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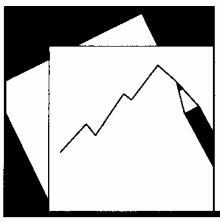

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Forecasting ECB Monetary Policy: Accuracy Is (Still) a Matter of Geography

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Forecasting ECB Monetary Policy: Accuracy Is (Still) a Matter of Geography

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Abstract

Monetary policy in the euro area is conducted within a multicountry, multicultural, and multilingual context involving multiple central banking traditions. How does this heterogeneity affect the ability of economic agents to understand and to anticipate monetary policy by the European Central Bank (ECB)? Using a database of surveys of professional ECB policy forecasters in 24 countries, we find remarkable differences in forecast accuracy, and show that they are partly related to geography and clustering around informational hubs, as well as to country-specific economic conditions and traditions of independent central banking in the past. In large part, this heterogeneity can be traced to differences in forecasting models. While some systematic differences between analysts have been transitional and are indicative of learning, others are more persistent.

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Keywords: monetary policy; ECB; forecast; geography; history; heterogeneity; Taylor rule; learning; transmission; survey data; communication

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Contents Page

I. INTRODUCTION

Monetary policy in the euro area is conducted within a multicountry, multicultural, and multilingual context. With the formation of the European Economic and Monetary Union (EMU), countries with markedly different histories of inflation, monetary policy strategies, and central banking traditions delegated the conduct of monetary policy to a single entity –the European Central Bank (ECB). Since this transition, questions that have come to the fore include the following: Have economic agents in different member countries have been able to adjust and understand equally well the European perspective of monetary policy? To what extent are expectations about monetary policy still influenced by different national and cultural backgrounds? Moreover, to what extent may differences in the ability to forecast monetary policy decisions reflect more permanent information asymmetries related to geographic proximity to the ECB and country-specific factors? While random heterogeneity in forecasts will characterize many uncertain environments, the presence of systematic heterogeneity is important from a policy perspective. Expectations are a crucial transmission channel for monetary policy, and systematic heterogeneity linked to, for instance, geographical factors can imply that monetary policy in the euro area exerts differential effects in the various EMU countries.

This paper analyzes the ability of economic agents in EMU and non-EMU countries to forecast monetary policy decisions by the ECB. In particular, we investigate the extent to which expectations are related to geographic location and distance, country-specific characteristics, and the history of central bank independence of the country in which forecasters are located. We develop a novel database of monetary policy expectations by professional financial analysts from 120 institutions in 24 countries between 1999 and 2005. The data stem from surveys conducted by Reuters and provide information on the expected ECB policy rates for upcoming Governing Council meetings, the probability distribution around analyst's point estimates, as well as their expectations about future monetary policy steps. The survey responses represent a highly accurate measure of analysts' expectations for two reasons. First, they are generally in the public domain, which implies that they must be in line with the recommendations given by the institutions to their clients. Second, as most institutions participate regularly, clients have the possibility to evaluate the forecasting performance of the various institutions.

We find that differences in forecast accuracy are substantial, as the top 10 percent of all institutions have a forecast error that is on average 8 basis points smaller than the error made by the worst 10 percent of performers. These differences are significant in economic terms, both from a financial market perspective and from a policy point of view, reaching a level of about one-third of the typical ECB policy rate change of 25 basis points during the sample period.

What explains this large heterogeneity in anticipating ECB monetary policy decisions? A first result of our empirical analysis is that *geography* matters for forecast accuracy. There is a surprising amount of cross-country variance in expectations about ECB policy rates—especially in the first years of the sample period. But the pattern of forecast accuracy exceeds the concept of nationality. Frankfurt, Germany's financial center, also hosts the ECB head-quarters and the German Bundesbank, one of the ECB's national member banks and, arguably, one of its early role models. Being close to this informational hub tends to improve forecast accuracy of analysts working for financial institutions headquartered in Frankfurt or running a subsidiary there. The importance of informational hubs is corroborated by the good

performance of analysts based in London/United Kingdom or working for institutions with a subsidiary in the City. As for forecasters working from other locations, accuracy tends to be lower with greater geographical distance to Frankfurt.

A second finding is that national *macroeconomic conditions* also tend to influence forecast accuracy, as the predictions of ECB policies become less precise if the forecaster is located in a country where inflation or unemployment rates deviate from the euro area average.

A third factor driving accuracy seems to be *history*. Analysts working for institutions reporting predominantly from countries with a history of relatively high central bank independence tend to make better forecasts of ECB behavior.

Finally, we show that the observed heterogeneity is *systematic* rather than based on differences in "gut feeling" among analysts. To extract the systematic component from observed predictions, we estimate bank-specific reaction functions. These Taylor-type rules, which tend to be different across institutions, capture a significant part of the underlying structure of the published forecast.

While some of the systematic differences between analysts have been transitional and are thus indicative of learning, other asymmetries in forecasting performance are more persistent. Although some geographical differences in forecasting ability diminish over time, other asymmetries prevail or even gain in importance. Splitting the sample into pre–2001 and post–2001 subperiods, our results show that analysts *headquartered* in Frankfurt saw their performance decline relative to the sample average. Relative forecast accuracy of financial institutions with *subsidiaries* in Frankfurt became only slightly weaker in the post–2001 period. In addition, it seems that confusion by forecasters over the importance of national relative to euro area macroeconomic conditions for ECB policy decisions was hampering their precision of predictions post–2001 more than before.

Our results are reasonably robust across performance measures. In addition to the expected level of the ECB policy rate, the data also allow looking at the expected timing of ECB policy rate adjustments. We find a broadly similar and stable pattern of forecast accuracy across countries and institutions for both types of variables. There is evidence that the factors that determine analysts' expectations of the level of the ECB's policy rate also influence their expectations on the timing of adjustments to this rate.

To our knowledge, the focus on explaining the heterogeneity in monetary policy expectations is novel. It relates to earlier literature on the differences in the transmission of the ECB's monetary policy. In the run-up to EMU, several papers asked whether a change in policy rates would affect national economies in a heterogeneous fashion, possibly due to differences in expectations (Dornbusch, Favero, and Giavezzi, 1998; Cecchetti, 2001; Mihov, 2001). However, results are contradictory across studies (Mojon and Peersman, 2003). Evidence using data obtained under EMU is scarce, for the most part because longer time samples are needed to estimate the full transmission path from interest rates to inflation. Accordingly, the few studies available analyze only elements of the transmission process (e.g., Angeloni and Ehrmann, 2003). No study has yet been conducted on the homogeneity of interest rate expectations in the euro area, and this is where the present paper attempts to contribute.

In addition, our work is broadly related to the literature on trade in goods and in financial assets, as well as the literature on home bias in the allocation of financial portfolios. For instance, there is substantial empirical evidence that information asymmetries and information frictions are fundamental in explaining trade in goods and financial assets as well as financial

investment decisions (e.g. Froot and Stein, 1991; Gordon and Bovenberg, 1996; Portes, Rey, and Oh, 2001; Dvorak, 2005). Such information asymmetries can take various forms and can be related to language, cultural ties, common legal origins, and institutions, among others.[2] As the literature on home bias and capital flows emphasizes, information is also a key factor inhibiting "optimal" investment decisions based on portfolio theory. Moreover, location decisions by financial firms point toward the importance of information-based agglomeration effects. Even though centrifugal factors in the sense of Krugman (1998) exist—for instance, the need to be close to locally dispersed customers—and advances in communication technology continue to lower transaction costs, centripetal forces seem to matter more in financial services (Tschoegl, 2000, Clark, 2002, Cook and others, 2004).

In particular, geographic proximity and common sociocultural attitudes remain key when it comes to the realization of information spillovers and economies of scale in information processing (Thrift, 1994; Grote, 2004). Faulconbridge (2003, p. 237) counts "face-to-face contact facilitated by social proximity" among the arguments why financial companies agglomerate in international financial centers. More generally, Strauss-Kahn and Vives (2005) show that firms tend to locate their headquarters preferably in close vicinity to other headquarters in the same sector of activity. Another related strand of the literature emphasizes that investors are more profitable when investing in firms that are located in geographic proximity. For instance, Coval and Moskowitz (1999, 2001) show that mutual fund managers earn significantly more on investments in firms with headquarters located geographically near to the mutual fund's offices. Bae, Stulz, and Tan (2005) provide international evidence for a significant advantage of local analysts even when controlling for the quality of information provided by firms. The present paper suggests that information asymmetries and agglomeration effects along these lines might also influence the quality of forecasting of ECB monetary policy.

Our findings have important policy implications. The results indicate that the ECB operates in an environment where economic agents have yet to converge on a common expectation-formation process when it comes to monetary policy. This heterogeneity is systematically related to differences in forecasting models, significant in size and closely related to geographic and country-specific factors. That there is only limited evidence of learning suggests the presence of persistent informational frictions and asymmetries or agglomeration effects in euro area financial markets. Given the importance of expectations for the transmission of monetary policy, continued heterogeneity along these lines might prove problematic. One implication is that there is room for policies that foster the convergence to a common expectation-formation process, for instance through careful and targeted central bank communication.

The rest of the paper is organized as follows. Sections II presents our dataset based on the Reuters survey as well as some key stylized facts based on these data. The analysis of the determinants of differences in forecasting abilities across economic agents, distinguishing between geography, country-specific economic conditions, and history, is presented in Section III. Section IV conducts bank-specific Taylor-type rule estimates in order to

[2] The influence of these factors might exceed the economic realm. For instance, Ginsburg, Weber, and Ortuño-Ortín (2005) discuss the case of lack of a common language causing political disenfranchisement among EU citizens.

distinguish between the systematic and the unsystematic components of the forecasting errors. Section V summarizes the main findings and discusses policy implications.

II. DATA AND SOME STYLIZED FACTS

The data on ECB policy expectations consist of about 4,500 observations. They comprise analysts' forecasts from 11 euro area and 13 other countries polled by Reuters prior to ECB Governing Council meetings between January 1999 and January 2005. The panel encompasses on average about 30 financial institutions per Governing Council meeting in the first years and an average of about 60 institutions toward the end of the sample. Overall, the sample covers 120 institutions. The polled financial institutions vary somewhat from meeting to meeting, but a core group—comprising most large euro area financial institutions, those operating in the City of London, and a few in the United States, Australia, and Japan—is represented for most meetings. About half the observations are from financial institutions with headquarters in euro area countries.

Before each Governing Council meeting, Reuters asked analysts to attach probabilities to different scenarios for the ECB's policy rate (the interest rate paid for the ECB's main refinancing operations facility). For instance, analysts would assign a probability that the ECB would increase or decrease the policy rate by 50 or 25 basis points. In addition, the questionnaire asked for the analysts' opinions on the probable timing of the next ECB policy change, its direction, and its size. Moreover, there were often (but not always) questions regarding the expected interest rate levels at the end of the current and following calendar year. Appendix 3 gives an example of the raw data collected by Reuters.

While the questions changed somewhat over time and not all issues were touched upon before every meeting, the data allowed us to construct three series that summarize well the expectations of institutions and analysts: the expected ECB policy rate (*expected rate*) for the meeting ahead, the policy rate with the highest probability (*most likely rate*), and the expected speed of ECB decision-making as measured by the expected number of meetings until the next change in the policy rate (*meetings-to-change*).

With a few exceptions, each set of forecasts was associated with a reporting financial institution and the specific location where the Reuters questionnaire was answered.[3] In many cases, the reporting location was the institution's headquarters. If headquarters and reporting location diverged, it was often the institution's subsidiary in Frankfurt or London that answered the questionnaire. This information was used to describe the geographic pattern of the forecasts.

To help analyze the data on forecasts and locations, we collected a real-time dataset on inflation, annual growth of industrial production, annual growth of M3, consumer confidence indicators, and the actual ECB policy rate, spanning the period 1999 to early 2005 and covering, where applicable, the euro area and its individual member countries.

