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Lessons from the ECB experience: Frankfurt still matters!

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Lessons from the ECB experience: Frankfurt still matters! [1]

by

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Abstract

This paper compares the European Central Bank's conduct of monetary policy (1999-2005) with that of the Bundesbank (after the German Unification: 1990-1998) in order to test the hypothesis of an ECB with "Bundesbank's preferences" put forward in the theoretical literature (Alesina and Grilli 1993, Fatum 2006). Econometric tests and simulations based on monetary policy reaction functions show that the continuation of the former Bundesbank regime is supported by the data. Given this empirical evidence we discuss the lessons for future Monetary Unions stemming from the ECB experience.

JEL: E52, E58.
Key Words: EMU, Monetary Policy, Reaction Function, Taylor rule, ECB, Bundesbank.

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1. Introduction

The birth of the European Monetary Union (EMU) and its new currency, the Euro, occurred despite the general scepticism of economists (American economists mainly, but many in Europe were also non believers and/or against it). It was a political decision, attributable to a large extent to the strong determination of France and Germany, that of their governments rather than of their peoples. As often happens in good marriages, a monetary union requires the presence of a partner on which the virtues of the union will be anchored. There is no doubt that that anchor was found in the reputation of the German central bank. The priority that had always been given to monetary stability by the Bundesbank consecrated the central role that the German mark and its price in terms of interest rates was to play in setting the "convergence" to be achieved. And this is precisely what happened as countries gradually moved closer to the best performance, which until then had been personified by Germany and its currency.

It remains to be discovered whether and to what extent this transfer of reputation was completed in the period from 1992 to 1998 (from Maastricht to the start of EMU) or whether it also continued after the start of EMU (from 1st January 1999) or even after the changeover (1st January 2002) when the new currency actually came into circulation.

It is our hypothesis that the role of anchor attributed to Germany and therefore to the monetary stability (low inflation) of that country has continued beyond the start of EMU and that to achieve this, the ECB has continued to reflect the German concern that inflation should be as low as possible. And this is not only a question of the "relative weights" attributed to the various arguments of a "reaction function", but it is also more specifically a question of continuously ensuring that price increases remain at a minimum in the anchor country, and that is in Germany, and that the less virtuous member countries of the Union are therefore penalised (because they lose competitiveness). The ECB therefore fulfils its mission in full if it seeks not only to hold average European inflation down, but also to ensure that there is always a quality benchmark, which sets the monetary stability which each country should achieve. In other words, our hypothesis, which we intend to verify here and which seems to be confirmed by the model subjected to econometric estimate, is that the priority attributed to monetary stability has been observed by the ECB in the dual sense of giving importance to both expected inflation and to German inflation in setting interest rates.

The structure of the presentation is the following. In section 2 we analyse briefly the positive achievements of EMU and the important role played by ECB monetary policy. In section 3 we discuss the virtues of ECB preferences and their link with the Bundesbank's preferences. Section 4 reports our empirical findings. Here we test the hypothesis of an ECB "with Bundesbank's

preferences". Section 5 makes some concluding observations and discusses the lessons for future Monetary Unions that can be derived from the ECB experience.

2. The EMU as a successful Monetary Union

What are the criteria for the success of a monetary union?[4] The first and most obvious indicator is its success in maintaining the "value" of the new currency. One approximate measure of this may be obtained by comparing average inflation in the euro zone after 1999 with that in the United States for example. It is quite clear (see figure 1, consumers prices Us-Euro area) that the inflation suffered by the euro has been less and more stable than that of the US dollar. This "virtue", however, had already emerged in the run up to the euro, when inflation in those countries wishing to join the euro with the highest inflation (Italy for example) was brought down in order to converge with the anchor countries (who were also reducing inflation) like Germany (see figure 2, consumer prices Italy-Germany). From this viewpoint, EMU caused those countries who in the past had been the least disciplined to share the virtues, in terms of monetary stability, of the best countries, who also remained the best because they continued to have the lowest inflation even after the introduction of the euro.

This "monetary virtue" has been reflected in extremely low interest rates: not just in the short-term, as it is obvious given the presence of only one currency, but also in the long-term (figures 3 and 4, short- and long-term interest rates). The premium that Italy has continued to pay on long-term rates has been very small, much lower than would have been justified by the differences in the stock of public debt!

The conclusion from a monetary viewpoint (inflation and interest rates) is that this monetary union is clearly a success: the member states with the worst record in the past have "inherited" the monetary virtues of those with the best record.[5]

The situation is, however, more complex in real terms. Growth in national product is very different in different member states and this difference has perhaps actually become greater after the introduction of the euro (figure 5, gross domestic product), with convergence occurring at various levels of national product rather than on growth.

[4] The purpose of the present section is merely to examine briefly the major achievements of EMU and to underline the key role played by ECB monetary policy. See Wyplosz (2006) and Artis (2006) for more extensive analyses of the EMU experience.

[5] This view that the launch of the Euro was a success and that the ECB has acted wisely so far is widespread in the academic profession. Nevertheless there is still some concern about the degree of transparency of monetary policy and the lack of democratic accountability of the ECB (see for instance Wyplosz 2006).

Basically the experience acquired to date seems to show that those countries which were already the most virtuous because of their lower inflation have lost nothing by joining the euro and those which had the highest inflation have reduced it, while those countries with the lowest per capita income have continued to have the highest real income growth. A situation which contains these three positive factors deserves a positive judgement, which must clearly also apply to the policies pursued by the ECB. Let us say that an appropriate monetary policy has been successfully pursued, while the most positive characteristics of the past have been maintained.

