that the very same function explains quite well the choices of the European Central Bank.

The positive results that are obtained from our analysis confirm the fee that had to be paid to Germany for its being ready to abandon the well prized D. Mark. But we do not conclude that all problems have been solved. In recent years in fact, because of the increasing variance of the inflationary process among the 12 Euro-zone countries, what has been observed is that monetary policy has been less and less appropriate for each and all of the countries.

Quite on the contrary: it has been an increasing burden for those countries – like Germany – which register low inflation rates. The very importance that, in a true Bundesbank tradition, the European Central Bank has given to lower Euro-zone inflation has led to tighter monetary conditions in Germany. And given the strictness of the *Stability Pact*, tighter monetary conditions have also led to a deflationary fiscal policy: an outcome that absolutely no one had foreseen when the European monetary union was formed and inaugurated.

2. Bundesbank's heritage

It is usually argued that the ECB was shaped after the Bundesbank. The Maastricht Treaty famously required the ECB to pursue the single goal of price stability with no trade-off permitted between that and other goals. The ECB is allowed to pursue real economic stability only insofar as this is consistent with the goal of price stability, where price stability is usually understood as zero or close to zero inflation. The main rationale for this explicit restriction, as with the adoption of monetary targets, has been the attempt to ensure continuity with respect to the past, in order to help the ECB to inherit the anti-inflationary reputation earned by the Bundesbank. Indeed, the lexicographic ordering of goals is consistent with the well-known formulation of the Bundesbank's goals, where "safeguarding the currency" was interpreted as the primary goal and "supporting the general economic policy of the Federal Government, but only in so far as this is consistent with the aim of safeguarding the currency" was interpreted as the secondary goal.[1]

During the 90s one of the main issues in the discussion of the benefits of the EMU was the credibility gain for low inflation policies. Alesina and Grilli (1993) identify the conditions which make monetary union feasible by focusing on the issue of "how to keep Germany in". In fact the question they ask is, why should the country with the highest anti-inflationary reputation agree to help the other European countries to gain credibility? Alesina and Grilli argue that, as the country with the lowest inflation has relatively greater bargaining power, monetary union is feasible only if the European Central Bank is entrusted to Germany. In their framework Germany is just indifferent

[1] See for instance Svensson (1995) and von Hagen (1995).

between joining the union or not. So in order to keep Germany "in", concessions have to be made to this country.

In the present analysis we test the hypothesis that the concession made to Germany in order to make EMU feasible, implicit in the Maastricht Treaty, was to require the ECB to follow the Bundesbank's reaction function. In order to prove this we need to show that the ECB has been following the same interest rate rule as the Bundesbank, with monetary policy decisions based on German news only.

It can be argued that this concession represents an unfeasible element of fragility in the union, as it may become difficult to bear - and hence to accept - for the other countries if and when they suffer severe shocks. But at the same time it should be remembered that without this requirement it would not have been possible to have neither a feasible EMU nor a newly born common central bank with a credible anti-inflationary monetary policy.

3. Theoretical background

3.1 A monetary policy model for the ECB

In this section we develop a framework for examining the optimal interest rate rule for a central bank under lexicographic preferences.[2] The model considered is a stylised New Keynesian model, which is a simplified version of Clarida, Galì and Gertler (1999), and the analysis developed draws on Driffill and Rotondi (2002).

The supply function is given by a Phillips curve that relates inflation positively to the output gap

$$\pi_t = \delta E_t \pi_{t+1} + \eta y_t + v_t . \qquad (1)$$

We have also an IS equation which relates inversely the output gap to the real interest rate

[2] See Driffill and Rotondi (2002) and Rotondi (2002) for an extensive analysis of monetary policy when the central bank has lexicographic preference ordering.

$$y_t = -\beta(r_t - E_t\pi_{t+1}) + u_t. \tag{2}$$

The central bank has lexicographic preferences. As primary goal the central bank has price stability, expressed as

$$L^1 = E_0 \sum_{t=0}^{\infty} \delta^t L_t^1. \tag{3}$$

with $\delta > 0$ the discount factor. The period loss function corresponding to the primary objective is

$$L^1{}_t = (E_{t-1}\pi_t - \bar{\pi})^2, \tag{4}$$

where $\bar{\pi}$ is the inflation target. Expression (4) is one possible definition of price stability. An alternative definition of price stability, sometimes used in the literature, is the following:

$$E_{t-1}\pi_t = \bar{\pi}. \tag{5}$$

The problem with this last definition is that it is too general and, as price stability is not expressed in terms of a loss function, it does not allow to order the multiple solutions that satisfy the above condition.[3]

