Comparing Monetary Policy Reaction Functions: ECB versus Bundesbank

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Abstract

We estimate monetary policy reaction functions for the Bundesbank (1979:4-1998:12) and the European Central Bank (1999:1-2003:7). The Bundesbank regime can be characterised, both before and after German reunification, by an inflation weight of 1.2 and an output weight of 0.4. The estimates for the ECB are 1.2, and 1, respectively. Thus, the ECB, while reacting similarly to expected inflation, puts significantly more weight on stabilising the business cycle than the Bundesbank did.

JEL: E5
Keywords: Taylor rule, monetary policy, ECB, Bundesbank

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Thanks to Efrem Castelnuovo, Jürgen von Hagen, Dieter Nautz, and Paolo Surico for helpful comments. The usual disclaimer applies.

I. Introduction

In January 1999, the European Central Bank (ECB) took over control of monetary policy in Europe from the German Bundesbank, the de-facto leading monetary authority in the European Monetary System. In the Maastricht Treaty, the ECB was explicitly designed after the German Bundesbank, with institutional independence and the overriding objective of price stability as the outstanding design features. The Bundesbank had the best track record among European central banks in achieving low and stable inflation rates. Transferring the Bundesbank's anti-inflation reputation to the ECB by using a similar institutional framework was regarded as a way to ensure price stability in the euro area. However, after five years of operation, the evaluation of the ECB's inflation record by external observers has not been unanimously positive. For instance, Gali et al. (2004) show that under Wim Duisenberg's term of office the annual rate of change in the euro area harmonised index of consumer prices (HICP) has been more often above the 2% upper bound of the ECB's inflation objective than below. They conclude that the ECB has not managed to meet its inflation objective and that euro area headline inflation "appears to be adrift due to inattentive policy."

The first years of EMU were also accompanied by a pronounced weakness in economic activity in the euro area as a whole and in Germany in particular. In the last three years, real GDP growth was around 1% in the euro area, compared to a mere 0.2 % in Germany. At the same time, consumer price inflation averaged 2.2 % in the euro area and 1.4 % in Germany. Since all countries face the same short-term nominal interest rate set by the ECB, this implies that despite its weaker growth performance Germany experienced higher real interest rates than the euro area average. This observation leads some observers to argue that the ECB's monetary policy has been inadequate for the needs of the German economy and does in fact contribute to the German economic crisis by delivering interest rates which are too high for Germany under the current circumstances.

Whether the ECB's monetary policy did not respond rigorously enough to rising inflation in the euro are and whether it contributed through high real interest rates to the German economic malaise are questions of great economic and political importance. In the present study, we provide an empirical assessment of these questions. We estimate and compare the monetary policy reaction of the ECB and the Bundesbank. First, by estimating the interest rate reactions of the ECB and the Bundesbank to the expected inflation rate, we address the question of whether the former responded forcefully enough to a violation of its prime objective of keeping price stability in the euro area. Second, based on the estimated reaction functions we compute target interest rates that are employed to simulate which interest rates the Bundesbank would have set if it were still determining monetary policy in Germany. This analysis provides an answer to the question of whether the ECB is responsible for the present state of the German economy.

The plan of the paper is as follows. Section 2 discusses the empirical set up, the econometric methodology, and the data base. Section 3 presents the empirical results and discusses the economic implications of the empirical findings. In section 4 we compare interest rate setting under the ECB and the Bundesbank regime. Section 5 concludes.

2. Empirical Set up, Econometric Methodology and Data Base

In recent years, virtually all central banks in the industrialised countries have conducted monetary policy through market-orientated instruments designed to influence short-term interest rates (Borio 1997). Since the seminal contribution of Taylor (1993), it has become common to describe interest rate setting in terms of a monetary policy reaction function, where the short-term nominal interest rate, representing the central bank's monetary policy instrument, responds to deviations of inflation and output from their targets. There are now quite a number of studies which estimate such a reaction function for the euro area (Gerlach and Schnabel 2000, Mihov 2001, Doménech et al. 2002, Clausen and Hayo 2004, Gerdesmeier and Roffia 2003). All of these studies utilise synthetic aggregate data on macroeconomic variables and span a sample period going back at least to the mid-1980s. There is not much evidence that the national aggregate demand and supply functions in the euro area member countries did exhibit a pronounced structural break as a result of forming EMU (Mihov 2001, Clausen and Hayo 2004). This does not imply, however, that averaging the behaviour of national central banks in the past gives a good account of how interest rates under the new monetary regime react to output and inflation. Before EMU, monetary policy was effectively conducted by the Deutsche Bundesbank and the ECB is, after all, a new institution with new rules and responsibilities.