What do the data tell us? In a first attempt to gauge forecasting accuracy, we compute the absolute forecasting errors for our three policy variables, that is, the absolute difference between the predicted and the ex post action of the ECB at a particular Governing Council

[3] We discard all unattributed responses, as well as those of institutions that participated less than seven times in the poll.

meeting. We find that a first stylized fact is that the ability to anticipate ECB policy decisions differs markedly across economic agents. Figure 1 shows the average absolute forecasting error by the financial institutions from the most accurate to the least accurate decile. The most accurate institutions have an average forecast error of around 2 basis points, while the least accurate ones have an average error of more than 10 basis points over the 1999-2005 period. Differences of up to 8 basis points are certainly significant in economic terms, both from a financial market perspective and from a policy point of view, reaching a level of about one-third of the typical ECB policy rate change of 25 basis points during the sample period.[4] The differences in forecasting ability are quite notable compared to the observed average forecasting error in the sample of about 6 basis points for the full sample period (see below Table 1 (a)). A second stylized fact is that the dispersion in forecast accuracy remained fairly constant (and large) over time. The difference between the best and the worst deciles is around 12 basis points in the period prior to mid-2001, and around 10 basis points in the post-2001 period.[5] This suggests that there has been little learning and only a modest reduction in information asymmetries across economic agents, though we will return to the issue of dispersion and its interpretation.

Table 1 views forecasting performance through the country lens, that is, we sort reporting institutions and their analysts based on the country in which they are headquartered. The table reports the absolute forecasting error by year and country and sample averages across various country groups and sub-periods. Also included are tests for bias and efficiency of the forecasts. Panel (a) refers to the *expected rate*, panel (b) to the *most likely rate*, and panel (c) to *meetings-to-change*.

The country perspective suggests that geography matters. Looking at average performance regarding the expected policy rate (panel (a)), analysts based in some countries did better than others: while forecasters based in companies headquartered in Germany and Portugal show significantly lower absolute errors than the euro area average, analysts in Austria, France, and Ireland show significantly higher errors. Also, as a rule, forecasters working with financial institutions located outside the euro area performed less well than euro area analysts. This pattern broadly extends to the *most likely rate* and to *meetings-to-change* (panels (b) and (c)).

Moreover, accuracy varies over time. Aggregating across countries, forecast accuracy started at fairly high overall levels in 1999, decreased sharply in 2000, stabilized in 2001, and improved again—albeit not to its starting level—in more recent years. This suggests a structural break around early 2001, when the ECB moved from a policy of interest rate hikes to lowering rates. Indeed, especially non-euro area forecasters improved their performance in the downward part of the interest rate cycle. Another interesting pattern uncovered by Table 1

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[4] Unfortunately, the Reuters poll does not provide comparable data for the United States, where mostly primary dealers—a substantially more homogenous group of forecasters, and mostly located in New York—are surveyed prior to Federal Open Market Committee (FOMC) meetings. This precludes a direct comparison of ECB results with the Fed experience. Furthermore, a principle complication is that the ECB Governing Council meets more frequently than the FOMC.

[5] Note that the calculations were performed separately for all three sample periods. Accordingly, the composition of the deciles differs, such that the figures for the full sample are not necessarily weighted averages of the two subperiods. The sample means are about 5 and 6 basis points, respectively, in the pre- and post-2001 period (Table 1(a)).

is that, perhaps not unexpectedly, forecasters face particular difficulties correctly predicting interest rate changes. In fact, across the sample, the absolute forecasting error in periods of changing policy rates is more than four times larger than in calmer periods. Moreover, there is some movement in the ranking of forecasting analysts by country, even though a clear pattern is hard to discern by simple descriptive statistics alone. These results are broadly similar across the two forecasted interest rate variables and the variable *meetings-to-change*.

Despite these differences in forecast accuracy among institutions, the forecasts generally are unbiased and efficient. The very last columns in Table 1 provide information on standard tests allowing rejection of the hypothesis that the forecasts are biased or inefficient—both for the overall sample and, in most cases, by country.[6] This is true for the good and the bad performers in the sample. For the *expected rate*, Figure 2 illustrates that the average forecast closely tracks the actual (post-meeting) ECB policy rate during most of the period, while individual forecasts varied more widely.

While there is evidence that forecasting performance differs across countries, Table 1 also indicates that there is substantially more variation within than across countries. The table reports the standard deviation of the mean absolute forecast error across institutions within each country. For the expected rate in Table 1a, this standard deviation ranges from 0.06 to 0.14, with an average of 0.08. Calculating the standard deviation of the average national forecasting errors leads to a considerably lower figure, at 0.02. This suggests that the search for determinants of forecasting performance needs to go beyond the country dimension.

The results summarized so far invite further discussion. In what follows, we attempt to decompose the findings along two dimensions.

One dimension pertains to the geographical pattern. This is open to a number of interpretations. The good forecasting performance of analysts headquartered in, say, Germany could be due to their relative closeness to Frankfurt. Alternatively, it might have to do with advantages from informational agglomeration. At the same time, we cannot exclude that historical experience with "central bank watching" plays a role.

Another relates to theory. If analysts based their forecasts of ECB behavior (mostly) on economic theory, one would expect that their predictions could, one way or the other, be explained by concepts like the Taylor rule. If true, this would allow us to filter out the unsystematic errors made by analysts—and focus on the systematic, model-based error instead. In addition, it would allow us to learn something about the models applied by different groups of analysts to forecast ECB behavior.

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[6] The unbiasedness test is based on the following equation: $r_t = \alpha + \beta r_t^e + \varepsilon_t$, where r_t is the policy rate after the Council meeting t and r_t^e are the expectations, with the Wald test of the joint hypothesis that H_0: $\alpha=0$ and $\beta=1$. Under the efficiency test, expectations are efficient if forecast errors cannot be predicted systematically on the basis of past policy decisions r_{t-p} : $r_t - r_t^e = \zeta + \sum_{p=1}^{P} \psi_p r_{t-p} + \varepsilon_t$, with the lag length chosen as P=6. The efficiency hypothesis to be tested is $\psi 1 = \psi 2 = ... = \psi P = 0$. Note that both tests are based on country-specific, rather than institution-specific estimations. For a more detailed discussion, see Ehrmann and Fratzscher (2005).

III. The Role of Geography, Macro Conditions, and History

To learn more about the pattern underlying the forecasting errors, we move to an econometric approach. In the bulk of this section, we focus on the expected policy rate. Toward the end of this section, we also comment on the results for the highest expected rate and meetings-to-change.

Our main objective is to understand differences in the forecasting accuracy (in the sense of a lower forecasting error) across financial institutions in anticipating ECB monetary policy decisions. Hence we investigate whether the size, or absolute value, of the forecast error varies across institutions, and whether this difference can be explained with factors reflecting geography, country-specific macroeconomic factors, and central banking conditions. While the directional differences in forecasting errors is not central to the question of accuracy, we will shed some light on this issue in Section IV, where we analyze whether differences in forecasting performance are related to different weights economic agents give to various macroeconomic variables when forming their policy expectations.

A. Explaining the *expected rate*

Since we are interested in overall forecasting accuracy, the variable of interest is the absolute observed forecasting error e made by each analyst i for meeting t:

$$| e_{it} | = | r_{it}^{e} - r_{t} |,$$

where r_t is the policy rate after the Governing Council meeting t and r_{it}^{e} are analyst i's published expectations for the policy rate. The model takes the general form

$$| e_{it} | = \alpha + \boldsymbol{\beta}\mathbf{y}_{it} + \gamma_{t} + u_{it},$$

where α is a constant, $\mathbf{y}_{it}$ is a vector of explanatory variables that are either analyst-specific or analyst- and meeting-specific, $\boldsymbol{\beta}$ is the matching coefficient vector, γ_t represents meeting-fixed-effects, and u_{it} is a residual following standard assumptions.[7]

Including meeting-fixed-effects in the model is a very flexible tool to robustly control for a number of potentially influential unobservables. For instance, there might be idiosyncrasies regarding the selection of financial institutions or analysts by Reuters or, as already hinted at, time-trends in the number of financial institutions polled by Reuters. Moreover, including meeting-fixed-effects helps to model any changes in forecasting behavior possibly associated with the ECB Council's change from a bimonthly meeting to monthly meetings in late 2001.

[7] Note that we want to explain the difference in the magnitude of the forecasting error made by each forecasting institution. Accordingly, the model contains a number of purely institution-varying explanatory variables, which precludes the inclusion of an institution-fixed effect.

To learn more about the pattern underlying the forecasting errors, we define a comprehensive set of explanatory variables along the dimensions of geography, macro conditions, and history. The variables are described below.[8]

Geography

Headquarters in Frankfurt:	dummy variable; one for all financial institutions that file their forecasts of ECB policy rates from Frankfurt in the majority of cases, and zero otherwise
Subsidiary in Frankfurt:	dummy variable; marks financial institutions that report at least once from Frankfurt, but from other locations in the majority of cases
Headquarter or subsidiary in London:	dummy variable; identifies financial institutions reporting at least once from London that are not already included in the first two categories
Vicinity:	dummy variable; includes financial institutions that have not been classified into one of the three categories above, but that have their headquarters or a subsidiary within 1,000 kilometers of Frankfurt

Macro conditions

Relative inflation:	difference between euro area and national HCPI inflation rates based on information available at the time of the Reuters poll regarding meeting *t*; set to zero for all financial institutions that are headquartered outside the euro area
Relative unemployment:	equivalent variable for unemployment rates

History

Central bank independence:	dummy variable; 1 if the pre-1999 Grilli, Masciandaro, and Tabellini (1991) index for central bank independence for the country in which a bank is headquartered is above the (unweighted) euro area average; -1 if the index is below the euro area average; set to zero for non-euro area financial institutions

Table 2 presents ordinary least squares (OLS) estimates for the full sample. As a robustness check, and because the macro condition variables might not be fully independent from the history variable, model (1) shows the results without and model (2) shows the results with

[8] All "geography" variables are based on the information contained in the Reuters polls. "Macro conditions" are based on real-time information extracted from Bloomberg. "History" is constructed from the Grilli, Masciandaro, and Tabellini (1991) index for central bank independence. While more recent central bank independence indicators are available, the Grilli, Masciandaro, and Tabellini (1991) index has the advantage of providing information prior to EMU-induced institutional convergence.

"central bank independence" as a right-hand-side variable. Below we extend the analysis by looking at subsamples.

The full-sample results show the importance of information and location. Analysts working for institutions that either are headquartered in Frankfurt or operate a subsidiary there tend to have significantly lower forecasting errors (i.e., higher forecasting errors or better performance) than others.[9] This might be because it is helpful to observe the ECB's action up-close and on an everyday basis or because of informal information spillovers in a financial center. Another explanation for the importance of Frankfurt as a location might be previous experience: to the extent that the ECB's actions followed similar patters as the Bundesbank before 1999, local analysts might have found the human capital they had accumulated watching the Bundesbank still helpful after 1999. In addition, financial expertise in general and, possibly, positive agglomeration effects with regard to information processing might be at work as well. This notion is weakly supported by the negative point-estimate for the coefficient of *headquarter or subsidiary in London*. The coefficient is not significant at conventional levels, however.

Macro conditions also matter for forecasting performance. We find that deviations of national inflation and unemployment rates from the euro area average have a significant positive effect on the absolute forecasting error.[10] The coefficient estimate for *relative inflation* exceeds the estimated coefficient for *relative unemployment*, signaling a greater potential for national inflation experiences to influence the precision of forecasters located in a particular euro area country.[11]

There are at least two interpretations of these findings. One is that analysts (still) have a national perspective. While producing predictions on actions by the euro area's common central bank, forecasters continue to be informed by developments in their respective host countries. That is, they are tempted to take real-time data at the national level as indicators of area-wide developments rather than aggregating properly weighted national data to form an opinion on developments in the area as a whole. An alternative explanation would be that high values of the relative macro variables are indicative of increased forecasting uncertainty in general. It might simply be easier to predict the ECB's interest rate policy when euro area member economies move in sync than otherwise.

The magnitude of the forecasting errors linked to geographic and macro factors is sizable. For example, financial institutions with their headquarters or a subsidiary in Frankfurt show an

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[9] The headquarters identified by the reporting criterion are not always the *chartered* headquarters of the respective financial institution. However, we can safely assume that the dominant location from which Reuters polls are filed corresponds to the location of the section that performs the ECB-watching tasks. More often than not, this section will also conduct a substantial fraction of the euro area business of the respective financial institution.