3. The preferences of the ECB and the Bundesbank's heritage

It is usually argued that the ECB was shaped after the Bundesbank. The Maastricht Treaty famously requires 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 targeting, 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 "support 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.[6]

During the 90s one of the main issues in the discussion of the benefits of 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". The question they pose is the following: 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. They develop an analytical framework where Germany is just indifferent between joining the union or not. So in order to keep "Germany in", concessions have to be made to this country. Of course, it can be argued that this concession represents an unfeasible element of fragility in the union, as it may become difficult to bear - and to accept - for the other countries if and when they suffer severe macroeconomic shocks. But at the

[6] See for instance Svensson (1995) and von Hagen (1995). See Driffill and Rotondi (2004) for an extensive analysis of monetary policy when the central bank has lexicographic preference ordering.

same time it should be remembered that without this requirement it would not have been possible to have neither a feasible EMU with a single currency nor a newly born common central bank with a credible anti-inflationary monetary policy.

Even if we accept the idea of a ECB implementing the monetary policy of the Bundesbank it is not clear how this would coexists with ECB Council members which are country delegated and may have conflicting interests when voting on the common monetary policy. However, by means of a multi-country delegation monetary policy model, Fatum (2006) has shown that when the median voter mechanism is replaced with a "weighted mean mechanism" strategic delegation can lead to a surprisingly high degree of inflation aversion.[7] Namely the same aversion of the most inflation-averse member state. The rationale for this result is due to the fact that the most inflation-averse member state is always able to push for higher interest rates in order to off-set the less inflation-averse members' push for lower interest rates. On the contrary the less inflation-averse members are constrained by the fact that interest rates cannot be negative. This result is robust also to an enlargement of the EMU.

Now, before presenting our empirical evidence on the monetary policy of the ECB, it is useful to discuss some descriptive evidence on the achievement of price stability in the EMU. In figure 6 are reported the harmonized inflation rates of the EMU members. As it is possible to see Germany's inflation rate has actually played the role of "anchor" for the other members, apart from few episodes. Since 1999 German average annual inflation rate has been the minimum in the EMU, with a value of 1.5 per cent. Moreover, the primary objective of the ECB monetary policy is to maintain price stability, defined as an Euro Area inflation rate of below, but close to, 2 per cent over the medium term. However, the Euro Area average inflation rate has been 2.1 per cent. Hence German inflation has satisfied the primary objective of the ECB, while Euro Area inflation not.

4. Empirical evidence on the interest rate rule of the ECB

4.1 Methodological approach and data

Here we will try to provide new empirical evidence in order to verify the hypothesis of an ECB with Bundesbank's preferences. As discussed previously, 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 to German data. In order to prove this we need to show that, from the point of view of monetary policy outcomes, Germany would be indifferent if the

[7] The "weighted mean mechanism" is consistent with the probabilistic voting model used in the political economy literature; see Fatum (2006) for further details.

ECB follows the same interest rate rule as the Bundesbank or if monetary policy is directly chosen by the Bundesbank.

Von Hagen and Fratianni (1990) have provided empirical evidence on the presence of asymmetries between the national money market interest rates during the European Monetary System (EMS). In particular they have shown that Germany has been the least dependent country, especially in the early phase of EMS. Moreover, Bini Smaghi and Ferri (2006) have found the presence of asymmetries in the importance of member countries in the decision-making process of the EMS. They have shown that liquidity support was decided according the discretion of the anchor country, i.e. Germany, and that it was provided in an asymmetric way across member countries.

All this empirical evidence implies that the Bundesbank was the *de facto* leading monetary authority during the EMS. Nevertheless the evidence about the presence of asymmetries in the importance of member countries in the decision-making process of the ECB is mixed. There exist in the literature several analyses comparing the ECB interest rate decisions with the fitted rates derived from an estimated Bundesbank's reaction function. In this type of exercise the Bundesbank's reaction function is estimated over the pre-EMU period and responds to Eurozone data during the EMU period. By following this approach researchers have found that actual ECB rates are systematically below those values that would have been chosen by the Bundesbank (Faust *et al.* 2001, Alesina *et al.* 2001, Gali 2003, Clausen-Hayo 2005). This finding supports the hypothesis of an ECB "softer" than the Bundesbank, which clearly contradicts the argumentation of a "feasible" EMU considered in section 3.

On the contrary Rotondi and Vaciago (2003) have found some evidence supporting the hypothesis of an ECB following an estimated Bundesbank's reaction function responding only to German data during the EMU period. However, the period considered in their analysis is relatively short: 1999-2001.

Having now more data available for testing the hypothesis relevant for the present study we develop a novel analysis by both following the same approach of Rotondi and Vaciago (2003) and extending their analysis by estimating a counterfactual Bundesbank's reaction function over the EMU period. Moreover, we use quarterly data - instead of monthly data - and the output gap measures provided by the OECD - instead of fitting linear or quadratic trends of the industrial production series.

Hayo and Hofmann (2006) by replicating the exercise of Rotondi and Vaciago (2003) - with monthly data for the 1999-2003 period and by using the day-to-day money market rate as policy rate – find a weaker evidence on the ECB with Bundesbank's preferences hypothesis. Until the late 2000 the fitted target rates derived from the estimated reaction functions of the ECB and Bundesbank are very similar. While starting from 2001 the fitted target rates diverge increasingly with the

Bundesbank target rates systematically lower than the ECB target rates.[8] But their results hinge crucially on the trend interest rate postulated for the Bundesbank during the EMU period. They assume that it is equal to the trend interest rate estimated for the ECB in the EMU period, which is lower than what estimated for Bundesbank in the Pre-EMU period. But it could be argued that the German trend interest rate should reflect German data only and not necessarily be the same of the trend interest rate referred to the Euro area. A more correct approach would be to re-estimate the trend interest rate for the Bundesbank in the EMU period, but keeping fixed the other parameters in the interest rate rule estimated for the pre-EMU period. In the present analysis we will follow this alternative estimation approach for the trend interest rate, allowing also for a different degree of interest-rate smoothing for the Bundesbank in the EMU period, but keeping fixed in the re-estimation the inflation and output coefficients of the Bundesbank's reaction function estimated for the pre-EMU period.

The source of the quarterly data used is DATASTREAM: German inflation (taken from OECD statistics); Eurozone inflation (taken from ECB statistics); German and Eurozone output gap (taken from OECD statistics); 1-month Fibor and Euribor rates, i.e. the interbank rates respectively of Germany during the pre-EMU period and of the Eurozone. The interest rates are taken as quarterly averages. The sample period is 1986Q1-2006Q2 for German data and 1999Q1-2006Q2 for Eurozone data.