Now that almost five years have passed since the start of EMU, enough observations have become available to perform a first assessment of the ECB's conduct of monetary policy using an empirically estimated Taylor rule. In order to address the two questions raised above we estimate Taylor rules for the ECB and the Bundesbank. For Germany, we use monthly data from the formation of the EMS onwards (1979:4 – 1998:12), explicitly taking into account the period after German unification (1990:8 – 1998:12). For the ECB, data from 1999:1 to 2003:7 is employed. Based on the estimated Taylor rules it is tested whether the ECB differs from the Bundesbank with respect to interest rate setting. In particular, we assess whether the ECB's monetary policy reaction was sufficient to stabilise the inflation rate. Employing counter-factual out-of sample simulations, we compare the interest rate path the Bundesbank would have delivered if it were still in control of German monetary policy with the one actually delivered by the ECB. This allows to answer the second question, namely whether nominal interest rates in Germany would have been lower under a continuation of the Bundesbank regime.

In the estimations of the Taylor rules, we follow Clarida et al. (1998).[1] Short-term nominal interest rates are modelled as a function of deviations of output from its trend and of inflation from its (constant) target. We assume that the central banks are forward looking and react to the expected one-year ahead inflation rate and the current output gap.[2] Finally, we allow for interest rate smoothing by including a lagged interest rate term in the Taylor rule specification. Recent evidence shows that the explicit modelling of a lagged interest rate term is preferable to an autoregressive errors specification (Castelnuovo 2003). Given these considerations, we estimate the following Taylor rule:

(1) $i_t = \rho\, i_{t-1} + (1-\rho)\,\alpha + (1-\rho)\,\beta\,\pi_{t+12} + (1-\rho)\,\gamma\, y_t + \varepsilon_t,$

with: i = nominal short-term interest rate, π = inflation rate, y = output gap, ρ = degree of interest rates smoothing, α = long-term equilibrium of nominal interest rate, β = inflation weight, γ = output weight, ε = error term.

A major problem when working with forward-looking and current variables is that they may be correlated with the error term, leading to biased estimates of the coefficients of interest. Therefore, these variables must be instrumented. In addition, the error term may experience non-normality, autocorrelation and heteroscedasticity, causing problems with respect to statistical inference. It is now common to use the General Method of Moments (GMM) estimator, as it accounts for endogeneity biases as well as non-spherical errors. The GMM estimator possesses excellent asymptotic properties, but may perform poorly in small samples (see the special issue of the *Journal of Economics and Business Statistics* 1996).

Traditional instrumental variable methods are also problematic in the case of finite samples (Nelson and Startz 1990); they are special cases of the GMM estimator (Hayashi

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[1] The utilised data are: Interest rate: Day-to-day rate, Output: Industrial production, Inflation: CPI growth rate. Data sources are IFS for Germany and the ECB web site. The output gap has been constructed using a Hodrick-Prescott filter. The typical endpoint problem of the filter is not an issue here, as both in the Bundesbank and in the EMU estimation we have at least 10 months of output gap data that do not enter the estimation process.

2000). However, since the traditional instrumental variable methods are more efficient, it appears likely that they outperform unrestricted GMM as long as their assumptions are fulfilled. In small samples like the present ones, efficiency is of particular importance, and it appears to be advisable to rely on a traditional instrumental variable estimator whenever possible.

Another general estimation problem is the choice of instruments. In time-series econometrics, it is easy to find instruments that fulfil the orthogonality conditions between regressors and error term. Typically, this assumption is tested using a test of the validity of over-identifying restrictions when there are more instruments than estimated coefficients (Davidson and McKinnon 1993). [3] Recent research shows that the use of weak instruments, i.e. instruments that do not contribute much to explaining the instrumented variable, can lead to substantial biases in both estimators and test statistics even in large samples (Hahn and Hausman 2003, Stock et al. 2002). Stock and Yogo (2003) propose a test of weak instruments based on the F-test value of the first stage regression in a two-stage least squares procedure. This test does not, however, solve the question of how to choose *specific* instruments, for example, which lags of a variable.

We address the instrument selection problem in a novel way by applying a recently developed automatic model selection algorithm called GETS (see Hendry and Krolzig 1999). GETS starts from a general model and removes redundant instruments. While doing so, it searches all possible paths of the testing-down process and reports the most parsimonious model that does not violate a reduction test. Thus, the strongest instruments will be selected from a given choice of variables and their lags. This does not remove all arbitrariness, as, for instance, the researcher still needs to choose the potential instrumental variables and their maximum lag length, but it appears to be superior to the ad hoc methods typically employed in empirical research.