As a secondary goal the central bank has output stability, expressed as

$$L^2 = E_0 \sum_{t=0}^{\infty} \delta^t L_t^2. \tag{6}$$

The period loss function corresponding to the secondary objective is

$$L^2{}_t = (y_t - \bar{y})^2 + \varphi(r_t - \bar{r}_t)^2. \quad (7)$$

with $\varphi > 0$ and $\bar{r}_t$ an operative target for the interest rate chosen according to an optimal rule that minimises the period loss function corresponding to the primary objective.

The operative target is chosen endogenously ex post by the central banker, after expectations are formed and before r_t is chosen, in order to achieve the primary objective. In our framework the operative target can be state contingent. As observed by Svensson (1997) and Beetsma and Jensen (1999) state contingent targeting may not be feasible in general. However in our framework, given the preferences of the central bank and the structure of the economy, it is possible for private agents to determine rationally the value of the operative target.

Notice that usually the assumption made in the literature on interest rate rules is that φ is infinite, or alternatively there is no possibility of deviating from the interest rate rule. The only exception is when some degree of monetary inertia (usually due to the presence of a financial stability motive in the central bank's loss function) is explicitly introduced in the analysis. Hence the present framework is more flexible of the standard one used in the literature and probably closer to the real world too.

3.2 Equilibrium interest rate rule

In the present framework the optimisation process is divided in two steps: first the primary objective is minimised; second as long as the first order condition for minimising the primary objective remains satisfied it is possible to use the residual degrees of freedom for minimising the secondary objective. In other words the optimisation of the secondary objective is conditional on the optimisation of the primary objective. Moreover solutions which imply a lower value for L_t^1 are

[3] Price stability can also be defined in terms of price level stabilisation, but even if this is an interesting theoretical case it is not adopted in practice.

strictly preferred by the central banker and similarly solutions which imply the same value of L_t^1, but a lower value of L_t^2 are strictly preferred as well.

Here we focus only on the equilibrium values prevailing in the case of discretionary monetary policy, i.e. when the policy maker is not able to pre-commit to a rule for setting the interest rate. The first order condition for minimising L_t^2 with respect to r_t is given by

$$-\beta\left(y_t-\bar{y}\right)+\varphi\left(r_t-\bar{r}_t\right)=0. \tag{8}$$

Inserting (2) in (8) and collecting for r_t we get

$$r_t=\frac{1}{\varphi+\beta^2}\left(\beta^2 E_t\pi_{t+1}+\varphi\bar{r}_t+\beta u_t-\beta\bar{y}\right). \tag{9}$$

By inserting expression (9) back in the expressions (1) and (2) we can express output and inflation as a function of the operative target r_t:

$$y_t=-\frac{\beta}{\varphi+\beta^2}\left(\beta^2 E_t\pi_{t+1}+\varphi\bar{r}_t+\beta u_t-\beta\bar{y}\right)+\beta E_t\pi_{t+1}+u_t. \tag{10}$$

and

$$\pi_t=\frac{\eta}{\varphi+\beta^2}\left(\beta\varphi E_t\pi_{t+1}-\beta\varphi\bar{r}_t+\varphi u_t+\beta^2\bar{y}\right)+\delta E_t\pi_{t+1}+v_t. \tag{11}$$

By using expression (11) for inflation we can show that the first order condition for minimising L_t^1 with respect to $\bar{r}_t$ is given by

$$E_{t-1}\pi_t=\bar{\pi}. \tag{12}$$

It is possible to show that condition (12) is satisfied by at least two rules for $\bar{r}_t$. A first rule consists in setting the target equal to a constant value given by

$$\bar{r}_t = -\frac{\left(\varphi + \beta^2\right)k}{\eta\varphi\beta}\bar{\pi} + \frac{\beta}{\varphi}\bar{y} \equiv \bar{r}, \tag{13}$$

with

$$k = 1 - \frac{\delta\left(\varphi + \beta^2\right) + \eta\varphi\beta}{\varphi + \beta^2}. \tag{14}$$

In this case the expression for inflation becomes

$$\pi_t = \frac{\delta\left(\varphi + \beta^2\right) + \eta\beta\varphi}{\varphi + \beta^2} E_t\pi_{t+1} + k\bar{\pi} + \frac{\eta\varphi}{\varphi + \beta^2} u_t + v_t, \tag{15}$$

and the first order condition for the primary objective is satisfied if, and only if,

$$\frac{\delta\left(\varphi + \beta^2\right) + \eta\beta\varphi}{\varphi + \beta^2} < 1. \tag{16}$$