[10] The main reason for using the unemployment rates is that industrial production—perhaps a preferable measure of economic activity—is available in real time only for the large countries and the euro area aggregate.

[11] Even controlling for the fact that the standard deviation of the national unemployment rates is three times as large as the one of national inflation rates, inflation developments appear more important for forecast accuracy than changes in unemployment.

average forecasting error that is lower by 1 to 1.5 basis points than their peers, compared to the 8 basis points difference overall between the best and worst forecasters reported in Figure 1. With respect to the macroeconomic variables, a one percentage point larger inflation rate differential leads to forecasting errors that are larger by half a basis point on average, whereas a one percentage point larger unemployment rate differential increases forecasting errors by one-tenth of a basis point.

Finally, institutional history as captured by the *central bank independence* dummy variable is not significant in the full sample.

How do results change over time? The second and third columns of Table 2 report OLS estimates with the sample split about halfway to allow separate estimates for the upward and downward part of the interest rate cycle. Standard tests indicate that January 2001 is indeed a structural breakpoint in the empirical model, suggesting that analysts changed their behavior in a systematic fashion.

The importance of geography declines over time. The coefficients estimated for *headquarters in Frankfurt* and *subsidiary in Frankfurt* tend to be more negative and statistically more significant during the pre-2001 subperiod than post-2001. In addition, *vicinity to Frankfurt* shows a significantly negative effect on the forecasting error during the early but not the late period. This intertemporal pattern is present in both models (1) and (2) in Table 2. Looking at model (2), we also find weak evidence of a negative coefficient for *headquarters or subsidiary in London* during the pre-2001 subperiod which disappears afterwards.[12]

A plausible explanation for these results could be learning. While location, especially closeness to Frankfurt, played a major role in the earlier years, location might have become less important as forecasters throughout the euro area got to know the ECB, picked up the necessary tools, or adjusted their models in line with the new realities. Of course, learning might also have taken a more "passive" or accidental form. For instance, one could imagine changes in the macroeconomic framework or, indeed, in the ECB's policy setup that increase the fit of a given forecasting model that previously underperformed. Finally, there might also have been passive "unlearning" in the sense that some forecasters failed to adjust models that performed well pre-2001 to changing circumstances post-2001.[13] The evidence we present in Section IV.C suggests that both active and passive forms of learning might have played a role here.

A second result is that both macro conditions and institutional history matter *more* in the post-2001 subperiod. Indeed, closer inspection of Table 2 reveals that the effect of the three variables *relative inflation, relative unemployment*, and *central bank independence* was almost negligible during the pre-2001 subperiod. This suggests that macro conditions and

[12] The *London* variable plays a more significant role in explaining systematic forecasting errors for *meetings-to-change* (see below).

[13] Institutions making an effort to report forecasts from a *subsidiary in Frankfurt* seem to lose somewhat less of their competitive edge than those with *headquarters in Frankfurt*. This suggests that some "unlearning" might have taken the form of the erosion of what could be called accidental advantages of location. In fact, there might be a positive selection bias at work: a forecasting institution might only choose to run a subsidiary in Frankfurt because (and as long) the closeness to Frankfurt is associated with better forecasting accuracy.

institutional history mattered more (or their influence was more visible) once learning had eroded most of the accidental advantage of those headquartered in Frankfurt and when the macroeconomic performance of the national economies became somewhat more divergent over the latter part of the sample.[14] With regard to institutional history, forecast accuracy is higher for financial institutions reporting from countries with long-standing traditions of independent central banking. Note that this result comes from a regression that already controls for geographical factors—that is, we are measuring the impact of institutional history on a bank's forecasting quality in addition to being or not being located in Frankfurt, for instance.

B. Explaining the *most likely rate* and *meetings-to-next-change*

The results for macro conditions also extend to our second endogenous variable, the *most likely rate*. For both *most likely rate* and *meetings to next change*, the findings regarding geography are somewhat weaker.[15] A possible explanation for the latter is that our alternative indicators of ECB activity are noisier than the expected policy rate. For instance, forecasters falling under the *subsidiary in Frankfurt* category might implicitly coordinate on a (good) mean prediction for the ECB's policy rate, all the while disagreeing on the full distribution or on the time path for the next rate change.[16] While the explanatory power of geography is weaker for these two alternative endogenous variables, institutional history has a larger role for both of them.

IV. Decomposition of the Forecasting Errors

There is a remarkable (if not puzzling) degree of heterogeneity to forecasting errors in the euro area's early years. Although we expect geography and clustering around informational hubs not to matter a lot in tightly integrated and efficient financial markets, apparently they do. Moreover, even professional forecasters show some degree of confusion about the relative importance of national relative to euro area macroeconomic developments. Also close-hand experience with independent central banking in the past seems to influence forecasting accuracy. The question is whether this heterogeneity can be traced to differences in forecasting mechanisms?

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[14] See Angeloni and Ehrmann (2004). For instance, in our sample the average of *relative inflation* triples from pre-2001 to post-2001.

[15] The tables showing results equivalent to Table 2 above for the *most likely rate* and *meetings-to-change* can be found in Appendix 1 (Table A1.1) and 2 (Table A2.1), respectively. Note that the point estimates of the coefficients of Table A1.1 for *most likely rate* are not directly comparable to those for *expected rate*. The regressions for the former variable were run with an ordered probit estimator, owing to the discrete nature of the *most likely rate* forecast errors,

[16] The variable *meetings-to-change* contains a couple of outliers according to which no change in interest rates seems to have been expected for an unreasonably long time period. A closer analysis of these cases showed that they are most likely due to typos. We cleaned the dataset for such outliers by dropping the upper 5 percent of the distribution. No such cleaning was necessary for *expected rate* and *most likely rate*.

Economic theory suggests that central banks might follow a monetary policy rule. This could be because they have optimally selected a particular rule, for instance one of the Taylor variety, from a set of simple rules or because they follow an optimal monetary policy program that resembles such a rule. In both cases, financial markets have reason to mimic the bank's supposed behavior when formulating forecasting models for policy rates.

A. Definitions

This argument can be used to filter out the systematic error from the observed (or overall) errors made by forecasting institutions. Above we defined the observed error e_{it} made by forecaster i at (or rather before) meeting t as $e_{it} = r_{it}^e - r_t$, with r_t being the post-meeting policy rate and r_{it}^e i's published forecast. The question is how these expectations are formed?

A plausible assumption is that i's forecast of the policy rate will include a systematic component, based on economic theory. In addition, more often than not, the forecast might contain an unsystematic component representing the "gut feeling," i.e., nontangibles in the information set of the forecasting institution's analytical staff. Alternatively, this residual could reflect differences in the analysts' forecasts of relevant euro area variables. This would imply

$$r_{it}^e = \hat{r}_{it}^e + \hat{u}_{it},$$

with $\hat{r}_{it}^e$ representing the systematic and $\hat{u}_{it}$ the unsystematic component in i's forecast. For instance, if the forecaster assumed that the ECB set its policy rate in line with a simple linear rule, we would have a model along the lines of

$$r_{it}^e = \sum_{k=1}^{n} \hat{\beta}_{ik} x_{kt} + \hat{u}_{it},$$

where the $\hat{\beta}_{ik}$ are forecaster-specific coefficients weighting relevant euro area variables, x_{kt}, and $\hat{u}_{it}$ summarizes any influence of other factors unrelated to the x_{kt}. The assumption is that the euro area variables are common knowledge.

While we do not directly observe i's forecasting model, a reasonable first attempt is perhaps to approximate its systematic component by a standard backward-looking Taylor-type rule.[17] In the actual application, we use real-time information on euro area year-on-year changes in consumer prices (HICP), industrial production, M3, and the level of consumer confidence—as available at the time of the Reuters poll, i.e., on the Friday prior to meeting t—for the x_{kt}.[18]

[17] Implementing a forward-looking model at the forecaster level would be an alternative. From the perspective of the practitioners whose behavior we are modeling, however, the difference between a backward- and a forward-looking model might be moot. For instance, Sauer and Sturm (2003) show that using real time data (as we do in the empirical application), especially when including confidence indicators, is the more important step when maximizing the "fit" of Taylor-type rules for the ECB. There is also a well-known arbitrariness in selecting the instruments in forward-looking specifications of such rules.

[18] The data are taken from Bloomberg.

We also introduce a forecaster-specific constant and the previous ECB policy rate into the regression. Finally, in line with the earlier discussion, we allow the empirical model to differentiate between the upward and downward part of the interest rate cycle. Thus, separately for each reporting financial institution *i*, we estimate

$$r_{it}^{e} = \alpha_{i1} + \alpha_{i2} D_t + (1 + D_t)\left(\beta_{i0} r_{t-1} + \sum_{k=1}^{4} \beta_{ik} x_{kt} \right) + u_{it},$$

where α_{i1}, α_{i2}, β_{i0}, and the β_{ik} are coefficients, D_t is a dummy variable that is one during the post-2001 period and zero otherwise, and the residuals u_{it} depict the estimated unsystematic component in the bank's policy rate.

This allows us to decompose the observed error in bank *i*'s expectations on the policy rate

$$\begin{aligned} e_{it} &= r_{it}^{e} - r_t \\ &= \alpha_{i1} + \alpha_{i2} D_t + (1 + D_t)\left(\beta_0 r_{t-1} + \sum_{k=1}^{4} \beta_{ik} x_{kt} \right) - r_t + u_{it}, \\ &= s_{it} + u_{it} \end{aligned}$$

where s_{it} stands for the systematic and u_{it} for the unsystematic component in the observed (or overall) forecasting error e_{it}. As before, we are mainly interested in the overall size of the forecasting error—that is, we look at the absolute value. Moreover, in what follows, we focus on the absolute systematic error of institution *i*, $|s_{it}|$, neglecting the unsystematic component in its forecasting performance.[19]

B. Explaining the Systematic Error for the Expected Rate

Table 3 provides information about the systematic component of the observed error similar to Table 1(a). A first finding is that the geographic country pattern behind $|s_{it}|$ is fairly similar to the observed error discussed in Section III. For instance, analysts reporting for German banks or other financial institutions perform significantly better than the euro area average, while their Austrian and French colleagues significantly underperform in Table 3. Moreover, variation over time is similar to $|e_{it}|$—that is, relatively high accuracy at the beginning and the end of the sample, but higher average errors in between.[20] Finally, the systematic forecasts, too, are generally unbiased and efficient.

Following the analysis in the previous section, we proceed by explaining the systematic error component through our set of explanatory variables focusing on geography, macro conditions, and institutional history. The variables are as described above.

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[19] See Section II for a discussion of the unbiasedness of the forecasts. Results for the unsystematic error component (not reported) very roughly resemble results for the systematic component, except for the time path of the average error level which is more erratic.

[20] Note, however, that the average systematic error is as low (or even lower) toward the end of the period as at the beginning.

The result emerging from Table 4 is that most of what has been said about the overall (or observed) forecasting error in Section III extends to the analysis of its Taylor-type-rule-based systematic component. In other words, differences in modeling the ECB's policy decisions underlie the observed differences in forecasting accuracy. As with $|e_{it}|$, we find that $|s_{it}|$ is significantly lower for forecasters that reside in the *vicinity of Frankfurt*, or report from *headquarters in Frankfurt* or a *subsidiary in Frankfurt*. As before, these effects are stronger in quantitative and statistical terms during the pre-2001 subperiod. In fact, the coefficient for v*icinity of Frankfurt* even turns significantly positive during the post-2001 subperiod. At the same time, *relative inflation, relative unemployment*, and *central bank independence* all matter significantly only during the later half of the sample. All in all, the results are very close to those reported in Table 2 above.

A similar picture emerges when we take a more general perspective on performance by again comparing top and bottom performers. In most cases, the best performers overall identified in Section III.A are also the best performers with respect to the systematic forecast error, and similarly, the worst performers overall generally show the worst performance when it comes to the systematic forecast. This is true for the full sample as well as for the pre- and post-2001 subsamples. We conclude that it is indeed the systematic component that matters most in the overall forecast accuracy.