3. Empirical Estimation of ECB and Bundesbank Monetary Reaction Functions

Starting with the *Bundesbank*, instruments are being selected using the GETS reduction algorithm at a nominal 5% significance level based on a general model containing six lags of the potential instruments interest rate, inflation rate, growth rate of the effective real exchange rate, output gap, growth rate of the oil price index in DM, and monthly growth rate of the

[2] Note that the output gap of the current period is not exactly known at the time of monetary policy decision making.

[3] It should be noted that the test of over-identifying restrictions in fact tests the joint hypotheses that the instruments are orthogonal to the error term *and* the estimated model is correctly specified.

money aggregate M3.[4] The Stock and Yogo (2003) test shows no indication of problems with regard to biases in the estimators. It is possible to reject the null hypothesis that the nominally sized test statistics at 5% significance level exceed an actual level of 15%. In contrast, there is evidence that the Clarida et al (1998) specification suffers from problems with weak instruments.[5] Employing these instruments in traditional instrumental variable estimation leads to residuals that exhibit severe problems of non-normality, autocorrelation and heteroscedasticity. Since at least the non-normality problems are not easily corrected, we choose GMM as the appropriate estimation technique.

An important event in recent German history is reunification, with German Monetary Union (GMU) taking place on 1 July 1990. We split our sample at that date to see whether it has a noticeable impact on the German reaction function (see Table 1).[6] The fit of all equations is high but the explanatory power is primarily due to the lagged interest rate variable, and thus does not provide much evidence regarding the adequacy of the estimated Taylor rules. A comparison of the two columns referring to the Bundesbank shows that the estimates are similar. The lagged interest rate has exactly the same coefficient and the inflation coefficients are very close. Some differences occur for the output gap coefficients, which are not statistically significant when taking into account the estimation uncertainty surrounding both coefficients ($F(1, 231) = 1.89$).

Comparing these value to the ones Clarida et al. (1998) obtained for the period 1979:4 to 1993:12 shows only slight differences ($\beta = 1.31$, $\gamma = 0.25$). However, estimating the Clarida et al. baseline model for the post-GMU period gives a coefficient of 0.74 for the inflation weight and 0.48 for the output gap. The drop of the coefficient on inflation below unity may be one indication of the weak instrument problem in their specification. As round summary values for the Bundesbank covering both periods, we propose a weight on inflation of 1.2 and an output weight of 0.4. These restrictions cannot be rejected using either pre- or post German Monetary Union data.[7]

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[4] The resulting instrument set is: interest rate (lags: 1, 2, 3), inflation (lag: 6), growth rate of the effective real exchange rate (lags: 1, 4), output gap (lags: 1, 2, 3, 6), the growth rate of the oil price index in DM (lags: 1, 6), and the monthly growth rate of the money aggregate M3 (lag: 2).

[5] In their basic specification, Clarida et al. (1998) use 48 instruments (p. 1045, Table 1). In the first-stage regression for the inflation rate the Stock and Yogo-test can barely reject the hypothesis of a bias of 10% of the OLS bias and cannot reject the Null that the nominally sized test statistics of a 5% level does not exceed a level of 15%.

[6] One could estimate a Taylor rule from 1979:4 to 2003:7 using German data and then test for a break in 1999:1. This would not take into account, however, that the ECB uses aggregate European variables in its rule.

Table 1: Estimates of reaction functions for the Bundesbank and the ECB

Variables	Bundesbank 79:4-90:6	Bundesbank 90:8-98:12	ECB 99:1-02:7
Interest rate$_{t-1}$ (ρ)	0.92**	0.92**	0.86**
	(0.018)	(0.015)	(0.033)
Inflation$_{t+12}$ (β)	1.21**	1.25**	1.12*
	(0.244)	(0.162)	(0.505)
Output gap$_t$ (γ)	0.43**	0.32**	1.03**
	(0.137)	(0.045)	(0.194)
Constant (α)	3.64**	2.56**	1.38
	(0.670)	(0.353)	(1.132)
No. of observations	135	101	43
σ	0.372	0.154	0.157
R^2	0.976	0.996	0.966
Over-identifying restrictions test	$Chi^2(13) = 8.53$	$Chi^2(13) = 8.25$	$Chi^2(25) = 31.2$

Notes: * (**) indicates significance at a 5% (1%) level. Bundesbank estimates based on GMM. ECB estimates based on a traditional instrumental variable method. Standard errors for coefficient estimates are computed using the procedure by Newey and West (1987). The R^2 is based on the short-run dynamic model. Diagnostic tests for the instrumental variable estimation of the ECB reaction function: Jarque-Bera normality test: $Chi^2(2) = 0.65$, LM autocorrelation test: $Chi^2(2) = 2.35$, ARCH test: $Chi^2(1) = 0.68$, White-heteroscedasticity test with cross-products: $Chi^2(9) = 20.3$**, RESET(1) test: F(1, 37) = 1.11.