4.2 Eurozone monetary policy chosen by the Bundesbank

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

We estimate by means of Generalized Method of Moments (GMM) the following interest rate rule for the Bundesbank

$$r_t = \rho \cdot r_{t-1} + (1-\rho) \cdot \bar{r}_t + \varepsilon_t , \tag{1}$$

$$\bar{r}_t = \phi + \phi_\pi \cdot (E_t \pi_{t+4} - \bar{\pi}\ ) + \phi_y \cdot (E_t y_t - \bar{y}). \tag{2}$$

This forward-looking interest rate rule represents a standard specification used in the empirical literature for modeling central banks' interest rate setting.[9] In the specification (1)-(2): the term $\bar{r}_t$ is

[8] This implies that the findings of Hayo and Hofmann (2006) do not support the hypothesis of an ECB "softer" than the Bundesbank.

[9] See for example Clarida, Gali and Gertler (2000) and (1998).

usually interpreted as an operating target for the policy rate r_t; ρ is the coefficient of partial adjustment and implies that the central bank adjusts gradually the policy rate towards the operating target (interest-rate smoothing); $E_t\pi_{t+4}$ is expected 4-quarters ahead inflation; $\bar{\pi}$ is the inflation target, set equal to 2 per cent for consistency with the ECB inflation target;[10] $(E_t y_t - \bar{y})$ is current expected output gap; the constant ϕ corresponds to trend nominal interest rate; and ε_t is a stochastic disturbance which reflects monetary policy shocks. The output gap is measured by the percentage deviation of log GDP from a trend.[11] In our empirical analysis the interest rate used is the 1-month Fibor rate. Usually in the empirical literature on the Bundesbank a shorter maturity is used.[12] We use a longer maturity first in order to make sure that the Eurozone short-term rate can be compared with the German one.[13] Second, the 1-month Euribor rate has been affected by the problems of the interbank market occurred in the starting year of EMU to a lesser extent than the Eonia rate.[14]

The interest rate rule is estimated over the 1990Q1-1998Q4 period, i.e. it considers only the Bundesbank's conduct of monetary policy during the German Unification and before the start of the EMU.[15]

The GMM estimates obtained from (1)-(2) are reported in table 1, column 1a.[16] We have taken as instruments the first 4 lags of the German inflation rate, output gap and interest rate. In the table we have reported also the R^2, the *J*-statistic for the validity of the instruments used, and robust *T*-statistic. The *T*-statistic is based on standard errors that have been corrected for heteroscedasticity and serial correlation using the method of Newey and West.

As it is possible to see from the estimates reported in the table, column 1a, the trend nominal interest rates has a point estimate of 4.3, while the inflation and output coefficients have point estimates of 1.2 and .8 respectively. The coefficient of partial adjustment, reflecting the degree of monetary inertia (or interest-rate smoothing) present in the empirical Taylor-type rule, has a point estimate of .9. The estimated coefficients are all statistically significant.

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[10] The assumption of an inflation target equal to 2 per cent for the Bundesbank does not affect the estimation of the parameters, apart from the constant term.

[11] We have used the quarterly deviation of output from its long-run level as measured by the OECD.

[12] For example Clarida, Gali and Gertler (1998) consider the German call money rate. An exception is Favero (2001), who similarly to our analysis assumes that the 1-month interest rate is policy-determined.

[13] In particular the German call money rate is not comparable with the Eonia rate, which is the Eurozone overnight interbank rate. Both rates are usually taken as measure of the short-term interest rate for the pre-EMU and EMU periods.

[14] Namely the issue of overbidding.

[15] Also in the comparative exercise developed by Hayo and Hofmann (2006) the Bundesbank's interest rate rule is estimated for the period after the German Unification.

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

In column 1b we have reported the estimate for the coefficient of partial adjustment for the period 1999Q1-2005Q2 obtained by estimating the specification (1)-(2) with OLS and using the estimated coefficients for the Bundesbank's target rate (i.e. expression (2)), given in column 1a. This counterfactual exercise implies to assume that monetary policy has been chosen by the Bundesbank during the EMU period. We allow only for a (possibly) different degree of monetary inertia for the Bundesbank during the EMU period. As it is possible to see the goodness of fit is worse off compared to the pre-EMU period, with an R^2 decreasing from 99 to 92 per cent.[17]

In figure 7 we compare the Eurozone 1-month interest rate with the fitted rates derived from the estimated Bundesbank's reaction function based on German data, as reported in column 1b of table 1. From figure 7 we can observe that, although the pattern of the fitted interest rate is similar to that of the actual policy rate, the estimated interest rate rule fits poorly actual monetary policy.

Now it is possible to show that this finding could reflect the presence of a lower trend nominal short-term interest rate in the interest rate rule (i.e. the constant term in the estimation). A lower trend nominal short-term interest rate may reflect either a downward shift in trend inflation or a downward shift in trend real short-term interest rate. The data available are not sufficient in order to make a robust assessment about the size and source of the downward shift. Hence here some caution is recommended. However it could be argued that, in absolute and relatively to rest of the world, the macroeconomic performance of Europe has been persistently weak over the recent years, with low growth and high unemployment. There seems to be a widely shared consensus on the idea that potential growth is low in Europe and that this "structural slump" mainly reflects a "productivity deficit". In order to put in place possible remedies for this decline the European Union (EU) has set the *Lisbon agenda*, where several objectives are defined and are intended to be met in 2010. This considerations lead us to believe that trend real short-term interest rate could be the likely source of the downward shift.

In table 1, column 1c, we have reported the estimates for the same specification used in column 1b but with re-estimating the constant term for the EMU period. As expected this new estimation implies a higher R^2, increasing to 98 per cent. We get an estimated trend nominal interest rate of 2.8. But, as underlined before, this measure should be regarded as tentative and considered with some caution. From figure 7 we can see that after the re-estimation of the trend interest rate the Bundesbank's interest rate rule tracks relatively well the actual policy rate.