C. Dissecting the Taylor-Type Rules for the Expected Rate

With systematic, model-based errors playing such an important role for the overall forecasting performance of individual forecasting institutions, the question arises whether anything can be said as to how their models of ECB behavior differed? Looking for answers, we sort individual forecasters according to various characteristics suggested by the analysis of forecasting errors and estimate group-specific Taylor-type rules.[21]

As a benchmark, Table 5 shows estimates for a pooled Taylor-type rule for the entire sample of financial institutions. We report short-run coefficients, as these are more meaningful for forecasts of the imminent policy decisions than the long-run coefficients that are typically analyzed in the literature on central bank reaction functions. As discussed above, the model relates the expected rate to a number of explanatory variables, allowing coefficients to differ between the pre-2001 and post-2001 period. The last column includes information on whether coefficients changed between periods in a significant way.

The results resemble standard estimated central bank reaction functions—that is, as a whole, forecasters follow a fairly conventional approach. On the nominal side, expectations for the ECB policy rate increase with *HICP inflation* and the growth rate of *M3*. The fact that a monetary aggregate plays a significant role might reflect the ECB's two-pillar strategy or, more generally, beliefs that money growth is a predictor of inflation in the medium to longterm. Indicator qualities for inflationary pressures might also be behind the fact that, on the real side, changes in *industrial production* and the level of *consumer confidence* are positively related to the expected rate. At the same time, the high estimated coefficients for *previous rate*, i.e., the policy rate prevailing before the meeting for which expectations are

[21] This is the most convenient analytical tool for this purpose. It is worthwhile repeating, however, that the decomposition of the overall forecasting error into its systematic and unsystematic part performed in the previous section is based on individual, institution-specific Taylor-type rules.

formed, suggest a high degree of interest rate smoothing and as such a rather protracted reaction to changes in the other model variables.

There are, however, interesting changes in the estimates over time. Note, first, that analysts expected the ECB to react faster to changes in the explanatory variables in the post-2001 period: the coefficient for *previous rate* drops (see last column of Table 5, Panel A) in the second half of the sample. At the same time, we observe a shift in the relative importance of variables: whereas *HICP inflation* and, to a smaller degree, *consumer confidence* have gained in importance, the relative weight of *industrial production* has decreased.

The question is whether these trends where shared by all analysts in the Reuters poll. Panel B of Table 5 breaks down the results by geography, macroeconomic conditions, and institutional history.[22] In the last two columns, the table includes information on whether the coefficients are significantly different in statistical terms for the two respective groups, separately for the two periods. As these estimates are based on about 120 observations (one per financial institution), which are further split into two, not necessarily equal large groups, the power of any statistical testing has to remain limited. This caveat notwithstanding, interesting results emerge:

First, the time variations observed for the full set of financial institutions apply equally to each subset, with only slight differences with respect to the statistical significance in these variations. The importance attached to HICP increases over time for all groups, as does the role of consumer confidence. Also the drop in coefficients for industrial production and the previous interest rate is shared by all groups.

Second, looking at the differences across groups, the point estimates of the coefficients suggest that financial institutions positioned in Frankfurt have given greater weight to inflation but lower weight to money growth than institutions operating outside Frankfurt. However, these differences, as well as most other between-group differences, are not significant, perhaps owing to the low statistical power of the tests.

D. Do These Results Extend to Other Measures of Systematic Expectations?

In principle, the tools developed to decompose the observed forecasting error into its systematic and unsystematic components can be used for our alternative independent variables as well. The application to *most likely rate* is straightforward. Regarding *meetings-*

[22] For these estimates, we have defined a dummy variable that classifies an institution into the "high inflation" (or "high unemployment") category if inflation (unemployment) in the country from which it reports is above the euro area average. Consistent with the treatment above, institutions reporting from non-euro area countries were set to the euro area average, and thus classified into the "low inflation" ("low unemployment") group. Our grouping with respect to *central bank independence* is based on the earlier definition of the CBI dummy, whereby we classified all institutions reporting from countries where the dummy equals one (i.e., where the central bank independence index is above the euro area average) into the "high central bank independence" category.

to-change, we estimate separate Taylor-type rules for times of expected policy rate increases and decreases.[23] Detailed results for both exercises are reported in Appendices A1 and A2.

most likely rate

Turning first to the results for *most likely rate*, we find the behavior of the systematic forecast error fairly similar to the *expected rate* variable. The country-by-country perspective (Table A1.2) identifies the same regions as significant under- and over-performers as Table 3 for *expected rate*, and the regression results (Table A1.3) indicate that the geographic, macroeconomic, and historical patterns underlying these results are comparable for both independent variables. Interestingly, however, the explanatory variable *headquarters or subsidiary in London*, which was estimated negative but insignificant for the *expected rate* (see Table 4), comes out negative and significant for *most likely rate*.

The intertemporal pattern of learning, change, and persistence behind the systematic forecasting error for *most likely rate* is not very different from the one found for *expected rate*. Splitting the sample into a pre-2001 and a post-2001 subperiod (Table A1.3), produces results akin to Table 4. Again, we find that *relative inflation, relative unemployment*, and *central bank independence* have a significant impact on the forecasting error only during the later half of the sample, while the significant effects of most geographic variables disappear post-2001.[24]

These similarities are also reflected in the estimated Taylor-type rule coefficients for the *most likely rate* model or their changes over time (Tables A1.4).

meetings-to-change

The variable *meetings-to-change* can be adequately modeled by a Taylor-type rule as well. And while the distribution of systematic *meetings-to-change* forecasting errors across countries differs from the one found for the *expected rate* and *most likely rate*, the underlying geographic, macroeconomic, and historical pattern tends to be broadly in line with previous findings. For instance, forecasters headquartered in Germany do not perform better than the average forecaster in the sample, while those working from the United Kingdom outperform their peers (Table A2.2). Nonetheless, the regression-based analysis reveals a number of similarities with the results reported above (Tables A2.3): while we cannot detect a significant role for macroeconomic conditions, we find that geography and institutional history matters in the same way as for *expected rate* or *most likely rate*. Interestingly, we find that *headquarters*

[23] The interpretation of the *meetings-to-change* variable depends on the expected direction of monetary policy. If markets expect a policy rate hike, higher inflation figures then imply that the next action should come sooner rather than later. The opposite holds when a drop in the policy rate is expected: with higher inflation, the next cut in policy rates should come later rather than sooner. Accordingly, the coefficients in the Taylor-type rule should flip signs depending on the expected direction of the next change in policy rates. By estimating Taylor-rules conditional on the expected direction of monetary policy, we can capture this feature of the independent variable.

[24] In contrast to the *expected rate* model, the coefficient for *headquarters in Frankfurt* is shown as increasing in column (1) post-2001 compared to pre-2001. Results are similar, however, when *central bank independence* is included—see column (2) in Table A1.3.

or subsidiary in London plays a more significant role than for *expected rate* or *most likely rate*.

Learning plays a remarkably large role in explaining the systematic errors for *meetings-to-change* (Table A2.3). Being located in either Frankfurt or London tends to significantly reduce forecasting errors pre-2001, but none of the geography variables matters during the post-2001 subperiod. Moreover, the history of central bank independence is associated with better forecasting performance only post-2001.

Turning to the underlying Taylor-type rules, we find that, although not comparable quantitatively, the rules are qualitatively very similar to those estimated with the other forecast variables (Table A2.4).[25] All coefficients in the Taylor-type rule based on the full panel are estimated to be significant, and they have the expected sign (Panel A). In the presence of rate hike expectations, higher inflation rates lead the forecasters to expect an interest rate hike sooner (as indicated through a negative coefficient, and thus fewer meetings before the next change). The same applies for larger figures for M3, industrial production, and consumer confidence. If the current interest rates are high under rate hike expectations, the urge to increase them further diminishes, as shown by the positive coefficients. The changes over time replicate those found for the other two forecasts, with the exception of inflation, which has become less prominent in this variant. This change in behavior is rather uniform across the various groups of forecasters (Panel B of Table A2.4).

V. CONCLUSIONS

EMU has implied the assignment to the ECB of monetary policy making for 12 countries with varying histories of inflation, policy strategies, and economic environments. Monetary policy is now conducted taking a euro-area-wide perspective, but operates in a multicountry, multicultural and multilingual context. This raises a number of issues: How does this heterogeneity of conditions and backgrounds in member countries affect the ability of economic agents to understand and anticipate monetary policy by the ECB? Is there convergence in the views about how the ECB conducts monetary policy? Or are the differences in the ability to anticipate the ECB's decisions indicative of more permanent information asymmetries related to geographic proximity and country-specific factors?

Using a novel database on the forecasts of ECB policy decisions of 120 financial institutions in 24 countries since 1999, we find some marked differences in the ability of economic agents to understand and anticipate policy decisions by the ECB. The paper shows that a substantial part of these differences is persistent and systematically explained by geography, country-specific economic conditions, and history. We find that financial institutions that are headquartered in Frankfurt, or have a subsidiary in Frankfurt, perform substantially better in predicting ECB policy decisions. Some informational advantage also appears to be at play for institutions based in the City of London. Furthermore, distance matters, as institutions that are located closer to Frankfurt also show better forecasting performance. This suggests that information asymmetries and agglomeration effects play a role in the ability of economic agents to anticipate monetary policy in the euro area. This finding is in line with earlier literature that analyzes the reasons for the existence of international financial centers, which

[25] Note that the coefficients shown are averaged over periods of expected policy rate increases and decreases. Coefficients for periods of policy rate declines have been multiplied by (–l) to ensure compatibility.

argues that face-to-face contacts among financial market actors are facilitated by proximity and are an essential factor in knowledge production and thus performance.

Country-specific economic conditions and histories also are relevant. Financial analysts are better at predicting ECB behavior when they are located in countries that have low levels of inflation and/or unemployment relative to the (weighted) euro area average. Moreover, financial institutions in countries with a history of relatively high central bank independence tend to make better forecasts of ECB behavior than others. Finally, we find that most of the heterogeneity in forecasting performance can be related to different models of ECB behavior, and there is little evidence of learning.

Our results have important policy implications. Expectations are a crucial factor in the transmission of monetary policy. And a central bank operating in a heterogeneous environment such as the ECB needs to be aware of differences in the ability of economic agents to understand and anticipate monetary policy—differences that appear to be significant in the case of the euro area. To a small degree, this heterogeneity is transitory and therefore not a cause of great concern. However, a substantial part of it appears to persist. Euro area financial markets have yet to converge on a homogeneous view of the ECB, to overcome locational and national biases, and to adopt a common expectation-formation process. Although some informational frictions and asymmetries or agglomeration effects may be a permanent feature of financial activity in any region, there seems to be scope for continuous guidance of this convergence process by a careful and targeted communication policy by the central bank.

There are multiple avenues for further research. A first extension would be to explore likely links between ECB communication and expectations on ECB policy. For instance, would communication in the form of speeches or interviews, perhaps targeted at particular audiences within EMU, be helpful in reducing systematic heterogeneity of expectations? A related question is whether certain forms of ECB communication are more likely to focus the attention of regional audiences than others. A second area for future research is to apply the framework for identifying and explaining systematic heterogeneity in expectations to other central banks, such as the U.S. Federal Reserve, in order to understand whether geography plays a central role for the formation of monetary policy expectations for other central banks or whether this is a factor specific to the European context.