The condition (16) is fulfilled for

$$0 < \varphi < \frac{\beta^2(1-\delta)}{\delta + \eta\beta - 1} \equiv \bar{\varphi}, \qquad \text{if} \qquad \left(\delta + \eta\beta - 1\right) > 0; \tag{17}$$

$$\varphi > 0, \qquad \text{if} \qquad \left(\delta + \eta\beta - 1\right) < 0.$$

Hence, in order to reach the price stability goal with a constant interest rate rule, it does not necessarily need rigidity on the achievement of the operative target.

A second rule consistent with condition (12) is given by the following expression

$$\bar{r}_t = \frac{\delta\left(\varphi + \beta^2\right) + \eta\varphi\beta}{\eta\varphi\beta} E_t \pi_{t+1} - \frac{\varphi + \beta^2}{\eta\varphi\beta} \bar{\pi} + \frac{\beta}{\varphi} \bar{y}. \tag{18}$$

In this last case the first order condition for the primary objective is satisfied for $\varphi>0$.
In both cases equilibrium inflation will be equal to

$$\pi_t = \bar{\pi} + \frac{\eta\varphi}{\varphi + \beta^2} u_t + v_t. \tag{19}$$

A problem with this equilibrium is that it is not clear how private agents may co-ordinate on one of the two possible rules for setting the operative target for the interest rate. One possibility available for the government for solving this problem of multiple equilibriums would be to delegate monetary policy to a central banker with $\varphi > \bar{\varphi}$. But this solution works only if $\left(\delta + \eta\beta - 1\right) > 0$.
Alternatively, transparency of monetary policy could play an important role in this situation of strategic uncertainty about the central bank's reaction function. In fact, suppose that the central bank increases the transparency of its policy decisions by underlying the forward-looking nature of its moves. Clearly this would affect private agents by making them focus on the forward-looking policy rule (18). As explained by Orphanides (2001): "because monetary policy operates with a lag, successful stabilization policy needs to be more forward-looking and estimated policy reaction functions should at least accommodate as much".
Actually the ECB has placed a great emphasis on the forward-looking nature of its conduct of monetary policy.[4] The ECB's stability-oriented monetary policy strategy prescribes the achievement of price stability, in terms of a 0 to 2 per cent inflation corridor to be maintained over the medium-term. According to the ECB the feature of a successful monetary policy is the following: "Owing to the lags in the transmission process, changes in monetary policy today will only affect the price level after a number of quarters or even years. This means that central banks need to asses what policy stance is needed today in order to maintain price stability in the future,

[4] Clarida, Galì and Gertler (1998) and Clarida and Gertler (1997) have found forward-looking interest rate rules useful for describing Bundesbank monetary policy as well.

after the transmission lags unwind. In this sense, monetary policy must be forward-looking" (ECB 2001, p. 45).

Moreover, as explained by Angeloni, Gaspar, Issing and Tristani (2001, p. 73), "the medium-term orientation is partly a reflection of the time lag with which monetary policy affects prices – price developments cannot be controlled through monetary policy on a monthly or even quarterly basis. More importantly, a medium-term orientation is compatible with the role of monetary policy in the overall framework of stability oriented policies. […] The idea is that a longer time horizon allows a more measured response to unforeseen shocks, thereby avoiding 'unnecessary' volatility in output, employment and interest rates."

4. Empirical analysis

4.1 A Bundesbank interest rate rule as a benchmark

In this section we try to answer the following question: does an interest rate rule estimated for the Bundesbank and based only on German data continue to track closely ECB interest rates decisions?

So far the previous literature has used two alternative benchmarks for assessing the monetary policy of the ECB. Either it applies an estimated reaction function of the Bundesbank to euro zone data, or it applies an estimated common reaction function that reflects the aggregate behaviour of the central banks of EMU-members, based on a pooled data set of the pre-EMU periods. Subsequently, the interest rate projections implied by the estimated reaction functions are compared with actual ECB policy rates.

By using the first type of benchmark researchers have found the ECB rates to be consistently below those values that would have been chosen by the Bundesbank (Faust, Rogers and Wright (2001), Alesina, Blanchard, Gali, Giavazzi and Uhlig (2001), Gali (2001) and Clausen and Hayo (2002)). This finding supports the hypothesis of a ECB "softer" than the Bundesbank, which contradicts the discussion made in section 2 on a "feasible EMU".