In order to test the robustness of our findings we estimate the specification (1)-(2) for the Bundesbank over the period 1999Q1-2005Q2 by means of GMM. In this counterfactual exercise we allow for (possible) changes in all the parameters of the specification (1)-(2) for the EMU period.

[17] A dummy variable for 2001-Q4 is introduced in all the specifications estimated over the EMU period.

In table 1, column 2, are reported the estimates found for this new estimation. By comparing column 1a with column 2 we can see that all the parameters decrease during the EMU period. Nevertheless, the Wald test does not reject the null hypothesis that the point estimates of the output and inflation coefficients estimated for the EMU period are the same of those estimated for the pre-EMU period. As regard with the point estimate of the trend nominal interest rate, in this new estimation we have a value of 3.4, higher than what found in the exercise reported in column 1c but lower than what found for the pre-EMU period. Thus our new estimation seems to confirm the presence of a downward shift in trend nominal interest rate. The goodness of fit is similar to the estimation reported in columns 1c and – as shown in figure 8 - we do not find large discrepancies between actual rates and fitted rates.[18]

In table 1 are reported two other robustness checks. In column 3 we have reported the nonlinear OLS estimates obtained from a backward-looking specification, where the interest rate responds to current inflation and not to expected future inflation. This is an alternative specification for the central bank's interest rate rule often used in the empirical literature. In this case the expressions (1)-(2) become:

$$r_t = \rho \cdot r_{t-1} + (1-\rho-\mu)\cdot \bar{r}_t + \mu \cdot r_{t-2} + \varepsilon_t , \tag{3}$$

$$\bar{r}_t = \phi + \phi_\pi \cdot (E_t \pi_t - \bar{\pi}\ ) + \phi_y \cdot (E_t y_t - \bar{y}), \tag{4}$$

where we have included a second-order partial adjustment mechanism.

As it is possible to see from table 1, column 3, the goodness of fit is similar to that of the forward-looking specification used in columns 1c and 2 of the same table. Moreover the point estimate of the inflation coefficient is significant (at the 5 per cent confidence level), but has a value less than one.[19]

[18] In figure 8 is reported also the comparison between the actual rates and the rates fitted from an estimated ECB reaction function responding to Eurozone news, which we will discuss later on. Hence disregard for the moment this information.

[19] This value of the estimated coefficient violates the principle according to which for the coefficient of inflation is required a value greater than one for stability in macroeconomic models with these types of policy rules. In the literature this concept is often referred as the Taylor principle. However, Woodford (2003) has shown that in general the necessary and sufficient condition required for stability may have a more complex form than that expressed by the Taylor principle, depending on the specification of the central bank's interest rate rule. In particular, in the present case of interest-rate smoothing it is possible to show that $\phi_\pi > 1$ is only a necessary condition for the determinacy of the rational expectations equilibrium, and even values of $0 < \phi_\pi < 1$ can be consistent with stability.

Finally, in column 4 we have reported the OLS estimates obtained from a "speed limit" rule recently proposed by Walsh (2003) and examined for the case of the Eurozone by Stracca (2006). Now the specification of the interest rate rule is:

$$r_t = 1 \cdot r_{t-1} + \phi_\pi \left(E_t \pi_t - \bar{\pi} \right) + \phi_y \Delta \left(E_t y_t - \bar{y}_t \right), \tag{5}$$

where Δ is the first difference operator. This alternative rule is characterized by super-inertia in the adjustment of the policy rate and, being a quasi-first-difference rule, it has been proposed as a possible solution to measurement problems in the level of trend nominal interest rate and of potential output. Another attractive feature of this rule is that it is able to closely approximate the performance of the optimal unconstrained instrument rule under commitment in most of the macro-models used in the literature.

As it is possible to see from table 1, column 4, the inflation and output coefficients are positive and significant. The parameter values are close to what found by Stracca (2006) for the Eurozone, by means of calibration in a theoretical framework for analyzing optimal monetary policy.[20] However, the goodness of fit is worse off compared to the estimations reported in the columns 1a, 1c, 2 and 3.

4.3 Eurozone monetary policy chosen by the ECB

In this section we try to answer the following question: does an interest rate rule estimated over the EMU period and based on Eurozone data track better ECB interest rates decisions compared to the case of an ECB with Bundesbank's preferences?

In table 2, columns 1-3, we have reported the estimates for the central bank reacting to Eurozone news and obtained by replicating the same type of estimations reported in table 1, columns 2-4. As regard with the forward-looking specification, from column 1 of table 2, it is possible to observe that the values of the parameters estimated for the ECB are very close to the values of the parameters estimated for the Bundesbank, in particular those reported in column 1c of table 1. However, the goodness of fit is slightly worse off compared to what found for the Bundesbank, with an R^2 decreasing from .98 to .97. Nevertheless as shown in figure 8 we do not find large discrepancies between actual rates and fitted rates.

[20] In particular, in the case based on the parameter estimates of Smets (2003), Stracca gets inflation and output coefficients respectively equal to .41 and .37 for the optimal speed limit rule. While, in the case based on the parameter estimates derived by himself, he gets respectively 0 and 1.7. The differences in these findings reflect the higher inflation persistence estimated by Smets (2003).

Finally, the estimations for the backward-looking rule and the speed limit rule feature findings similar to what found previously for the Bundesbank.

4.4 Discussion of the empirical findings

Now in order to make an assessment of the validity of the hypothesis of an ECB with Bundesbank's preferences we have reported in table 3 an in-sample predictive accuracy diagnostic for all the estimated interest rate rules. The indicators of accuracy considered are two: the Root Mean Square Error (RMSE) and the Mean Absolute Error (MAE). We consider both fitted interest rates and fitted target rates. Let's start with fitted interest rates. As it is possible to see from the table, the estimated rules feature similar predictive accuracy, although in the case of forward-looking rules the Bundesbank's interest rate rule performs slightly better. From the comparison of the two speed limit rules we can see that one performs better than the other depending on the indicator of predictive accuracy chosen.