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Table 1 (a): Absolute Error for *expected rate* by Country (in %)

		1999 - 2005										meetings with change	meetings with no change	pre- Feb. 2001	post- Feb. 2001	unbiased-ness test	efficiency test
	# obs	mean	diff.	st. dev.	1999	2000	2001	2002	2003	2004	2005	1999-2005	1999-2005			p-value	p-value
Austria	90	0.087	***	0.098	0.000	0.096	0.150	0.105	0.089	0.049	0.038	0.125	0.083	0.050	0.095	0.000	0.000
Belgium	8	0.100		0.139	--	--	--	0.063	0.130	0.025	--	0.188	0.048	--	0.100	0.981	--
Denmark	147	0.053		0.081	0.000	0.076	0.091	0.057	0.045	0.009	0.013	0.211	0.030	0.043	0.062	0.156	0.895
Finland	98	0.060		0.081	0.000	0.094	0.068	0.062	0.085	0.012	0.006	0.188	0.039	0.066	0.057	0.612	0.508
France	314	0.070	**	0.083	0.000	0.089	0.117	0.090	0.080	0.033	0.027	0.169	0.058	0.049	0.078	0.000	0.000
United Kingdom	1,426	0.062		0.075	0.011	0.090	0.092	0.070	0.064	0.028	0.008	0.177	0.046	0.060	0.064	0.000	0.000
Germany	1,290	0.053	***	0.075	0.003	0.068	0.084	0.068	0.055	0.025	0.007	0.182	0.035	0.040	0.060	0.000	0.000
Ireland	72	0.073	**	0.060	0.000	0.089	0.101	0.060	0.056	0.006	0.000	0.148	0.061	0.073	0.073	0.170	0.280
Italy	150	0.046		0.085	0.000	0.079	0.046	0.062	0.023	0.000	0.000	0.195	0.026	0.056	0.036	0.050	0.136
Netherlands	119	0.066		0.077	0.000	0.090	0.064	0.081	0.058	0.054	0.013	0.177	0.053	0.070	0.064	0.220	0.551
Portugal	118	0.042	***	0.071	0.000	0.057	0.089	0.028	0.027	0.006	0.000	0.175	0.025	0.043	0.041	0.023	0.000
Sweden	71	0.063		0.060	0.000	0.079	0.071	0.082	0.075	0.031	0.000	0.156	0.054	0.063	0.063	0.520	0.941
USA	96	0.063		0.089	0.023	0.103	0.063	0.044	0.071	0.071	--	0.216	0.041	0.064	0.062	0.046	0.296
Others	243	0.069	**	0.073	0.000	0.107	0.083	0.090	0.063	0.032	0.013	0.178	0.054	0.070	0.069	0.029	0.675
Euro area	2,350	0.057		0.078	0.002	0.076	0.085	0.071	0.061	0.027	0.013	0.179	0.041	0.047	0.063	0.000	0.000
Non-euro area	1,892	0.062	*	0.076	0.009	0.090	0.089	0.070	0.065	0.028	0.008	0.180	0.046	0.058	0.064	0.000	0.000
All countries	4,242	0.060		0.077	0.005	0.082	0.087	0.070	0.063	0.027	0.011	0.179	0.043	0.052	0.063	0.000	0.000

Notes: -- indicates missing values; "diff." shows significance level of a t-test of whether the country-specific mean is different from the mean for all countries. ***, **, and * indicate significance at the 99%, 95%, and 90% levels, respectively. The unbiasedness test and efficiency test are as defined in the text; p-values of above 0.90 indicate that unbiasedness or efficiency are rejected at the 90% level.

Table 1 (b): Absolute Error for *most likely rate* by Country (in %)

	# obs	1999 - 2005 mean	diff.	st. dev.	1999	2000	2001	2002	2003	2004	2005	meetings with change 1999-2005	meetings with no change 1999-2005	pre- Feb. 2001	post- Feb. 2001	unbiased-ness test p-value	efficiency test p-value
Austria	105	0.067	***	0.121	0.000	0.018	0.115	0.078	0.088	0.039	0.000	0.111	0.063	0.010	0.085	0.000	0.001
Belgium	8	0.094		0.186	--	--	--	0.000	0.150	0.000	--	0.250	0.000	--	0.094	0.920	--
Denmark	149	0.040		0.097	0.000	0.060	0.076	0.038	0.023	0.000	0.000	0.197	0.017	0.034	0.047	0.111	0.999
Finland	111	0.034		0.086	0.000	0.066	0.054	0.000	0.059	0.000	0.000	0.167	0.013	0.046	0.030	0.743	0.490
France	357	0.043		0.105	0.000	0.065	0.083	0.036	0.042	0.000	0.000	0.165	0.028	0.042	0.044	0.000	0.007
United Kingdom	1,442	0.036		0.092	0.012	0.073	0.058	0.017	0.030	0.001	0.000	0.173	0.016	0.049	0.030	0.064	0.000
Germany	1,299	0.030	***	0.084	0.003	0.052	0.048	0.020	0.030	0.001	0.000	0.175	0.010	0.031	0.029	0.846	0.018
Ireland	61	0.049		0.100	--	0.036	0.076	0.083	0.031	0.000	0.000	0.150	0.029	0.034	0.058	0.699	0.426
Italy	133	0.036		0.098	0.000	0.060	0.030	0.068	0.000	0.000	--	0.162	0.017	0.040	0.030	0.052	0.164
Netherlands	124	0.026		0.077	0.000	0.068	0.022	0.023	0.025	0.000	0.000	0.188	0.009	0.052	0.018	0.494	0.059
Portugal	130	0.027		0.078	0.000	0.039	0.051	0.016	0.017	0.000	0.000	0.161	0.011	0.028	0.026	0.027	0.000
Sweden	74	0.030		0.082	0.000	0.044	0.054	0.000	0.025	0.029	0.000	0.107	0.022	0.033	0.029	0.189	0.983
USA	73	0.051		0.125	0.050	0.075	0.034	0.033	0.058	0.094	--	0.250	0.023	0.056	0.050	0.212	0.260
Others	248	0.033		0.088	0.000	0.065	0.037	0.046	0.025	0.000	0.000	0.161	0.017	0.039	0.030	0.494	0.059
Euro area	2,421	0.034		0.091	0.002	0.055	0.054	0.027	0.035	0.003	0.000	0.170	0.016	0.035	0.034	0.000	0.000
Non-euro area	1,893	0.037		0.093	0.010	0.068	0.057	0.020	0.032	0.005	0.000	0.174	0.017	0.045	0.033	0.006	0.000
All countries	4,314	0.035		0.092	0.005	0.060	0.055	0.024	0.034	0.004	0.000	0.172	0.017	0.039	0.033	0.000	0.000

Notes: -- indicates missing values; "diff." shows significance level of a t-test of whether the country-specific mean is different from the mean for all countries. ***, **, and * indicate significance at the 99%, 95%, and 90% levels, respectively. The unbiasedness test and efficiency test are as defined in the text; p-values of above 0.90 indicate that unbiasedness or efficiency are rejected at the 90% level.

Table 1 (c): Absolute Error for *meetings-to-change* by Country (in number of meetings)

	# obs	1999 - 2005 mean	diff.	st. dev.	1999	2000	2001	2002	2003	2004	2005	meetings with change 1999-2005	meetings with no change 1999-2005	pre- Feb. 2001	post- Feb. 2001	unbiased-ness test p-value	efficiency test p-value
Austria	49	5.72		6.078	--	4.79	0.75	3.00	9.18	10.90	--	1.33	5.99	4.11	6.32	0.000	0.000
Belgium	0	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Denmark	112	4.72	*	4.894	6.73	4.55	1.19	3.69	8.10	9.50	3.00	1.88	5.10	4.87	4.65	0.003	0.000
Finland	83	5.01		5.657		1.50	1.48	3.47	8.12	9.22	4.50	1.75	5.45	1.50	5.09	0.001	0.000
France	264	5.64		5.656	6.86	3.41	2.40	3.44	9.95	11.09	4.75	2.34	6.07	4.33	6.30	0.000	0.000
United Kingdom	1113	5.59		6.031	6.04	3.48	2.60	3.85	10.56	9.22	4.24	2.05	6.11	4.01	6.17	0.000	0.000
Germany	887	5.18		5.536	6.20	3.14	1.97	3.33	9.97	10.01	3.30	2.01	5.64	4.08	5.70	0.000	0.000
Ireland	56	4.04	**	4.377	--	4.05	2.52	3.67	5.00	8.83	2.00	1.88	4.40	4.35	3.86	0.001	0.000
Italy	101	4.03	***	4.301	6.21	3.70	1.84	2.20	8.22	7.09	--	1.75	4.39	3.90	4.15	0.077	0.000
Netherlands	111	5.93		5.235	8.25	3.79	2.74	3.50	10.47	10.57	4.00	1.36	6.42	5.07	6.13	0.001	0.000
Portugal	121	6.17	**	6.298	9.88	3.52	2.31	3.67	13.60	11.68	6.50	1.71	6.65	4.14	7.05	0.000	0.000
Sweden	42	6.44		6.113	8.75	4.56	3.64	3.11	12.20	9.40	8.00	4.80	6.66	5.09	6.92	0.000	0.000
USA	63	4.92		6.393	7.50	4.36	2.06	3.81	11.50	17.00	--	2.25	5.39	4.69	4.99	0.000	0.000
Others	197	5.65		6.414	8.50	2.98	2.06	3.11	12.61	9.83	1.00	2.07	6.08	4.06	6.36	0.000	0.000
Euro area	1,754	5.31		5.621	6.48	3.40	2.05	3.35	10.05	10.23	3.82	1.95	5.76	4.12	5.82	0.000	0.000
Non-euro area	1,445	5.51		5.951	6.54	3.55	2.45	3.73	10.64	9.29	4.25	2.14	5.99	4.19	6.03	0.000	0.000
All countries	3,199	5.40		5.773	6.51	3.47	2.23	3.53	10.32	9.79	4.02	2.04	5.86	4.15	5.92	0.000	0.000

Notes: -- indicates missing values; "diff." shows significance level of a t-test of whether the country-specific mean is different from the mean for all countries. ***, **, and * indicate significance at the 99%, 95%, and 90% levels, respectively. The unbiasedness test and efficiency test are as defined in the text; p-values of above 0.90 indicate that unbiasedness or efficiency are rejected at the 90% level.

Table 2: Explaining the Forecasting Error: Geography, Macro Conditions, and History

	(1)						(2)					
	full period		pre-2001		post-2001		full period		pre-2001		post-2001	
	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*
Distance:												
Headquarters in Frankfurt	-0.011 ***	*0.003*	-0.017 ***	*0.005*	-0.007 *	*0.004*	-0.009 ***	*0.003*	-0.016 ***	*0.005*	-0.004	*0.004*
Subsidiary in Frankfurt	-0.015 ***	*0.003*	-0.017 ***	*0.005*	-0.015 ***	*0.004*	-0.014 ***	*0.003*	-0.016 ***	*0.006*	-0.012 ***	*0.004*
HQ or Subsidiary in London	-0.002	*0.003*	-0.007	*0.005*	0.001	*0.003*	-0.002	*0.003*	-0.007 *	*0.005*	0.002	*0.003*
Vicinity of Frankfurt	-0.001	*0.003*	-0.012 **	*0.005*	0.003	*0.004*	-0.001	*0.003*	-0.013 ***	*0.005*	0.005	*0.004*
Macro conditions:												
Relative inflation	0.005 ***	*0.002*	-0.001	*0.003*	0.008 ***	*0.002*	0.006 ***	*0.002*	0.000	*0.003*	0.010 ***	*0.002*
Relative unemployment	0.001 **	*0.001*	-0.001	*0.001*	0.002 ***	*0.001*	0.001 **	*0.001*	-0.001	*0.001*	0.003 ***	*0.001*
History:												
Central bank independence							-0.002	*0.001*	-0.001	*0.002*	-0.004 **	*0.002*
# observations	4242		1414		2828		4242		1414		2828	

Notes: ***, **, and * indicate significance at the 99%, 95%, and 90% levels, respectively.