By using the second type of benchmark researchers have found a "remarkable" closer tracking of actual values with the interest rate projections implied by the estimated common reaction function (Mihov (2001) and Clausen and Hayo (2002)). The problem with the second type of benchmark is that it uses aggregate pre-EMU variables for the interest rate, inflation and output gap, which are based on GDP-weighted averages of national variables of Germany, France and Italy, with a relatively higher weight on German data. Hence the Lucas critique may invalidate the inference based on historical data of EMU-members and used for describing the behaviour of the ECB in the past. Clearly some caution is required when we evaluate the relevance of these findings.

More importantly, none of the studies considered has examined whether during the transition from the Bundesbank regime to the ECB there actually was a structural break in the reaction function of the Bundesbank based only on German data, as implied by the findings relative to the common reaction function based on historical data of EMU-members. This hypothesis can be easily tested by focusing on the predictive accuracy of one-step ahead forecasts obtained from the Bundesbank rule based on German data only and comparing the results obtained for the EMU period with those obtained for the pre-EMU period. In the following analysis we perform this test.

The source of the data is DATASTREAM. Apart from German inflation and output (taken from OECD statistics), euro zone inflation and output (taken from ECB statistics). We estimate for the period 1986:01 – 1998:12 by means of Generalized Method of Moments (GMM) the following interest rate rule for the Bundesbank

$$r_t = c_2 \cdot r_{t-1} + (1 - c_2) \cdot [c_1 + c_3 \cdot E_t \pi_{t+12} + c_4 \cdot E_t y_t] \tag{20}$$

The specification of the forward-looking interest rate rule for the central bank reflects the standard specification used in the empirical literature.[5] $E_t \pi_{t+12}$ is expected 12-month ahead inflation, $E_t y_t$ is the current expected output gap, the constant c_1 corresponds to the trend nominal interest rate, and ε_t is a stochastic disturbance. The output gap is measured by the percent deviation of log industrial production from a trend.[6] In our empirical analysis the interest rate used is the 1-month German

[5] See for example Clarida, Gali and Gertler (2000) and (1998).
[6] We have used the deviation of output from its long-run level as measured by the Hodrick-Prescott filter.

euro rate for the pre-EMU period and the 1-month euribor rate for the EMU period. Usually in the empirical literature on the Bundesbank a shorter maturity is used: the call money rate.[7] Moreover, the target rate fitted from the estimated Bundesbank's reaction function is usually compared with the actual eonia rate for the EMU period. We use instead a longer maturity in order to ensure comparability between euro zone short-term rates and German short-term rates.[8]

As argued first by Rudebusch (2001), the evidence on the near-observational equivalence of partial adjustment and serially correlated shocks for monetary policy rules provides a motivation for testing whether the rule expressed by (20) is miss-specified. In fact the omission of a persistent, serially correlated variable that influences monetary policy could yield the spurious appearance of partial adjustments in the estimated rule. Indirect testing of these two alternative hypothesis, based on the evidence of the low predictability of policy rates, leads him to the conclusion that monetary inertia is an illusion and the lagged interest rate is not a fundamental component in the case of the U.S. policy rule. However, English, Nelson and Sack (2002) show, by testing these two alternative hypotheses directly in the estimation of the policy rule, that both hypotheses play an important role in describing the behaviour of the federal funds rate.

Following English, Nelson and Sack (2002), in order to assess the presence of monetary inertia our estimations are based also on a re-specification of (20), which allows for both partial adjustment and serially correlated errors. In particular we have the following alternative specification of the interest rate rule (20):

$$r_t = r_{t-1} + (1-c_2)\cdot\Delta\hat{r}_t + [(1-c_2)(1-c_5)]\cdot(\hat{r}_{t-1} - r_{t-1}) + (c_2 c_5)\cdot\Delta r_{t-1} + \varepsilon_t . \qquad (21)$$

with

[7] See for example Clarida and Gertler (1997), Clarida, Gali and Gertler (1998), Mihov (2001), Faust, Rogers and Wright (2001) and Clausen and Hayo (2002). An exception is Favero (2001), who similarly to our analysis assumes that the 1-month interest rate is policy-determined and uses it for estimating an interest rate rule for the Bundesbank.