As regards with fitted target rates, it is possible to see that the finding of a similar degree of accuracy is confirmed, although now the ECB target rate performs slightly better. In figure 9 we have reported the fitted target rates for the forward-looking specifications of the ECB and the Bundesbank. As it is possible to see the patterns are very similar, except for the initial year of EMU. This result is opposite to what found by Hayo and Hofmann (2006). They find that until the late 2000 the fitted target rates derived from the estimated reaction functions of the ECB and Bundesbank are very similar. While starting from 2001 the fitted target rates diverge increasingly, with the Bundesbank target rates systematically lower than the ECB target rates. The rationale of this different outcome can be found either in the different measures of the output gaps used and either in the longer sample of data available in the present analysis. In small samples like the present one efficiency is very relevant. As we have seen one the most crucial estimate for the exercise considered, driving strongly the comparative outcomes, is that of the trend interest rate for the EMU period. Thus small sample bias can play a crucial role in determining different outcomes.

In conclusion, our empirical analysis must be considered as merely preliminary and suggestive, and further research is needed. Nevertheless we provide new evidence supporting the hypothesis of an ECB with Bundesbank's preferences. In particular, we have shown that, from the point of view of monetary policy outcomes, Germany is indifferent if the ECB follows the same interest rate rule as the Bundesbank or if monetary policy is directly chosen by the Bundesbank.

5. Conclusions

In order to give good results in terms of expectations and therefore of the “costs” of guaranteeing monetary stability, it is important for the reputation of the newborn central bank to be high from the outset. This is more easily achieved if the reputation of that central bank of the member states of the union, which always guaranteed the lowest inflation, is adopted as the “anchor”.

What had already emerged in the Treaty of Maastricht was also symbolically confirmed by the choice of Frankfurt for the headquarters of the ECB. However, it is not just a question of geography. It is something that is more important and concerns the need, at least as long as data on inflation in different member states exists and is widely publicised and discussed, for that country which hosts the ECB, and that is Germany, to remain the anchor for minimum inflation. This is our hypothesis, which led us to consider that the initial policy making of the ECB was performed as if in German shoes (see Rotondi-Vaciago 2003) and which has been confirmed in more recent times. Our work differs from that of other scholars, such as Clausen-Hayo (2005) and Hayo-Hofmann (2006), who see the ECB as increasingly less similar to the Bundesbank. This is because we make a different hypothesis, which is the importance that, in our opinion, the ECB has continued to attribute to German inflation even after the German mark was replaced by the Euro. It is a rule which was proposed long ago in academic circles as a useful condition for convincing the Germans to participate in the monetary union that was to be created. However in our opinion it is something more, which has lasted after the creation of the Monetary Union, and it is the observance of the necessary condition for the success of any union: the virtue shared by all the participants is not diminished in the country that symbolises it most.

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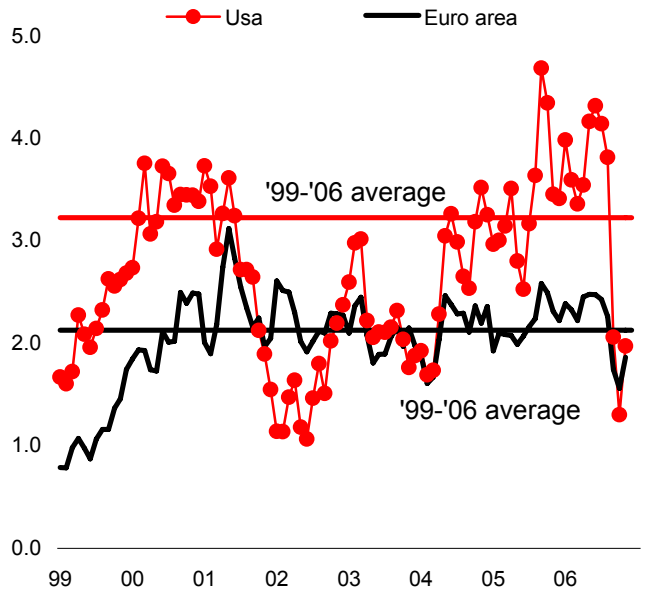
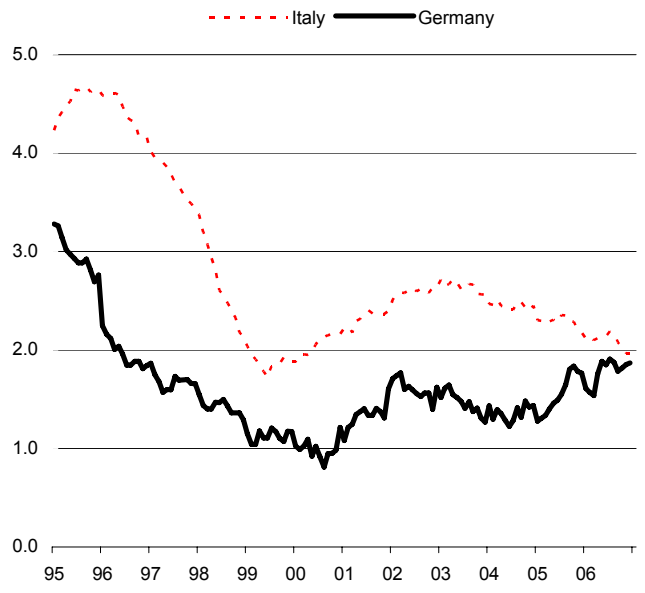
Figure 1 - Consumer prices



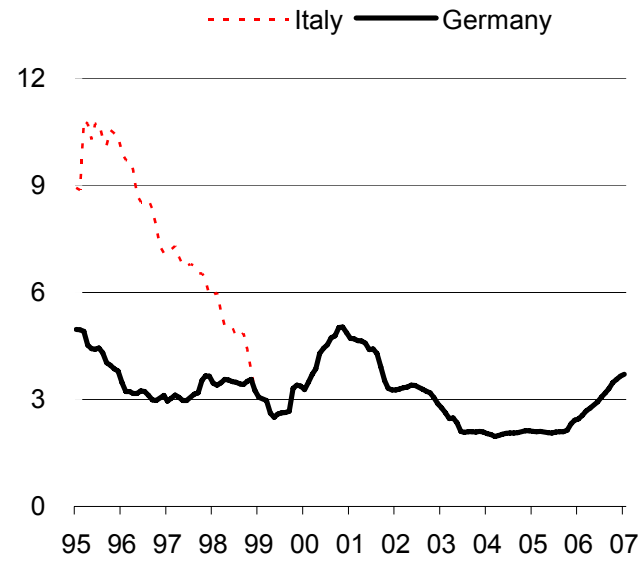
Notes : y o y % ch.