For the *ECB reaction function*, the data are from January 1999 to July 2003.[8] Again we select instruments based on the GETS algorithm, starting with six lags of the interest rate, the inflation rate, the growth rate of the effective real exchange rate, the output gap, the growth rate of the oil price index in euro, and the monthly growth rate of the money aggregate M3MA.[9] Applying the Stock and Yogo (2003) test, we can reject the hypotheses that the biases in the estimators are larger than 10% and that the nominally sized test statistics at 5% exceed an actual level of 25%. This time we find there are few problems with employing traditional instrumental variable techniques.[10] In the notes below Table 1, a battery of diagnostic tests are listed that show no violation of model assumptions except for evidence of

[7] Test results for the pre-GMU period: inflation coefficient against 1.2: F(1, 131) = 0.002, output coefficient against 0.4: F(1, 131) = 0.05, and joint: F(2, 131) = 0.03. Post-GMU period: inflation coefficient against 1.2: F(1, 97) = 0.09, output coefficient against 0.4: F(1, 97) = 2.88, and joint: F(2, 97) = 2.42.

[8] Given that we employ a one-year ahead inflation rate, the actual estimation period ends in July 2002.

[9] The resulting instrument set is: interest rate (lags: 1,2,4,6), inflation (lag: 1,3,5), growth rate of the effective real exchange rate (lags: 1,2,3,4,6), output gap (lags: 1,2,3,4,5,6), the growth rate of the oil price index in EUR (lags: 1,2,3,4,5), and the monthly growth rate of the money aggregate M3MA (lag: 2,3,4).

[10] There is an outlier in September 2001, the time of the terrorist attack on New York, which we include in the list of instruments. Including the dummy in the reaction function itself leaves the other estimators almost unchanged.

heteroscedasticity. To avoid invalid inference, we employ, as in our estimates for Germany, robust standard errors.[11]

Regarding the actual estimates, we first consider the inflation coefficient. A general finding of the theoretical literature on policy rules (e.g. Clarida et al. 2000) is that stabilising inflation around its target level requires that real interest rates rise in response to a rise in expected inflation. In other words, the inflation coefficient in the Taylor rule must be larger than unity. The point estimate of the inflation coefficient in the ECB Taylor rule is 1.12 and therefore above one. However, statistically we can not reject the hypothesis that it is equal to one ($F(1,39) = 0.03$). Moreover, the inflation coefficient in the ECB Taylor rule is also not significantly different from the inflation coefficient in the Bundesbank Taylor rule. Thus, the evidence neither supports the view that the ECB responds sufficiently aggressive to expected inflation in order to stabilise the inflation rate around its target value, nor that it places less emphasis on price stability than the Bundesbank did.

On the other hand, the output weight estimated for the ECB is more than twice as large as the one found for the Bundesbank. Testing the ECB coefficient against 0.4 leads to a rejection of the hypothesis of equal size ($F(1,39) = 10.5^{**}$).[12] This test does not take into account that there is uncertainty in the estimation of the German coefficient. Taking this uncertainty into account still leads to the conclusion that the ECB output coefficient is significantly larger than the one for the Bundesbank.[13] Does this finding imply that the ECB gives a relatively higher weight to output stabilisation than the Bundesbank did? In order to address this question, we need to know how the reaction coefficients depend on the preference parameters of the central bank and on the structural parameters of the economy.[14] Favero and Rovelli (2001) and Castelnuovo and Surico (2003) identify the preference parameters of the US Federal Reserve Bank by estimating jointly a small structural model of the US economy and a Taylor rule using quarterly data. Prior to the empirical estimation, they determine the functional form of the Talyor rule by calculating the optimal rule based on the estimated dynamic structure of the economy. By using the model-specific optimal Taylor rule, they impose restrictions on the

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[11] Normal standard errors are: ρ (0.038), β (0.730), γ (0.232), and α (1.62).

[12] Eliminating the constant from the ECB equation raises the coefficient on inflation to 1.7 and makes it significant at a 1% level, while the output gap coefficient remains basically unchanged. However, from the point of view of both economic theory and history, it is implausible to have a zero long-run nominal interest rate.

[13] Testing the ECB output coefficient against the pre-GMU coefficient leads to a t-test value of 2.53. This is significant at the 5% level when performing a two-sided test and significant at a 1% level for a one-sided test. Against the post-GMU coefficient the value of the t-test is 3.57, which is significant at a 1% level.