[8] In fact the German call money rate is not comparable with the eonia rate, as it is usually done by all the works quoted in the previous footnote. The call money rate is the rate paid by a broker to a bank that loaned the broker the cash that ultimately went to an investor. On the contrary the eonia rate (euro overnight index average) contitutes one of most important reference rate for unsecured transactions between banks in the euro zone money market. The first rate is mainly used for speculative investments, while the latter is mainly used for liquidity management purposes.

$$\hat{r}_t = c_1 + c_3 \cdot E_t \pi_{t+12} + c_4 \cdot E_t y_t;$$

$$r_t = c_2 \cdot r_{t-1} + (1 - c_2) \cdot \hat{r}_t + \omega_t; \tag{22}$$

$$\omega_t = c_5 \cdot \omega_{t-1} + \varepsilon_t.$$

In expression (21) the parameter c_2 is related to the present monetary inertia (i.e. interest rate smoothing), while c_5 is related to the presence of serially correlated variables. If both parameters are significant, then both hypotheses are valid and important in explaining the behaviour of the central bank.[9]

The GMM estimates obtained from (20) and (21) are reported in table 1. We have corrected for heteroscedasticity and autocorrelation of unknown form with a Newey-West fixed bandwidth and chosen Bartlett weights to ensure positive definiteness of the estimated variance-covariance matrix.[10] We have taken as instruments the first 6 lags of the German inflation rate, output gap and 1-month euro rate.

As it is possible to see from table 1, the estimates of c_2 and c_5 are both highly significant in the specification (21) of the interest rate rule of Bundesbank. This result suggests that both partial adjustment and serially correlated errors are present. Moreover allowing for serially correlated errors does reduce the estimated degree of partial adjustment to some extent, but the effect is small, with the c_2 parameter falling from 0.91 to 0.86.

In figure 1 we compare the euro zone 1-month interest rate with the fitted target rates derived from the estimated Bundesbank's reaction function (20), based alternatively on German and on euro zone data. First, we focus on euro zone data. In this case, we confirm partially the findings of euro zone interest rates being lower than the fitted target rates, as we can observe also several periods of overlapping. Moreover, we do not find the large discrepancies between actual rates and fitted target rates found for the first year of EMU by Faust, Rogers and Wright (2001).

[9] For the case of the Fed English, Nelson and Sack (2002) have found that both hypotheses are valid. Hence, contrary to what found by Rudebusch (2001) monetary inertia is not an illusion.

[10] As starting values for the coefficients we have considered Two-Stage Least Squares estimates.

Table 1 – GMM estimation of the equation of the 1-month German rate

	Equation (20)	Equation (21)
c_1	1.39	1.18
	(0.37)	(0.44)
c_2	0.91	0.86
	(0.02)	(0.04)
c_3	1.61	1.88
	(0.17)	(0.19)
c_4	0.69	0.59
	(0.19)	(0.18)
c_5		0.21
		(0.05)
R-Squared	0.99	0.98
S.D. dep.var.	2.23	2.23
S.E. regression	0.27	0.31
J-Statistic	7.19	6.07