Figure 2 - Consumer prices



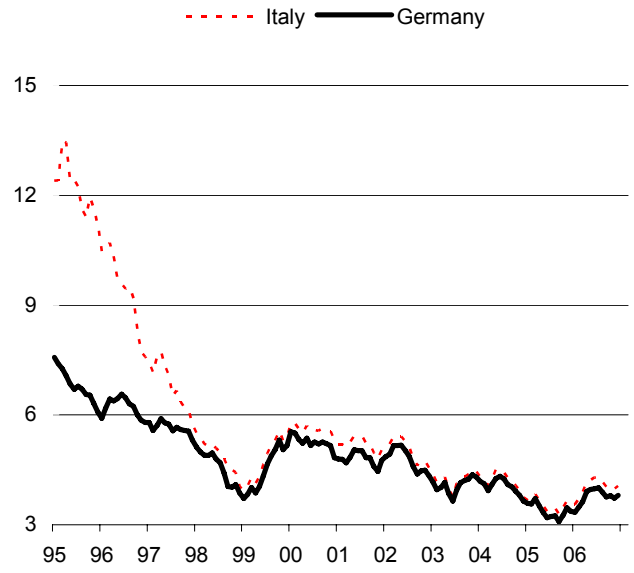
Notes : y o y % ch. - 3 years moving average

Figure 3 - Short term interest rates



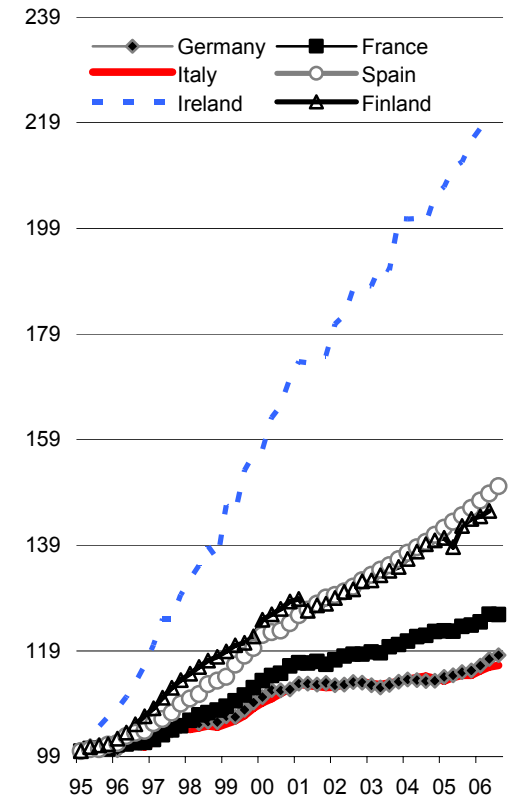
Notes : Three months eurocurrencies;Euribor from January 1999

Figure 4 - Long term interest rates



Notes : Benchmark bonds 10 years

Figure 5 - Gross domestic Product



Notes : Constant prices; Index I Q '95 = 100

Figure 6 - Germany's inflation rate as the "anchor" for the other member States

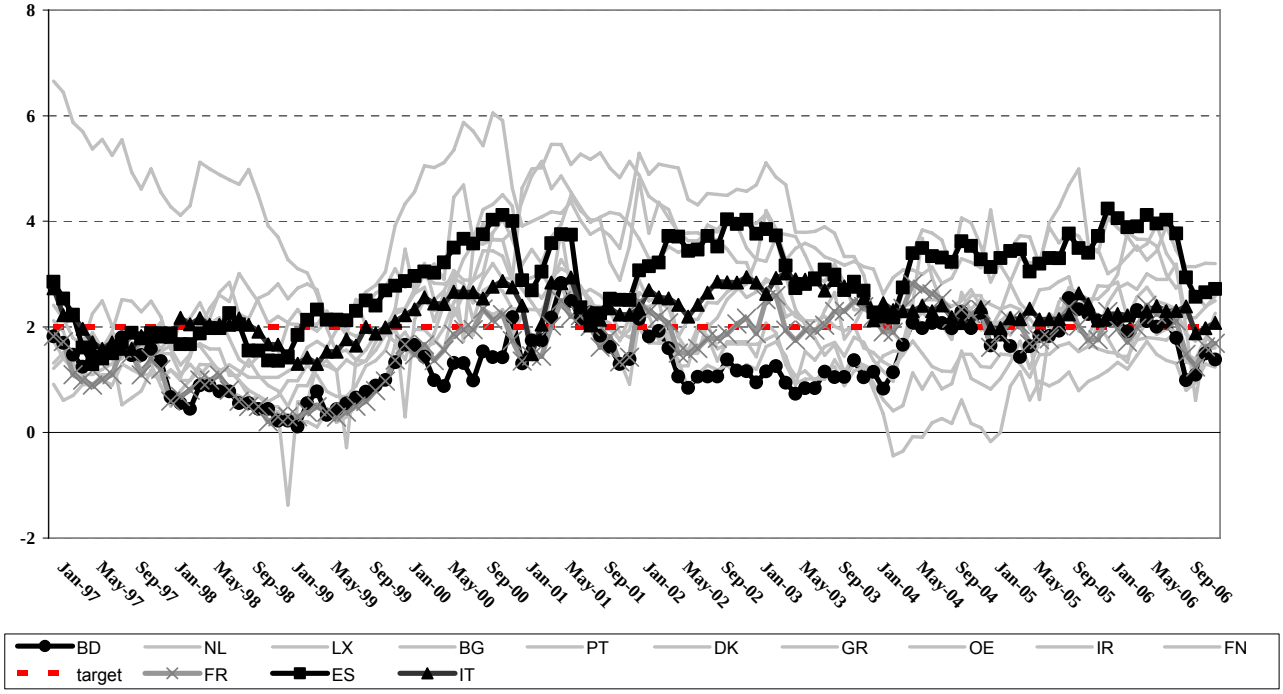


Figure 7 - Comparison between the 1-month euribor rates and the rates fitted from the estimated pre-EMU Buba forward-looking rules