[14] The coefficients in the Taylor rule depend upon policy preferences, economic structure, and shocks. In general it is impossible to identify the policy preferences from the estimated parameters of the reaction function. Cecchetti and Ehrmann (1999) discuss how to recover policy preferences from Taylor rule estimates under very restrictive assumptions.

Taylor rule which enables them, using the estimated structural parameters of the economy and the reaction coefficients, to derive the preference parameters of the central bank.

Instead of considering an optimising Taylor rule in connection with a structural model, we have estimated a standard, but ad hoc formulation of the monetary policy reaction function.[15] As this ad hoc formulation does not represent the optimal Taylor rule for an identified structural model of the economy, it may appear that we are not able to address the question of whether the variations in our estimated reaction functions are due to differences in the preferences of the two central banks. However, it turns out that the specific formulation of our monetary policy reaction function represents the optimal specification of the Taylor rule for a fairly standard and commonly used small structural model of the economy proposed by Svensson (1997). The economy is described by two equations, an aggregate supply and an aggregate demand function:

(2) $\pi_{t+1} = \pi_t + \alpha_1 y_t + \varepsilon_{t+1}$

(3) $y_{t+1} = \beta_1 y_t - \beta_2 (i_t - \pi_{t+1|t}) + \eta_{t+1}$,

where $\pi_{t+1|t}$ denotes the expectation of π_{t+1} in period t. The dynamic structure of the model applies to annual data (Svensson, 1997). The intertemporal loss function of the central bank is given by

(4) $L = E_t \sum_{\tau=t}^{\infty} \delta^{\tau-t} \frac{1}{2}\left[(\pi_t - \pi^*)^2 + \lambda y_t^2\right]$,

where δ is the central banks' discount factor, π^* is its inflation target and λ is the relativ weight the central bank puts on output stabilisation. The central banks minimises its loss function by optimally adjusting its monetary policy instrument, the short-term nominal interest rate. The resulting optimal Taylor rule is given by[16]

[15] While in principle it would be possible to follow the approach by Favero and Rovelli (2001) and Castelnuovo and Surico (2003) by estimating a structural model of the euro area economy and a Taylor rule corresponding to the estimated structural model, the ECB regime is still too young to estimate these equations with quarterly data. Such an exercise would only be feasible by extending the sample size through the use of synthetic euro area data. However, drawing inferences about the ECB's preferences based on pre-EMU observations, a period where monetary policy in Europe was heavily influenced by the Bundesbank, will not yield the desired result.

$$(5)\quad \begin{aligned} i_t &= \pi_{t+1|t} + \frac{1}{\beta_2}\left[1 - \frac{\delta\alpha_1^2 k}{\lambda + \delta\alpha_1^2 k}\right](\pi_{t+1|t} - \pi^*) + \frac{\alpha_1\beta_1}{\beta_2} y_t, \\ k &= \frac{1}{2}\left(1 - \frac{\lambda(1-\delta)}{\delta\alpha_1^2} + \sqrt{\left(1 + \frac{\lambda(1-\delta)}{\delta\alpha_1^2}\right)^2 + \frac{4\lambda}{\alpha_1^2}}\right) \end{aligned}$$

Equation (5) suggests that the optimal Taylor rule for the simple structural model proposed by Svensson (1997) has the same functional form as the ad hoc Taylor rule specification usually utilised in the empirical literature. As we cannot rule out a situation of observational equivalence, this does not mean that the ad hoc Taylor rule directly implies a structural model of this form. It shows, however, that the ad hoc specification of the Taylor rule is based on the same assumption about the time lags of monetary transmission as the Svensson model. Moreover, equation (5) implies that the output gap coefficient solely depends on the structural parameters of the economy and not on the preference parameters of the central bank. The relative weight of the output gap in the central banks loss function only affects the inflation coefficient. The bigger the weight on the output gap, the less aggressive the central bank responds to an increase in expected inflation. Thus, the ECB's significantly stronger response to output deviations compared to the Bundesbank's may be a reflection of the dissimilarities between the euro area economy and the German economy.

Within the given framework, the following differences can explain the ECB's relative output orientation. First, the inflation rate in the euro area reacts more sensitively to deviations from trend output. Second, the persistence of the output gap series has increased under EMU. Third, the euro area reacts less strongly to real interest rate changes than the German economy. Let us consider these possibilities in turn. Due to the smoothing effect of aggregating heterogenous entities, it is unlikely that the HICP in the euro area reacts more strongly to changes in the output gap than the German index of consumer prices. If at all, the effect should go into the other direction. The aggregation effect would explain, however, an increase in the persistence of the output gap series. Finally, the available empirical evidence indicates that German output reacts rather more strongly to monetary policy changes than the euro area average (Clausen and Hayo 2002, Peersman 2002). To summarise, within the framework of the Svensson model, we can interpret the significant differences in output gap coefficients between the ECB and the Bundesbank monetary policy reaction functions. They