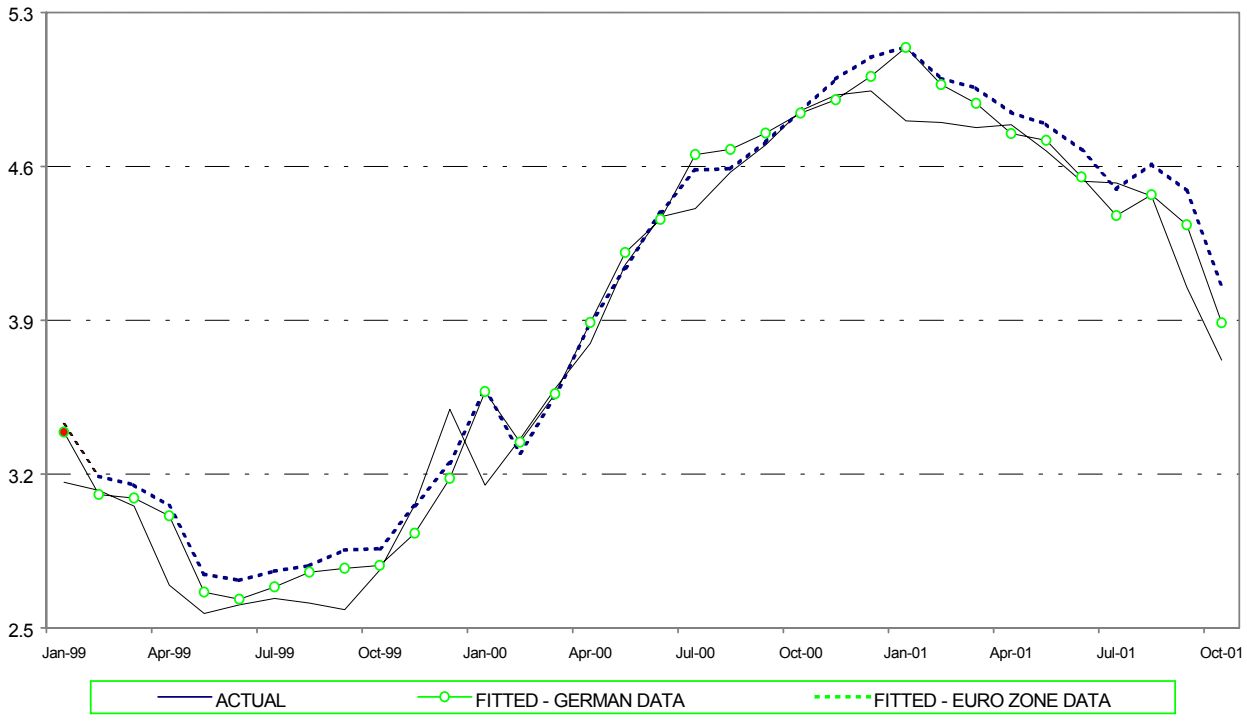
Notes: robust standard errors in parentheses.

The new insight deriving from our analysis appears when we consider the estimated Bundesbank's reaction function and compare the case when the central bank reacts to German news with the case when it reacts to euro zone news. As shown in figure 1, the target rates based on German data are closer to actual values than those based on euro zone data. The above results can be examined further from table 2, where the one-step ahead forecasts derived from the estimated reaction functions are reported.[11] It is possible to observe that the target rates based on German data have a predictive accuracy superior to that of the target rates based on euro zone data.

[11] In table 2 in order to compute the predictive accuracy of the one-step ahead forecats for the pre-EMU period we have re-estimated specifications (20) and (21) over the sample 1986:01 – 1996:02. Nevertheless the observations included in the forecast sample are always the same: 34 months.

Mihov (2001) has found a root mean squared error of 0.19 for the estimated common reaction function, based on pooled EMU data, for the EMU period. He describes as "remarkable" the close tracking of actual values by his estimates. However in our case of the target rates derived from the Bundesbank rule and based on German data corresponds a root mean squared error of 0.16 for the EMU period. Moreover, the passage from the pre-EMU period to the EMU period did not imply a significant break for the Bundesbank from the point of view of the predictive accuracy of the fitted target rates based on German data. This is particularly evident for the specification (20) of the interest rate rule.

Figure 1 - Comparison between 1-month euribor rate and the target rates fitted from the estimated Bundesbank's reaction function



The latter result represents also a convincing argument against the hypothesis of the ECB being "softer" than Bundesbank's. The presence of a positive spread between target rates corresponding to a Bundesbank rule based on EMU data and actual ECB rates has led some researchers to suggest that the reaction function of the ECB might feature a higher weight on the output gap relative to the

weight on inflation, compared to the Bundesbank (see for instance Faust, Rogers and Wright 2001). On the contrary, our findings clearly reject this hypothesis.

Hence, from the perspective of Germany the passage to EMU did not imply a substantial modification in the conduct of monetary policy, as the presence of the majority vote mechanism in the ECB would have instead suggested. In conclusion, according to our empirical evidence, it is possible to argue that the concession made to Germany in order to make EMU feasible, implicit in the Maastricht Treaty, was to require the ECB to follow the Bundesbank's reaction function.

Table 2 – Forecast diagnostics of one-step ahead forecasts for the estimated reaction functions

	German data				**Euro zone data**			
	Bundesbank		**Bundesbank**		**Bundesbank**		**Fed**	
	1996:03-1998:12		**1999:01-2001:10**		**1999:01-2001:10**		**1999:01-2001:10**	
	$c_5 = 0$	$c_5 \neq 0$	$c_5 = 0$	$c_5 \neq 0$	$c_5 = 0$	$c_5 \neq 0$	$c_5 = 0$	$c_5 \neq 0$
Root Mean Squared Error	0.13	0.15	0.16	0.22	0.19	0.26	0.20	0.18
Mean Absolute Error	0.11	0.12	0.12	0.17	0.15	0.23	0.16	0.14
Mean Absolute Percentage Error	3.21	3.67	3.35	4.81	4.27	6.45	4.10	3.78
The Inequality coefficient	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.02

4.2 A Fed-in-Frankfurt interest rate rule as a benchmark

In this section we compare the behaviour of the ECB with the Fed. In particular we apply an estimated reaction function of the Fed to euro zone data.[12] As before the interest rate projections implied by the benchmark reaction function are compared with actual ECB policy rates.