Table 3: Absolute Systematic Error for *expected rate* by Country (in %)

		1999 - 2005										meetings with change 1999-2005	meetings with no change 1999-2005	pre-Feb. 2001	post-Feb. 2001
	# obs	mean	diff.	st. dev.	1999	2000	2001	2002	2003	2004	2005				
Austria	90	0.107	***	0.094	0.029	0.132	0.114	0.153	0.139	0.061	0.009	0.219	0.094	0.079	0.113
Belgium	8	0.135	*	0.140	--	--	--	0.125	0.162	0.023	--	0.245	0.069	--	0.135
Denmark	147	0.066		0.089	0.020	0.091	0.083	0.092	0.093	0.014	0.011	0.270	0.037	0.061	0.071
Finland	98	0.077		0.092	0.016	0.114	0.090	0.065	0.114	0.020	0.046	0.238	0.051	0.086	0.074
France	314	0.085	***	0.081	0.023	0.115	0.109	0.116	0.117	0.037	0.036	0.243	0.067	0.076	0.089
United Kingdom	1,426	0.074		0.084	0.028	0.111	0.084	0.076	0.108	0.027	0.018	0.237	0.051	0.078	0.072
Germany	1,290	0.069	**	0.088	0.024	0.095	0.075	0.098	0.097	0.023	0.020	0.261	0.043	0.063	0.072
Ireland	72	0.070		0.071	0.014	0.102	0.073	0.056	0.064	0.029	0.018	0.186	0.051	0.087	0.062
Italy	150	0.067		0.086	0.024	0.098	0.052	0.072	0.110	0.025	0.012	0.252	0.041	0.075	0.058
Netherlands	119	0.071		0.090	0.029	0.114	0.060	0.085	0.092	0.025	0.015	0.275	0.048	0.092	0.065
Portugal	118	0.069		0.086	0.031	0.107	0.076	0.087	0.078	0.016	0.009	0.268	0.044	0.084	0.062
Sweden	71	0.065		0.074	0.016	0.078	0.065	0.090	0.076	0.036	0.013	0.219	0.051	0.064	0.065
USA	96	0.060		0.090	0.029	0.089	0.056	0.047	0.084	0.058	--	0.216	0.038	0.058	0.061
Others	243	0.078		0.084	0.044	0.113	0.070	0.090	0.108	0.029	0.018	0.240	0.055	0.086	0.072
Euro area	2,350	0.073		0.087	0.025	0.101	0.077	0.097	0.103	0.027	0.023	0.254	0.050	0.071	0.075
Non-euro area	1,892	0.072		0.084	0.027	0.107	0.081	0.077	0.104	0.027	0.017	0.237	0.049	0.075	0.071
All countries	4,242	0.073		0.086	0.026	0.104	0.079	0.088	0.104	0.027	0.021	0.246	0.049	0.073	0.073

Notes: -- indicates missing values; "diff." shows significance level of a t-test of whether the country-specific mean is different from the mean for all countries. ***, **, and * indicate significance at the 99%, 95%, and 90% levels, respectively.

Table 4: Explaining the Taylor-Type Rule Systematic Error: Geography, Macro Conditions, and History across Subperiods

	(1)						(2)					
	full period		**pre-2001**		**post-2001**		**full period**		**pre-2001**		**post-2001**	
	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*
Distance:												
Headquarters in Frankfurt	-0.008 ***	*0.002*	-0.011 ***	*0.004*	-0.006 *	*0.003*	-0.006 ***	*0.003*	-0.012 ***	*0.004*	-0.001	*0.003*
Subsidiary in Frankfurt	-0.010 ***	*0.002*	-0.011 **	*0.004*	-0.010 ***	*0.003*	-0.009 ***	*0.003*	-0.011 ***	*0.004*	-0.007 **	*0.003*
HQ or Subsidiary in London	-0.001	*0.002*	-0.004	*0.004*	0.001	*0.002*	-0.001	*0.002*	-0.005	*0.004*	0.002	*0.002*
Vicinity of Frankfurt	0.000	*0.002*	-0.009 **	*0.004*	0.004	*0.003*	0.000	*0.002*	-0.009 **	*0.004*	0.005 **	*0.003*
Macro conditions:												
Relative inflation	0.005 ***	*0.001*	-0.163	*0.002*	0.855 ***	*0.001*	0.006 ***	*0.001*	-0.002	*0.002*	0.011 ***	*0.002*
Relative unemployment	0.001 ***	*0.000*	-0.010	*0.001*	0.247 ***	*0.001*	0.002 ***	*0.000*	0.000	*0.001*	0.003 ***	*0.001*
History:												
Central bank independence							-0.002 *	*0.001*	0.001	*0.002*	-0.004 ***	*0.001*
# observations	4242		1414		2828		4242		1414		2828	

Notes: ***, **, and * indicate significance at the 99%, 95%, and 90% levels, respectively.

Table 5: Taylor-Type Rule Estimates

(A) All groups

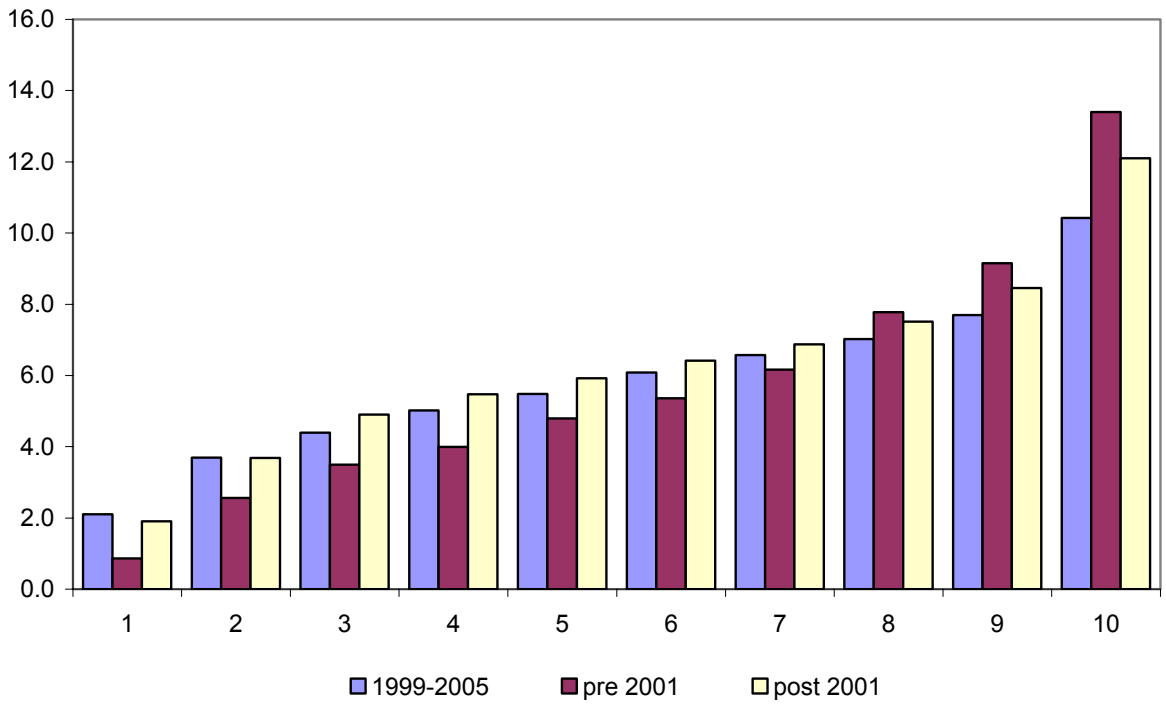
	pre-2001		post-2001		pre- vs. post-2001[A]
	coef.	*std. err.*	coef.	*std. err.*	
HICP inflation	3.651 ***	*1.112*	6.184 ***	*0.562*	Y
M3	2.556 ***	*0.527*	3.467 ***	*0.287*	
Industrial production	1.761 ***	*0.172*	0.606 ***	*0.094*	Y
Consumer confidence	0.001	*0.001*	0.032 ***	*0.001*	Y
Previous rate	0.948 ***	*0.008*	0.827 ***	*0.004*	Y

(B) By group

	pre-2001	post-2001	pre- vs. post-2001[A]	pre-2001	post-2001	pre- vs. post-2001[A]	*comparison* pre-2001[B]	*comparison* post-2001[C]
	coef.	coef.		coef.	coef.			
Vicinity	**outside Frankfurt**			**HQ or subsidiary in Frankfurt**				
HICP inflation	3.595 ***	6.147 ***	Y	3.410	6.659 ***			
M3	2.825 ***	3.509 ***		2.331 **	3.313 ***			
Industrial production	1.786 ***	0.579 ***	Y	1.536 ***	0.667 ***	Y		
Consumer confidence	0.001	0.032 ***	Y	-0.001	0.030 ***	Y		
Previous rate	0.948 ***	0.824 ***	Y	0.954 ***	0.834 ***	Y		
Macro conditions	**high inflation**			**low inflation**				
HICP inflation	5.096 *	4.050 ***		3.503 ***	6.500 ***	Y		
M3	3.885 ***	2.581 ***		2.362 ***	3.605 ***	Y		
Industrial production	1.717 ***	0.580 **	Y	1.741 ***	0.589 ***	Y		
Consumer confidence	0.003	0.027 ***	Y	0.000	0.032 ***	Y		Y
Previous rate	0.933 ***	0.860 ***	Y	0.951 ***	0.822 ***	Y		Y
Macro conditions	**high unemployment**			**low unemployment**				
HICP inflation	1.907	5.705 ***	Y	5.065 ***	6.557 ***			
M3	2.296 ***	3.562 ***		3.034 ***	3.381 ***			
Industrial production	1.750 ***	0.725 ***	Y	1.701 ***	0.511 ***	Y		
Consumer confidence	0.000	0.031 ***	Y	0.001	0.032 ***	Y		
Previous rate	0.960 ***	0.830 ***	Y	0.940 ***	0.825 ***	Y		
History	**low CB independence**			**high CB independence**				
HICP inflation	4.919 ***	5.730 ***		1.573	7.002 ***	Y		
M3	3.412 ***	3.268 ***		1.566 *	3.824 ***	Y		
Industrial production	1.684 ***	0.494 ***	Y	1.796 ***	0.806 ***	Y		
Consumer confidence	0.000	0.032 ***	Y	0.001	0.031 ***	Y		
Previous rate	0.941 ***	0.826 ***	Y	0.961 ***	0.828 ***	Y		

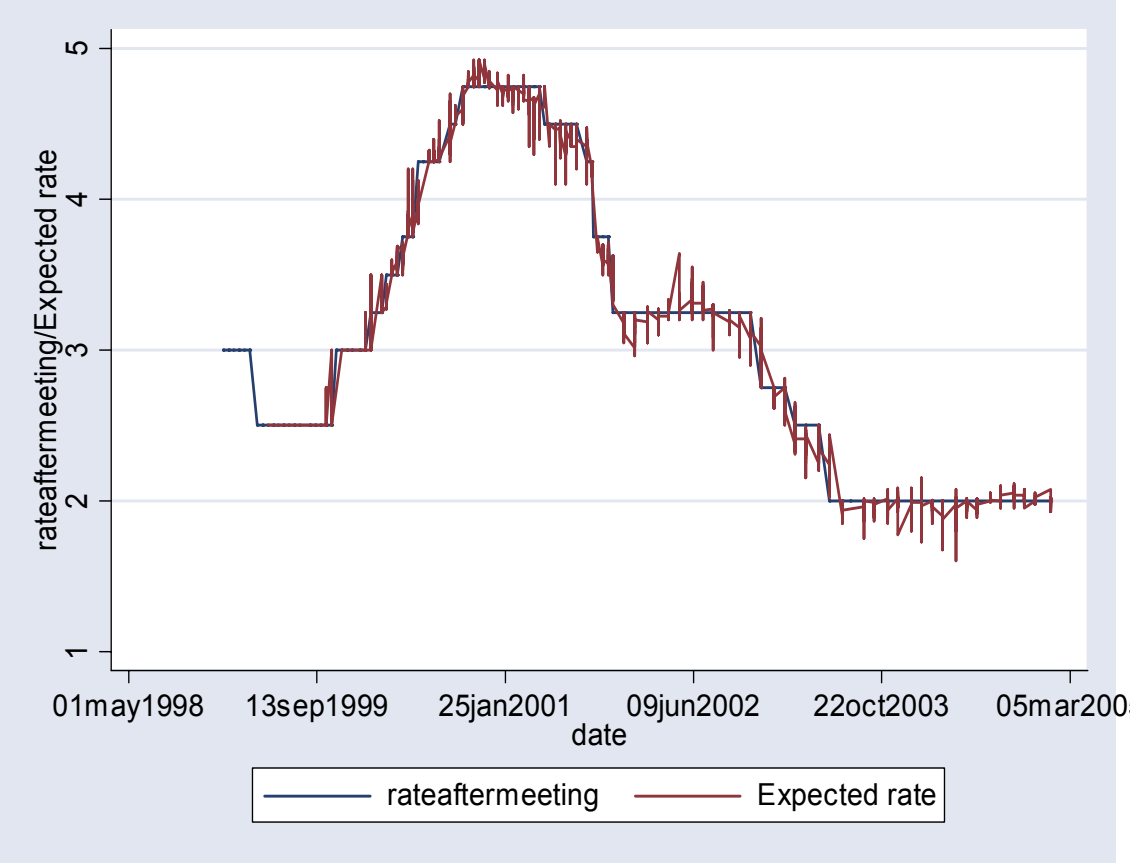
Notes: ***, **, * indicate significance at the 99%, 95%, and 90% level, respectively.
[A] Y indicates rejection at the 90% level of a t-test of equality of the pre-2001 and post-2001 coefficients.
[B] Y indicates rejection at the 90% level of a t-test of equality of the coefficients of the two groups pre-2001.
[C] Y indicates rejection at the 90% level of a t-test of equality of the coefficients of the two groups post-2001.