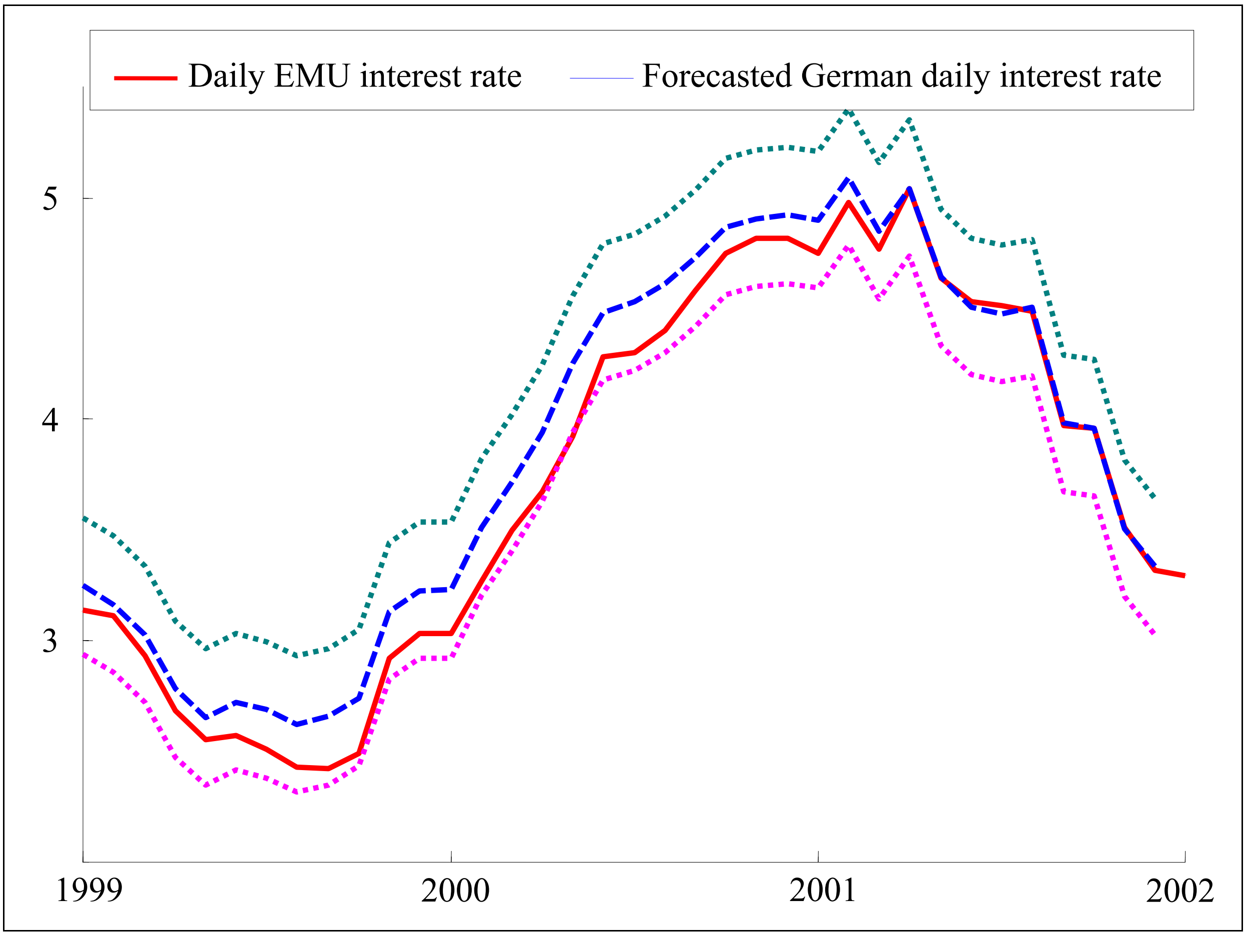
[16] A detailed derivation of the equation can be found in Svensson (1997).

appear to originate from a higher interest rate elasticity of the German economy and a more persisting output gap series at the European level.