During 2001 the Fed cut its policy rate more often and by a greater amount than the ECB. Some commentators praised the aggressive orientation of the monetary policy by the Fed, underlying its ability in stimulating the economy without compromising the achievement of price stability. On the contrary the ECB has been criticised for being slow in responding to macroeconomic shocks. An interesting question here is to ask whether the reason for this different behaviour of the ECB was due to continuing investment in the build up of credibility.

The existing empirical evidence does not clearly show that the ECB was more passive than a Fed-in-Frankfurt would have been. For instance, Begg, Canova, De Grauwe, Fatas and Lane (2002) have found that in 2001, while the ECB was initially slow in reacting to euro zone news, the counterfactual rate based on the Fed rule was very close to actual rates.[13] However in the first two years of EMU, actual rates are consistently lower than counterfactual rates based on the Fed rule.

Let's examine our findings. In this case the source of the data is only DATASTREAM. In table 3 we report the GMM estimates of specifications (20) and (21) for the Fed. Here, we have taken as instruments the first 6 lags of the US inflation rate, output gap, 1-month euro rate and Fed Funds rate.

As it is possible to see from table 3, the estimates of c_2 and c_5 are both highly significant in the specification (21) of the Fed rule. Again allowing for serially correlated errors does reduce the estimated degree of partial adjustment to some extent, but the effect is small, with the c_2 parameter falling from 0.91 to 0.88. Notice that it falls slightly less than in the case of the Bundesbank. In both cases the degree of monetary inertia, as measured by the parameter c_2, remains high.

[12] A related issue examined in the literature is whether the ECB has followed the Fed in the timing of its moves, see for instance CESP(2002). Here we examine only what would have happened if the Fed was in charge of monetary policy decisions in EMU.

[13] The interest rate used in their empirical analysis is the rate on main refinancing operations of the ECB. However in order to ensure comparability between euro zone and US interest rates a 1-month interest rate would be better. For this reason we estimate the Fed rule by using US 1-month euro rates and apply it to 1-month euribor rates.

In figure 2 we compare the euro zone 1-month interest rate with the fitted target rates derived from the Bundesbank rule based on German data and those derived from the Fed rule based on euro zone data, both under the specification given by (20). It is interesting to observe the almost perfect overlap of the two counterfactual rates up to October 2000. Subsequently they diverge, with the Bundesbank target rate consistently lower than that of the Fed. Moreover, in 2001 the actual rate is always lower than the counterfactual rate derived from the Fed rule, apart from July, while the counterfactual rate derived from the Bundesbank presents some overlapping periods.

In conclusion, our findings do not support the hypothesis that the ECB has been passive in responding to macroeconomic shocks. Indeed, contrary to the standard findings obtained in the empirical literature and to the common opinion held by ECB watchers, the ECB in 2001 has reduced its short-term interest rate more aggressively than a Fed-in-Frankfurt would have done.

Moreover, according to our empirical evidence a "Bundesbank-in-Frankfurt" would have replicated the ECB behaviour fairly closely compared to a Fed-in-Frankfurt.