Figure 1: Monetary Policy Forecasting Error by Decile for *expected rate*



Note: The figure shows the average absolute forecast error in basis points by financial institutions, ranging from those 10% of institutions with the lowest forecast errors in decile 1 to those 10% with the highest error in decile 10. The fact that the average errors for the full sample period can be (somewhat) larger or smaller than for both subperiods is owed to the fact that the allocation of institutions to deciles changes slightly over time.

Figure 2: Actual Rate and *expected rate* Based on the Overall Sample of Forecasters



Source: Reuters; authors' calculations.
Note: The figure shows the mean as well as the minimum and maximum of the policy rate forecasts polled by Reuters before a particular ECB Council meeting. In addition, the actual policy rate as decided in the respective meeting is depicted.

Appendix 1: Results for *most likely rate* and *meetings-to-change*

Table A1.1: *most likely rate*: Explaining the Forecasting Error: Geography, Macro Conditions, and History

	(1)						(2)					
	full period		pre-2001		post-2001		full period		pre-2001		post-2001	
	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*
Distance:												
Headquarters in Frankfurt	-0.252 *	*0.141*	-0.143	*0.256*	-0.298 *	*0.172*	-0.102	*0.154*	-0.073	*0.271*	-0.055	*0.191*
Subsidiary in Frankfurt	-0.264 *	*0.151*	-0.345	*0.280*	-0.213	*0.182*	-0.156	*0.158*	-0.294	*0.287*	-0.039	*0.192*
HQ or Subsidiary in London	-0.130	*0.114*	0.088	*0.214*	-0.227	*0.138*	-0.100	*0.115*	0.092	*0.214*	-0.171	*0.140*
Vicinity of Frankfurt	0.045	*0.122*	-0.192	*0.234*	0.081	*0.148*	0.089	*0.124*	-0.198	*0.234*	0.174	*0.153*
Macro conditions:												
Relative inflation	0.197 ***	*0.066*	0.060	*0.129*	0.287 ***	*0.081*	0.231 ***	*0.067*	0.081	*0.131*	0.344 ***	*0.083*
Relative unemployment	0.048 **	*0.020*	0.021	*0.033*	0.094 ***	*0.028*	0.057 ***	*0.021*	0.020	*0.033*	0.112 ***	*0.029*
History:												
Central bank independence							-0.135 **	*0.054*	-0.081	*0.099*	-0.205 ***	*0.066*
# observations	4314		1507		2807		4314		1507		2807	

Notes: ***, **, and * indicate significance at the 99%, 95%, and 90% levels, respectively. Note that the results in this table stem from an ordered probit estimation as the absolute forecast errors of the most likely rate take discrete values of 0 bp, 25 bp, or 50 bp.

Table A1.2: *most likely rate*: Absolute Systematic Error of Mean Expectations in Taylor-Type Rule (in %)

	1999 - 2005											meetings with change	meetings with no change	pre-Feb. 2001	post-Feb. 2001
	# obs	mean	diff.	st. dev.	1999	2000	2001	2002	2003	2004	2005	1999-2005	1999-2005		
Austria	105	0.095	***	0.103	0.012	0.089	0.091	0.143	0.148	0.053	0.019	0.240	0.082	0.065	0.105
Belgium	8	0.133	*	0.179	--	--	--	0.047	0.184	0.046	--	0.296	0.034	--	0.133
Denmark	149	0.064		0.092	0.018	0.087	0.084	0.089	0.085	0.010	0.000	0.269	0.034	0.059	0.069
Finland	111	0.072		0.095	0.011	0.112	0.082	0.069	0.094	0.022	0.040	0.250	0.044	0.082	0.068
France	357	0.078	**	0.087	0.021	0.103	0.089	0.118	0.100	0.025	0.034	0.255	0.055	0.077	0.079
United Kingdom	1,442	0.069		0.090	0.026	0.105	0.075	0.069	0.100	0.023	0.025	0.250	0.043	0.076	0.066
Germany	1,299	0.064	**	0.092	0.020	0.087	0.064	0.089	0.091	0.021	0.023	0.274	0.035	0.059	0.066
Ireland	61	0.074		0.078	--	0.104	0.064	0.136	0.039	0.028	0.010	0.174	0.055	0.102	0.058
Italy	133	0.076		0.086	0.025	0.103	0.064	0.076	0.121	0.033	--	0.253	0.050	0.080	0.069
Netherlands	124	0.054		0.101	0.022	0.101	0.049	0.057	0.064	0.010	0.017	0.316	0.026	0.082	0.046
Portugal	130	0.063		0.084	0.027	0.096	0.056	0.080	0.083	0.017	0.014	0.262	0.039	0.076	0.056
Sweden	74	0.063		0.076	0.031	0.066	0.073	0.085	0.057	0.043	0.016	0.232	0.045	0.054	0.066
USA	73	0.064		0.100	0.045	0.082	0.054	0.056	0.080	0.072	--	0.233	0.040	0.061	0.065
Others	248	0.070		0.088	0.041	0.106	0.058	0.087	0.088	0.031	0.030	0.261	0.046	0.079	0.064
Euro area	2,421	0.068		0.092	0.021	0.094	0.067	0.090	0.096	0.024	0.025	0.267	0.042	0.068	0.068
Non-euro area	1,893	0.068		0.089	0.027	0.101	0.074	0.072	0.095	0.025	0.023	0.249	0.043	0.073	0.066
All countries	4,314	0.068		0.091	0.024	0.097	0.070	0.082	0.095	0.024	0.024	0.259	0.042	0.070	0.067

Notes: -- indicates missing values; "diff." shows significance level of a t-test of whether the country-specific mean is different from the mean for all countries. ***, **, and * indicate significance at the 99%, 95%, and 90% levels, respectively.

Table A1.3: *most likely rate*: Explaining the Taylor-Type Rule Systematic Error: Geography, Macro Conditions, and History

	(1)						(2)					
	full period		pre-2001		post-2001		full period		pre-2001		post-2001	
	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*
Distance:												
Headquarters in Frankfurt	-0.013 ***	*0.003*	-0.012 **	*0.005*	-0.013 ***	*0.004*	-0.010 ***	*0.003*	-0.013 **	*0.005*	-0.005	*0.004*
Subsidiary in Frankfurt	-0.011 ***	*0.003*	-0.013 **	*0.005*	-0.010 **	*0.004*	-0.009 ***	*0.003*	-0.014 **	*0.005*	-0.004	*0.004*
HQ or Subsidiary in London	-0.005 **	*0.002*	-0.006	*0.005*	-0.004	*0.003*	-0.005 *	*0.002*	-0.006	*0.005*	-0.002	*0.003*
Vicinity of Frankfurt	-0.002	*0.003*	-0.013 ***	*0.005*	0.005	*0.003*	-0.001	*0.003*	-0.013 ***	*0.005*	0.008 **	*0.003*
Macro conditions:												
Relative inflation	0.007 ***	*0.001*	0.000	*0.003*	0.009 ***	*0.002*	0.008 ***	*0.002*	0.000	*0.003*	0.012 ***	*0.002*
Relative unemployment	0.001 *	*0.000*	0.000	*0.001*	0.001 *	*0.001*	0.001 **	*0.000*	0.000	*0.001*	0.002 ***	*0.001*
History:												
Central bank independence							-0.003 ***	*0.001*	0.000	*0.002*	-0.007 ***	*0.001*
# observations	4314		1507		2807		4314		1507		2807	

Notes: ***, **, and * indicate significance at the 99%, 95%, and 90% levels, respectively.

Table A1.4: *most likely rate*: Taylor-Type Rule Estimates

(A) All groups

	pre-2001		post-2001		pre- vs. post-2001[A]
	coef.	*std. err.*	coef.	*std. err.*	
HICP inflation	2.608 *	1.414	4.082 ***	0.765	
M3	2.466 ***	0.685	2.839 ***	0.391	
Industrial production	1.266 ***	0.221	0.740 ***	0.127	Y
Consumer confidence	0.002 *	0.001	0.028 ***	0.001	Y
Previous rate	0.956 ***	0.011	0.852 ***	0.006	Y

(B) By group

	pre-2001	post-2001	pre- vs. post-2001[A]	pre-2001	post-2001	pre- vs. post-2001[A]	*comparison* pre-2001[B]	*comparison* post-2001[C]
	coef.	coef.		coef.	coef.			
Vicinity	**outside Frankfurt**			**HQ or subsidiary in Frankfurt**				
HICP inflation	2.216	3.992 ***		3.617	4.689 ***			
M3	2.843 ***	3.038 ***		1.858	2.242 ***			
Industrial production	1.206 ***	0.767 ***		1.292 ***	0.639 **			
Consumer confidence	0.003 *	0.030 ***	Y	0.000	0.023 ***	Y		Y
Previous rate	0.960 ***	0.843 ***	Y	0.949 ***	0.872 ***	Y		Y
Macro conditions	**high inflation**			**low inflation**				
HICP inflation	2.946	4.719 **		2.741 *	3.820 ***			
M3	3.245 *	1.788 *		2.348 ***	3.030 ***			
Industrial production	1.396 **	0.561 *		1.218 ***	0.773 ***			
Consumer confidence	0.006 *	0.024 ***	Y	0.001	0.029 ***	Y		
Previous rate	0.941 ***	0.870 ***	Y	0.958 ***	0.848 ***	Y		
Macro conditions	**high unemployment**			**low unemployment**				
HICP inflation	1.576	4.350 *		3.703 **	3.900 ***			
M3	1.809 *	2.749 ***		3.284 ***	2.883 ***			
Industrial production	1.423 ***	0.811 ***		1.089 ***	0.685 ***			
Consumer confidence	0.001	0.027 ***	Y	0.003	0.029 ***	Y		
Previous rate	0.958 ***	0.853 ***	Y	0.953 ***	0.850 ***	Y		
History	**low CB independence**			**high CB independence**				
HICP inflation	3.435 **	3.529 ***		1.649	5.146 ***			
M3	3.422 ***	2.857 ***		1.101	2.845 ***			
Industrial production	1.109 ***	0.720 ***		1.498 ***	0.778 ***	Y		
Consumer confidence	0.002	0.030 ***	Y	0.002	0.026 ***	Y		
Previous rate	0.954 ***	0.845 ***	Y	0.955 ***	0.860 ***	Y		

Notes: ***, **, * indicate significance at the 99%, 95%, and 90% level, respectively.
[A] Y indicates rejection at the 90% level of a t-test of equality of the pre-2001 and post-2001 coefficients.
[B] Y indicates rejection at the 90% level of a t-test of equality of the coefficients of the two groups pre-2001.
[C] Y indicates rejection at the 90% level of a t-test of equality of the coefficients of the two groups post-2001.

Appendix 2. *meetings-to-change*

Table A2.1: *meetings-to-change*: Explaining the Forecasting Error: Geography, Macro Conditions, and History

	(1)						(2)					
	full period		pre-2001		post-2001		full period		pre-2001		post-2001	
	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*
Distance:												
Headquarters in Frankfurt	-0.376 **	*0.191*	-0.547	*0.358*	-0.289	*0.228*	-0.198	*0.208*	-0.557	*0.394*	-0.077	*0.248*
Subsidiary in Frankfurt	-0.066	*0.198*	-0.161	*0.375*	-0.013	*0.236*	0.081	*0.210*	-0.170	*0.403*	0.156	*0.248*
HQ or Subsidiary in London	-0.206	*0.150*	-0.372	*0.299*	-0.124	*0.175*	-0.165	*0.151*	-0.375	*0.303*	-0.081	*0.176*
Vicinity of Frankfurt	-0.115	*0.166*	0.053	*0.321*	-0.155	*0.198*	-0.062	*0.168*	0.052	*0.322*	-0.068	*0.202*
Macro conditions:												
Relative inflation	0.066	*0.089*	0.078	*0.167*	0.000	*0.000*	0.003	*0.094*	0.081	*0.173*	0.000	*0.000*
Relative unemployment	-0.026	*0.030*	-0.067	*0.045*	0.000	*0.000*	-0.038	*0.031*	-0.066	*0.046*	0.000	*0.000*
History:												
Central bank independence							-0.166 **	*0.077*	0.009	*0.142*	-0.207 **	*0.094*
# observations	3199		951		2248		3199		951		2248	

Notes: ***, **, and * indicate significance at the 99%, 95%, and 90% levels, respectively.