4. Comparing Counterfactual Interest Rate Paths

This section relates to the other question posed above, namely would interest rates in Germany have been lower if the Bundesbank regime were still in place. As a first step, we compare the path of actual nominal interest rates in the euro zone with simulated rates for Germany by combining the estimated dynamic monetary policy reaction function based on equation (1) with German data (see Figure 1):

Figure 1: Comparing predicted German interest rates based on the Bundesbank Taylor-rule with actual interest rates in the Euro Area (in %)

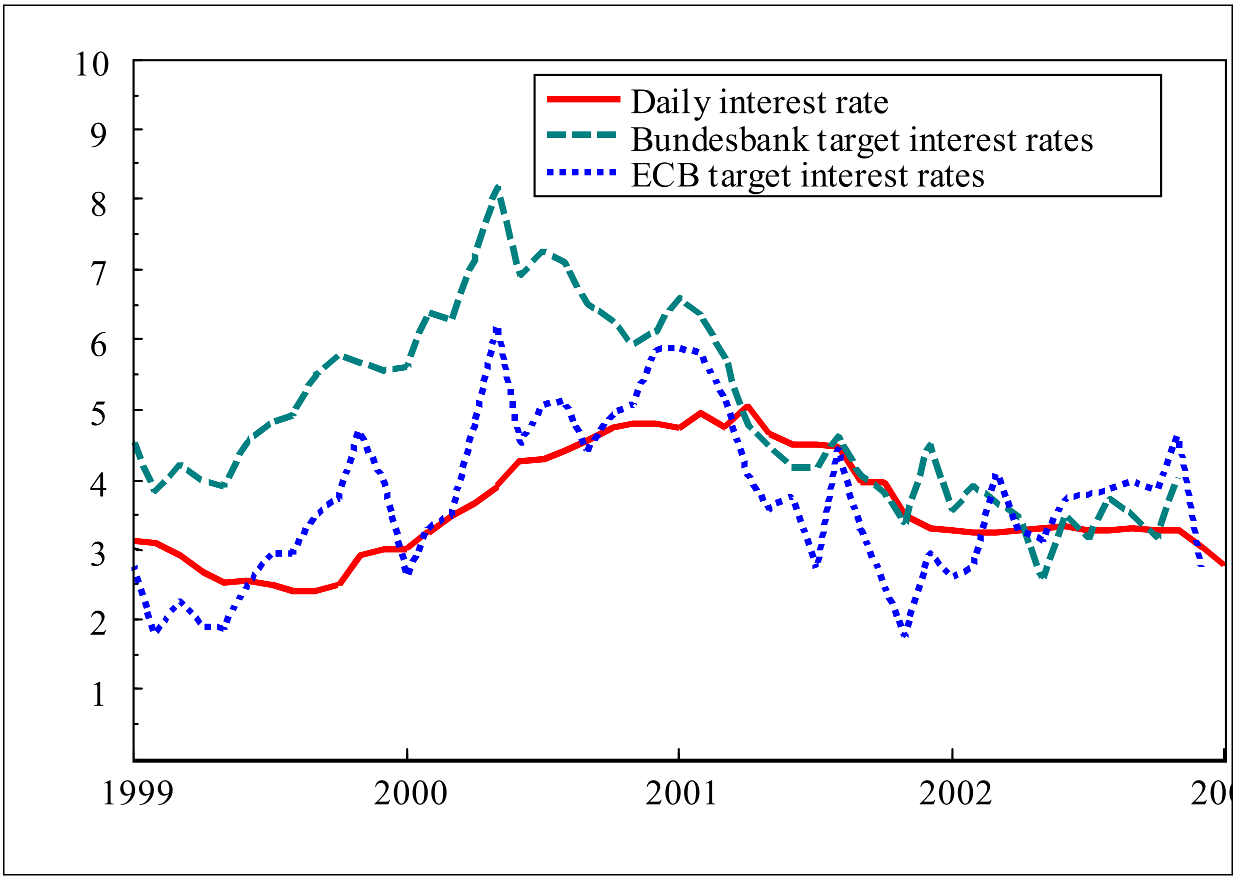


Notes: The dotted lines are confidence bands based on +/- 2 standard errors of the estimated dynamic reaction function for the Bundesbank over the period 1990:8-1998:12.

The actual interest rates tend to be below the simulated Bundesbank series. The dotted lines around the two series are 95% confidence band and for the most part of the sample, the actual values lie well within these bands. Thus, statistically, these two interest rate series are almost indistinguishable. The only exception occurs in Summer 2000, when the interest rates set by the ECB appear to be almost significantly lower than the ones we forecast for the counter-factual Bundesbank regime. It is noteworthy that from 2001 onwards, both series are virtually identical. Hence, we find evidence, if at all, that interest rates were lower in Germany under the ECB regime than they would have been under a continuation of the former Bundesbank regime.

The comparison of the dynamic reaction functions suffers from the problem that the lagged interest rate term drives a lot of the development. Given our estimates of Taylor rules in Table 1, we can compute target interest rates for the two central banks by plugging actual variables into these long-run reaction functions. To further address our question of interest, we compare the ECB target interest rates for the euro area with target rates for the Bundesbank based on German inflation and output gap values. Figure 2 plots these target rates over the period 1999 to 2002, adding the monthly average of the euro area day-to-day interest rate as an indicator of actual monetary policy conditions.