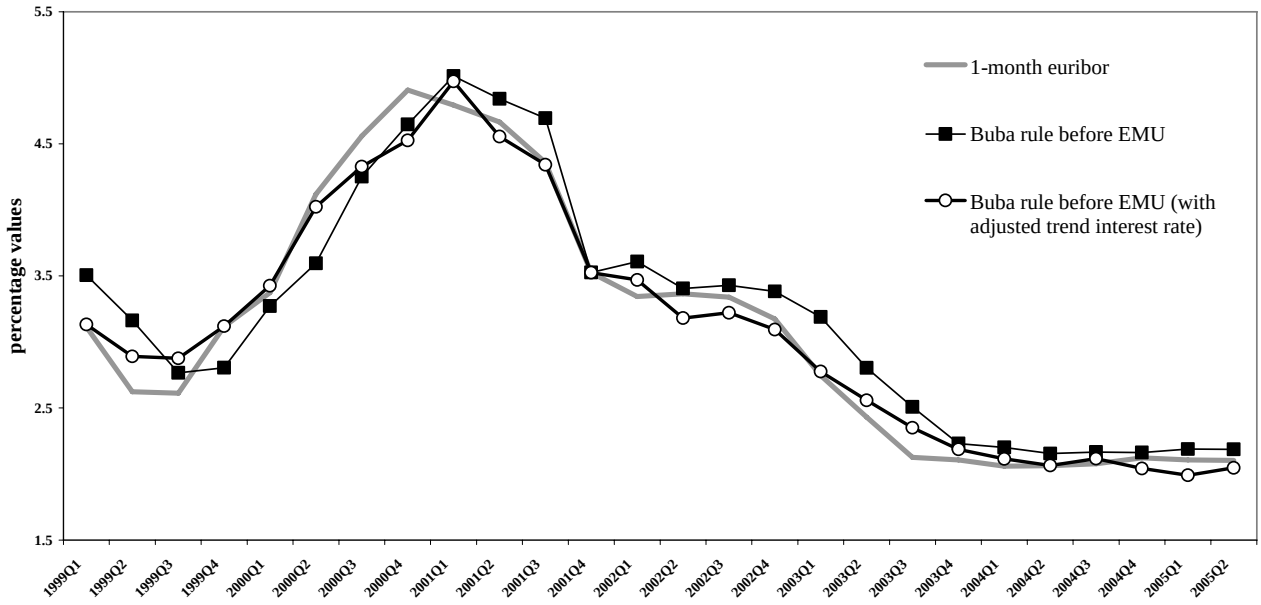


Figure 8 - Comparison between the 1-month euribor rates and the rates fitted from the estimated post-EMU Buba and ECB forward-looking rules

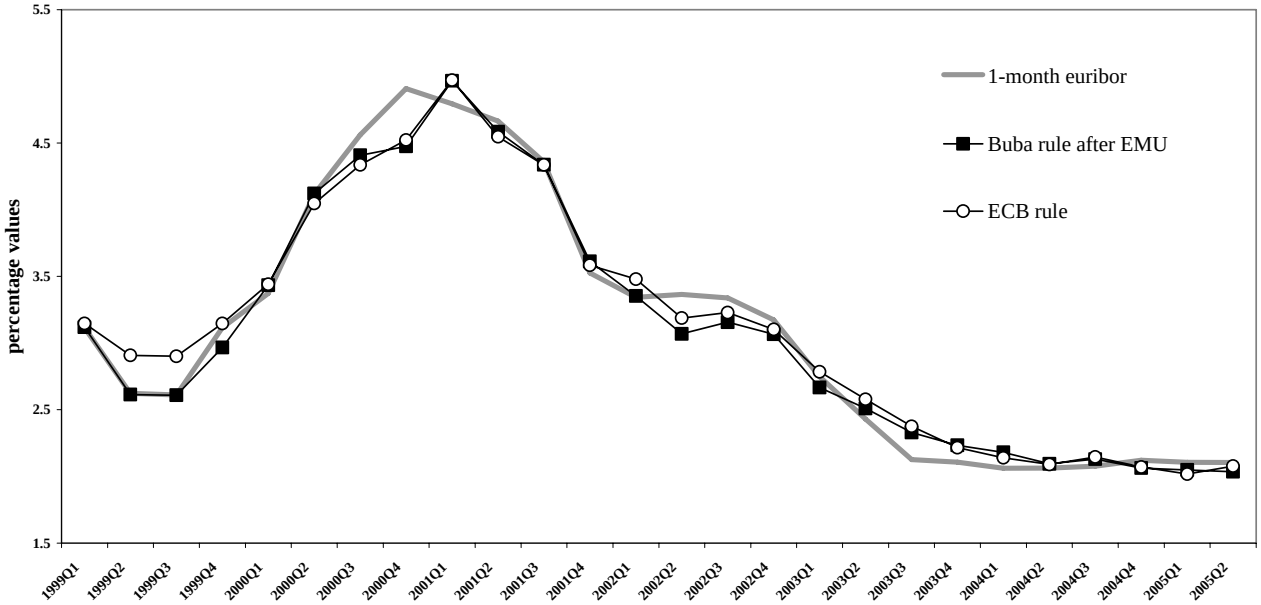


Figure 9 - Comparison between the 1-month euribor rates and the target rates fitted from the estimated post-EMU Buba and ECB forward-looking rules