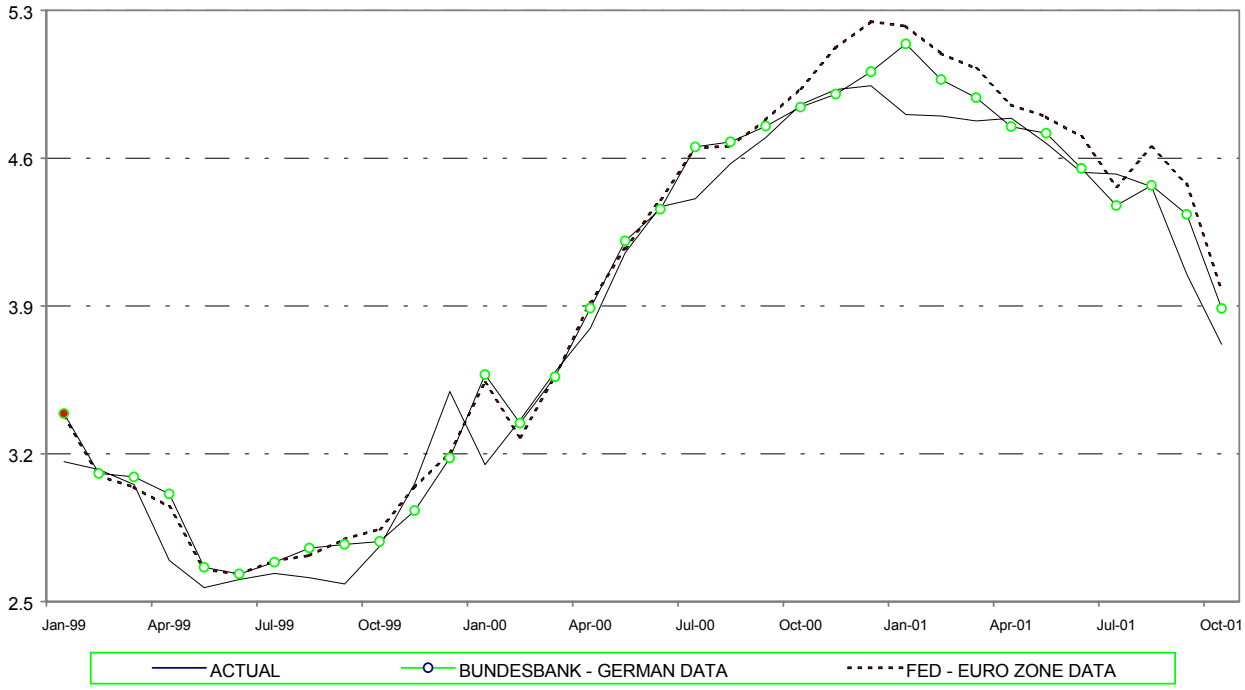
Table 3 – GMM estimation of the equation of the 1-month US rate

	Equation (20)	**Equation (21)**
$\mathbf{c_1}$	1.99	4.33
	(0.85)	(0.39)
$\mathbf{c_2}$	0.91	0.88
	(0.02)	(0.03)
$\mathbf{c_3}$	1.24	1.45
	(0.25)	(0.29)
$\mathbf{c_4}$	1.24	1.11
	(0.29)	(0.23)
$\mathbf{c_5}$		0.55
		(0.06)
R-Squared	0.97	0.97
S.D. dep.var.	1.69	1.69
S.E. regression	0.28	0.32

J-Statistic	23.35	23.18

Notes: robust standard errors in parentheses.

Figure 2 - Comparison between 1-month euribor rate and the target rates fitted from the estimated Bundesbank's and Fed's reaction function



5. Conclusions

In a previous paper[14], we had already suggested some degree of continuity between the Bundesbank and the European Central Bank; and we used that argument along with other econometric evidence to test the hypothesis that the new currency, the Euro, had closely followed the steps of its illustrious predecessor, the D. Mark.

We have now further developed the comparison between the Bundesbank and the European Central Bank. For the first time we test empirically the Alesina-Grilli (1993) conditions for "keeping Germany in". And for the first time, we develop – and compare – the "lexicographic model" of monetary policy for both the Bundesbank and the European Central Bank. We also estimate the role of data referring to Germany alone (*vs.* the entire Euro-zone) in the European Central Bank reaction function. Finally we make some progress on one specific, but important aspect of European Central Bank policy in recent years, which was criticised for being too slow to act, compared with the Federal Reserve's much more flexible and faster reaction.

In fact, the credibility of the American central bank in recent years has been largely based on its aggressive stance against the economic cycle (and several disruptive shocks). Our new European institution has largely followed the opposite approach: stability in its policies has been considered as important to achieve the final goal of monetary stability. Our analysis does not support the commonly held criticism that the European Central Bank was too slow to act.

Our final conclusion is therefore more positive than that of most European Central Bank watchers. The approach chosen to achieve credibility was correct, while most of the problems that the European Central Bank has encountered are due to the slow progress made in improving the quality of the monetary union. The increasing variance of the inflationary process among the 12 countries, especially at the extremes of the distribution of income levels, say between Germany and Portugal, has meant that the common monetary policy is not yet the best possible. The quest for an optimum currency area continues.

[14] See Rotondi-Vaciago (2002).

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