Figure 2: Comparing target interest rates for Germany under a national-oriented Bundesbank and a European-oriented ECB regime (in %)



Notes: The *ECB* target rates are based on inflation (t+12) and output gap (t) for the euro area. Weights: Expected inflation rate 1.12, output gap 1.03, constant: 1.38. The *Bundesbank* target rates are based on inflation (t+12) and output gap (t) for *Germany*. Weights: Expected inflation rate 1.25, output gap 0.32, constant: 2.56.

Starting in 1999, it is apparent that in our simulation the Bundesbank would have adopted an approximately one percentage point higher interest rate. This relatively less expansive stance would have been maintained until end of 2000. During the course of 2001, the Bundesbank target rates are only slightly above the ones for the ECB. Interestingly, they are closer to the actual interest rates than the ECB target rates. In 2002, we can observe that the Bundesbank target rates are now somewhat lower than the ECB target rates, and again very close to actual interest rates. However, at the end of 2002 the ECB target rates are moving below the ones for the Bundesbank. To summarise, Germany would have seen higher interest rates in 1999 and 2000, similar rates in 2001, and perhaps slightly lower rates in 2002.

Combining the results from our counter-factual analyses of short-run and long-run monetary policy reaction functions, it is difficult to argue that Germany would have seen a stronger monetary stimulus in a situation where the Bundesbank continued to be responsible for monetary policy. It should be noted, though, that this analysis does not imply that either the ECB policy or the simulated Bundesbank policy were optimal.

5. Conclusions

This study compares monetary policy reaction functions for the Bundesbank and the ECB by estimating Taylor rules for both the Bundesbank (1979:4 – 1998:12) and the European Central Bank (1999:1 – 2003:7) following the forward-looking specification suggested by Clarida et al. (1998). Particular care is spent on the selection of instruments and adequate estimation techniques. In particular, we put forward a novel way of instrument choice, combining the test for weak instruments suggested by Stock and Yogo (2003) with the model-selection algorithm GETS developed by Hendry and Krolzig (1999).

Concerning the first issue, we find that the Bundesbank reaction function can be characterised by an inflation weight of 1.2 and an output gap weight of 0.4 before and after German reunification. For the ECB we obtain a similar estimate of the inflation rate, and a unit coefficient on the output response, which is significantly higher than the corresponding coefficient for the Bundesbank. Thus, while the ECB reacts similarly to the Bundesbank when it comes to inflation deviations, it shows a much stronger response to output deviations. In general, especially given the similar institutional design, a stronger response of the ECB to the output gap may reflect different preferences of the ECB compared to the Bundesbank or the new economic and political environment the ECB operates in. Of course, whether these differences are temporary or permanent remains to be seen. It is noteworthy that our estimates differ from the ones put forward in the literature based on synthetic euro area data. For instance, Gerlach and Schnabel (2001) get an inflation weight of 1.51 and an output weight of 0.28, while Gerdesmeier and Roffia (2003) find an inflation weight of about 2 and an output weight of below 0.5. This may be an indication that using data on an artificial central bank is generating misleading results.

Based on our estimates, we can address two important economic policy questions: First, there are concerns that the ECB has not reacted strongly enough to deviations of the inflation rate from its target (Gali et al. 2004). Given our estimate of the ECB Taylor rule, we can answer the question of whether the response of the ECB to violations of the target inflation rate is sufficiently stabilising. While the point estimate of the inflation coefficient in the Taylor rule is above unity, this difference is not statistically significant. However, the same holds true for the Bundesbank, one of the most successful central banks in terms of fighting inflation. Based on a model by Svenson (1997), we show that the relatively stronger reaction of the ECB to deviations of output from trend can be traced back to lower interest rate sensitivity of output and a more persistent output gap series of the euro area compared to Germany.

The second policy oriented question asks whether the particularly weak economic performance of Germany after the start of EMU can be attributed to the changeover of monetary policy from the Bundesbank to the ECB. Using counter-factual scenarios, we ask whether the German economy would have experienced a different interest rate path if instead of the ECB the Bundesbank were still in charge of monetary policy in Germany. Our simulations compare the results for both short-run and long-run monetary policy reaction functions. The analysis of target interest rates suggests that under a Bundesbank regime interest rates would likely have been higher by about one percentage point in 1999 and 2000, relatively similar in 2001 and perhaps slightly lower in 2002. These results suggest that the monetary policy stance of the ECB has been rather more not less expansionary than what the Bundesbank had pursued. Thus, the ECB should not be held responsible for the sluggish performance of the German economy since the start of EMU.

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