Table A2.2: *meetings-to-change*: Absolute Systematic Error of Mean Expectations in Taylor-Type Rule (in number of meetings)

	1999 - 2005										meetings with change	meetings with no change	pre- post- Feb. 2001	
	# obs	mean	diff.	st. dev.	1999	2000	2001	2002	2003	2004	2005	1999-2005	1999-2005		
Austria	49	5.44		5.885	--	4.25	1.76	2.39	8.36	11.08	--	2.12	5.66	4.42	5.85
Belgium	0	--		--	--	--	--	--	--	--	--	--	--	--	--
Denmark	112	5.00		4.392	6.01	3.99	2.31	3.99	8.75	9.52	4.54	2.86	5.29	4.83	5.09
Finland	83	4.87		5.705		0.51	1.87	2.35	8.33	9.23	2.34	1.48	5.34	0.51	4.98
France	264	5.46		5.659	6.17	3.67	2.07	3.37	9.96	11.00	5.67	2.61	5.84	4.20	6.11
United Kingdom	1113	5.51		5.926	4.88	3.76	2.31	3.55	10.92	9.50	3.53	2.46	5.97	3.98	6.09
Germany	887	5.20		5.437	5.90	3.46	1.95	2.90	10.62	9.86	3.58	2.45	5.61	4.27	5.65
Ireland	56	3.84	***	3.895	--	4.13	2.02	3.56	4.68	8.57	3.98	2.00	4.15	3.97	3.77
Italy	101	3.89	***	4.244	6.81	3.64	1.65	2.20	7.88	7.04	--	2.26	4.15	3.94	3.83
Netherlands	111	5.33		4.858	5.15	4.59	2.21	3.19	10.10	9.08	3.12	2.39	5.66	4.59	5.51
Portugal	121	6.01		6.266	8.02	3.65	1.95	2.69	14.22	11.64	5.68	2.25	6.42	4.06	6.86
Sweden	42	5.89		5.451	7.36	4.88	1.82	2.50	12.48	9.25	3.33	2.36	6.36	5.03	6.19
USA	63	4.50		5.807	7.31	4.80	2.46	3.08	11.73	--	--	3.04	4.78	5.01	4.33
Others	197	5.65		6.379	7.33	3.59	2.21	2.47	12.72	9.48	2.93	2.47	6.03	4.42	6.19
Euro area	1,754	5.21		5.524	6.03	3.62	1.95	2.92	10.38	10.02	3.99	2.37	5.60	4.18	5.67
Non-euro area	1,445	5.43		5.789	5.46	3.83	2.33	3.39	11.00	9.42	3.52	2.52	5.86	4.21	5.92
All countries	3,199	5.31		5.645	5.80	3.71	2.12	3.14	10.67	9.74	3.77	2.44	5.72	4.19	5.78

Notes: -- indicates missing values; "diff." shows significance level of a t-test of whether the country-specific mean is different from the mean for all countries. ***, **, and * indicate significance at the 99%, 95%, and 90% levels, respectively.

Table A2.3: *meetings-to-change*: Explaining the Taylor-TypeRrule Systematic Error: Geography, Macro Conditions, and History

	(1)						(2)					
	full period		pre-2001		post-2001		full period		pre-2001		post-2001	
	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*	coef.	*std. err.*
Distance:												
Headquarters in Frankfurt	-0.404 **	*0.159*	-0.848 ***	*0.307*	-0.258	*0.187*	-0.221	*0.173*	-1.058 ***	*0.339*	0.018	*0.202*
Subsidiary in Frankfurt	-0.211	*0.165*	-0.586 *	*0.324*	-0.097	*0.192*	-0.062	*0.174*	-0.771 **	*0.347*	0.122	*0.201*
HQ or Subsidiary in London	-0.232 *	*0.125*	-0.760 ***	*0.257*	-0.050	*0.143*	-0.190	*0.126*	-0.821 ***	*0.260*	0.007	*0.143*
Vicinity of Frankfurt	-0.220	*0.138*	-0.306	*0.276*	-0.194	*0.162*	-0.166	*0.140*	-0.324	*0.276*	-0.081	*0.165*
Macro conditions:												
Relative inflation	0.021	*0.074*	-0.223	*0.144*	0.000	*0.000*	-0.042	*0.078*	-0.170	*0.148*	0.000	*0.000*
Relative unemployment	-0.006	*0.025*	-0.060	*0.039*	0.000	*0.000*	-0.018	*0.025*	-0.050	*0.039*	0.000	*0.000*
History:												
Central bank independence							-0.170 ***	*0.064*	0.180	*0.122*	-0.270 ***	*0.077*
# observations	3199		951		2248		3199		951		2248	

Notes: ***, **, and * indicate significance at the 99%, 95%, and 90% levels, respectively.

Table A2.4: *meetings-to-change*: Taylor-Type Rule Estimates

(A) All groups

	pre-2001		post-2001		pre- vs. post-2001[A]
	coef.	*std. err.*	coef.	*std. err.*	
HICP inflation	-327.731 ***	*49.812*	-90.657 ***	*23.576*	Y
M3	-22.133 **	*10.416*	-81.169 ***	*12.076*	Y
Industrial production	-63.470 ***	*7.998*	-7.255 *	*3.886*	Y
Consumer confidence	-0.460 ***	*0.038*	-0.447 ***	*0.042*	
Previous rate	2.137 ***	*0.382*	1.532 ***	*0.221*	

(B) By group

	pre-2001	post-2001	pre- vs. post-2001[A]	pre-2001	post-2001	pre- vs. post-2001[A]	*comparison* pre-2001[B]	*comparison* post-2001[C]
	coef.	coef.		coef.	coef.			
Vicinity	**outside Frankfurt**			**HQ or subsidiary in Frankfurt**				
HICP inflation	-272.566 ***	-81.806 ***	Y	-499.493 ***	-104.789 *	Y	Y	
M3	-13.624	-83.252 ***	Y	-41.629	-68.472 **			
Industrial production	-69.203 ***	-9.044 **	Y	-50.672 ***	-0.079	Y		
Consumer confidence	-0.491 ***	-0.449 ***		-0.394 ***	-0.454 ***			
Previous rate	1.787 ***	1.503 ***		3.067 ***	1.705 ***			
Macro conditions	**high inflation**			**low inflation**				
HICP inflation	-156.136	-35.764		-387.337 ***	-82.789 ***	Y	Y	
M3	-13.640	-111.116 ***	Y	-51.816 **	-63.455 ***			
Industrial production	-84.249 ***	-20.257 **	Y	-56.599 ***	0.575	Y		Y
Consumer confidence	-0.610 ***	-0.518 ***		-0.403 8***	-0.459 ***		Y	
Previous rate	1.359	1.605 ***		2.217 ***	1.687 ***			
Macro conditions	**high unemployment**			**low unemployment**				
HICP inflation	-409.893 ***	-80.758 **	Y	-290.127 ***	-66.750 **	Y		
M3	-32.975 **	-85.106 ***	Y	-55.034 *	-61.751 ***			
Industrial production	-53.220 ***	-3.740	Y	-67.361 ***	-2.647	Y		
Consumer confidence	-0.532 ***	-0.440 ***		-0.360 ***	-0.508 ***	Y	Y	
Previous rate	2.689 ***	1.521 ***	Y	1.711 ***	1.883 ***	Y		
History	**low CB independence**			**high CB independence**				
HICP inflation	-283.530 ***	-105.638 ***	Y	-454.308 ***	-56.500	Y		
M3	-21.004 *	-94.161 ***	Y	-94.295 **	-53.880 **			
Industrial production	-64.634 ***	-10.888 **	Y	-54.424 ***	1.065	Y		
Consumer confidence	-0.468 ***	-0.494 ***		-0.364 ***	-0.387 ***			
Previous rate	1.870 ***	1.770 ***		2.526 ***	1.259 ***			

Notes: ***, **, * indicate significance at the 99%, 95%, and 90% level, respectively.
[A] Y indicates rejection at the 90% level of a t-test of equality of the pre-2001 and post-2001 coefficients.
[B] Y indicates rejection at the 90% level of a t-test of equality of the coefficients of the two groups pre-2001.
[C] Y indicates rejection at the 90% level of a t-test of equality of the coefficients of the two groups post-2001.

Appendix 3: A Glimpse at the Reuters Raw Data (January 2002)

Contributor	City/Country	50P rise	25P Rise	No change	25P Cut	50P Cut	Next change when?	By how much?	Rates at end 2002?	Rates at end 2003?	Low – level?	Low when?
Invesco Asset Mgt	Frankfurt	0	0	40	25	35	Feb	-50	2.00	3.00	2.00	Sum 02
Standard Chartered	London	0	0	40	40	20	Feb	-50	2.00	3.00	2.00	-
American Express	London	0	0	60	30	10	Feb	-25	2.00	2.50	2.00	Q3-02
Exane	Paris	0	0	70	20	10	Feb	-25	2.50	4.00	2.00	Q2-02
Natexis Banques Populaires	Paris	0	0	10	65	25	.	.	2.50	3.00	2.50	Mar-02
….	….	….	….	….	….	….	….	….	….	…	…	….
HSBC	London	0	0	60	25	15	Feb	-50	2.75	.	2.50	Apr/May
Dresdner Bank	Frankfurt	0	0	60	20	20	March	-50	3.50	.	2.75	Mar-02
Commerzbank	Frankfurt	0	0	65	30	5	Feb/Mar	-25	3.00	4.25	2.75	Q2-02
RBS Financial Markets	London	0	0	67	25	8	Feb	-50	3.25	4.25	2.75	Feb
Sal Oppenheim	Cologne	0	0	70	20	10	Feb	-25	3.50	4.00	2.75	Mid-02
Halifax	London	0	0	70	25	5	.	-25	2.75	4.00	2.75	May-02
Stone & McCarthy	London	0	0	70	25	5	Feb	-25	3.50	4.25	2.75	End Q1- 02
CitigroupSSSB	London	0	0	75	20	5	Feb	-25	3.25	4.00	2.75	Q2-02
Nordea Group	Helsinki	0	0	80	15	5	Feb	-50	3.25	.	2.75	Q1/02
Alpha Bank	Athens	0	0	80	20	0	Feb	-25	3.25	3.75	2.75	Q1-02
Rabobank	Utrect	0	0	85	10	5	Feb	-25	3.25	3.50	2.75	Apr
Hypovereinsbank	Munich	0	1	85	13	1	Feb	-50	3.25	.	2.75	.
Standard & Poors MMS	London	0	0	90	9	1	Feb	-25	2.75	4.00	2.75	Q2-02
Banco Santander	Lisbon	0	0	50	50	0	Feb	-25	3.25	4.00	3.00	Q1-02
Fortis Bank	Amsterdam	0	5	60	25	10	Feb	-25	3.00	3.50	3.00	Q1/Q2
West LB	Duesseldorf	0	0	70	25	5	Feb	-25	3.25	4.00	3.00	Q1
Sanwa	London	0	0	75	25	0	Feb	-25	3.25	4.00	3.00	Q1-02
AM Generali Finanz	Cologne	0	0	90	10	0	Feb	-25	3.75	4.50	3.00	Feb-02
Bankgesellschaft	Berlin	0	0	90	10	0	Feb	-25	4.00	.	3.00	Feb-02
Investors Bank & Trust	Boston	0	1	98	1	0	March	-25	3.50	4.25	3.00	March
Nomura International	Frankfurt	0	0	100	0	0	March	-25	3.00	4.00	3.00	March

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Note: Shorted sample. Entries in the third to seventh column refer to probabilities (in percent).