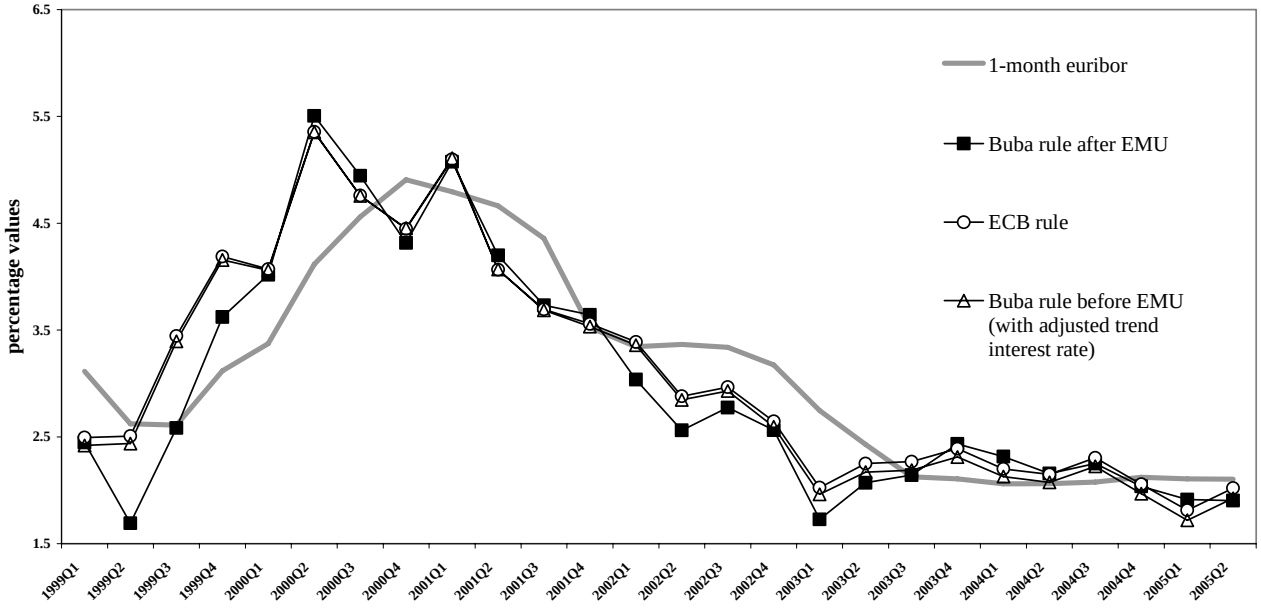


Table 1 - Estimation of the Bundesbank interest rate rule

	Forward-looking rule	*Forward-looking rule*	*Forward-looking rule with adjusted trend interest rate*	*Forward-looking rule*	*Backward-looking rule*	*Speed limit rule*
	1990Q1-1998Q4	1999Q1-2005Q2	1999Q1-2005Q2	1999Q1-2005Q2	1999Q1-2006Q2	1999Q1-2006Q2
	(1a)	(1b)	(1c)	(2)	(3)	(4)
ρ	0.87	0.94	0.67	0.65	1.02	1.00
	(23.88)	(17.21)	(22.54)	(19.46)	(8.12)	
Φ	4.26	4.26	2.82	3.36	3.35	0.12
	(8.51)		(23.69)	(54.64)	(33.33)	(1.69)
Φ_π	1.22	1.22	1.22	0.94	0.24	0.21
	(6.76)			(5.50)	(2.12)	(2.19)
Φ_y	0.81	0.81	0.81	0.74	0.59	0.35
	(2.29)			(19.02)	(11.32)	(4.09)
μ					-0.41	
					(-4.30)	
R^2	*0.99*	*0.92*	*0.98*	*0.98*	*0.98*	*0.95*
J-statistic	*0.94*			*0.88*		

Notes : Robust T-statistic in parantheses. A dummy variable for 2001-Q4 was introduced in the specifications reported in columns (1b)-(4). Columns (1a) and (2) are based on GMM estimation, while columns (1b),(1c),(3) and (4) are based on OLS estimation.

Table 2 - Estimation of the ECB interest rate rule

	Forward-looking rule	*Backward-looking rule*	*Speed limit rule*
	1999Q1-2005Q2	1999Q1-2006Q2	1999Q1-2006Q2
	(1)	(2)	(3)
ρ	0.66	1.02	1.00
	(20.28)	(9.68)	
Φ	2.87	3.15	-0.07
	(24.83)	(35.26)	(-1.48)
Φ_π	1.23	0.44	0.44
	(3.29)	(2.12)	(2.65)
Φ_y	0.79	0.67	0.57
	(21.06)	(9.28)	(5.91)
μ		-0.40	
		(-4.71)	
R^2	*0.97*	*0.98*	*0.96*
J-statistic	*0.83*		

Notes: Robust T-statistic in parantheses. A dummy variable for 2001-Q4 was introduced in the specifications reported in columns (1)-(3). Column (1) is based on GMM estimation, while columns (2) and (3) are based on OLS estimation.

Table 3 - In-sample predictive accuracy for fitted interest rates and fitted target rates

	Fitted interest rates		*Fitted target rates*	
	RMSE	MAE	RMSE	MAE
ECB rule	0.15	0.12	0.51	0.40
ECB rule backward-looking	0.13	0.10	0.32	0.25
ECB speed limit rule	0.20	0.17		
Buba rule before EMU	0.27	0.22	1.49	1.39
Buba rule before EMU with adjusted trend interest rate	0.15	0.11	0.52	0.41
Buba rule after EMU	0.14	0.10	0.55	0.45
Buba rule after EMU backward-looking	0.13	0.10	0.32	0.26
Buba speed limit rule after EMU	0.22	0.16		

Notes: The figures for the root mean squared error (RMSE) and the mean absolute error (MAE) are referred to the 1999Q1 - 2005Q2 period.