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Does one size fit all? A Taylor-rule based analysis of monetary policy for current and future EMU members.

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Abstract

This paper uses the Taylor rule to examine the appropriateness of ECB interest rate policy for the initial EMU members and the ten new EMU member states some of whom are expected to join the Eurozone in 2006-7. Specifically it addresses three questions. (1) Are there differences between the interest rate aggregated from the Taylor interest rates of individual member states in the euro area and the interest rate set by the ECB? (2) For which countries do the desired interest rates according to the original Taylor rule and the interest rate of the euro area differ most and in which respect? (3) The last question is whether the interest rate gaps change over time. We find that the ECB's policy does not fit individual EMU members equally well and this result is unlikely to be changed with the addition of the ten new members, which will have only a marginal effect on the ECB interest rate stance.

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Introduction

The original Taylor rule was developed to study the behavior of the Federal Reserve Bank (Taylor, 1993). Since then this line of research has been applied to many other central banks (e.g. Clarida, Gali and Gertler, 1998), yet the application to the ECB and the Eurozone has not been simple. The reason is that the ECB is a young institution which only began operation in January 1999. Thus the lack of data for a sufficiently long period of time has made it difficult to estimate an interest rate reaction function for the ECB. A number of studies have therefore approached the question by investigating whether interest rate setting by the ECB has been in line with previous interest rate setting by the Bundesbank, which is done by comparing the predictions of a Bundesbank reaction function with actual interest rate setting by the ECB (see e.g. Clausen and Hayo, 2002; Smant, 2002; Faust, Rogers and Wright, 2001).

Recently a number of papers have become available that use data solely from the ECB period, which show that with some modifications the Taylor equation is also a valid approximation of the ECB's interest rate policy see Fourçans and Vranceanu, 2002; Breuss, 2002; Sauer and Sturm, 2003; Ullrich, 2003).

In this paper we do not attempt to add to the literature on Taylor rules and central bank reaction functions. We start from the original Taylor interest rate equation and assume that it holds for the ECB as well as for the individual central banks of the

Eurozone (in case they still try to conduct their own independent monetary policy). In other words, we assume that all central banks adjust short-term interest rates in response to deviations of the actual inflation rate from its target and to a measure of the output gap. We further assume that they all place the same weight on the inflation gap and the output gap.

We then ask the following questions:

1. Is interest rate setting of the ECB in accordance with the needs of the individual member countries? If not, for which countries does the interest rate set by the ECB deviate most from their domestic need?
2. Is there a tendency over time for the ECB's interest rate policy to be more in line with the needs of the individual countries?
3. Assuming that the new EU-countries would already have been members of EMU, to what extent would this have changed interest rate setting by the ECB and would ECB interest rate setting have deviated much from their desired interest rate?

Before we start dealing with the above questions we show that interest rate setting by the ECB can be rather well represented by the simple Taylor interest rule that we use in the rest of the paper.

ECB interest rate setting and the Taylor rule

Taylor (1993) has suggested a simple reaction function where the central bank sets the interest rate based on the deviation of the actual inflation rate from the target inflation rate and on the output gap. The desired interest rate is then given by:

$$r_{it}^{*} = \rho + \pi_{it} + \theta(\pi_{it} - \pi^{*}) + (1-\theta)y_{it} \qquad (1)$$

where r* is the nominal desired short term interest rate, ρ is the equilibrium real interest rate, π the actual and π* the target inflation rate; θ and (1- θ) are the weights given to the inflation objective and the output objective, respectively and y is the output gap. The subscripts i and t are country and time indexes respectively. If we assume - as Taylor did - that the inflation target equals 2%, the equilibrium real interest rate equals 2% and that the weights on inflation and output are equal (θ = 0.5), we get the following equation:

$$r_{it}^{*} = 1 + 1.5\pi_{it} + 0.5y_{it} \qquad (2)$$

In determining the interest rate, the ECB focuses on the euro area as a whole. We therefore derive the Taylor rule for the euro area as a weighted sum of equation (2). Each country is given a weight equal to the share of its GDP in the euro area GDP (Greece is included in the calculations starting only from the first quarter of 2002 onwards when it joined the EMU. Luxembourg is not included). In other words, r^*_{EMU} is computed as:

$$r^*_{EMU,t} = \sum_{i=1}^{n} \alpha_i r^*_{it} \qquad (3)$$

with α_i standing for the share of country i's GDP in total GDP of the euro area and n for the number of current EMU countries (11 in this study) and where $\sum_{i=1}^{n} \alpha_i = 1$

This Taylor-based desired interest rate for the euro Area is shown in figure 1 as r^*_{EMU} and compared with the actual interest rate controlled by the ECB, viz. the EONIA (Euro Overnight Index Average)[2]. We use quarterly data[3] for the period 1999,Q1 - 2003,Q4.

Figure 1 shows that this simple version of the Taylor rule traces the actual interest rate quite well. A simple linear regression gives the following result:

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[2] We take the EONIA rate to compare the desired interest rates with because it is the equivalent of the Federal Funds rate. Perez-Quiros and Sicilia (2002) have challenged the usefulness of this rate as the correct short-term interest rate for the Euro Area due to its volatility on daily bases. Because we use Quarterly averages we are of the opinion that this should not be of interest for our analyses.

[3] Data on inflation is obtained from IFS database, data on output gap is obtained from OECD database and EONIA rates are obtained from http://www.bundesbank.de/statistik/statistik_zeitreihen.php

EONIA = 1.11 + 0.68 $r^*_{EMU.}$ R^2=0.88 (t-values between brackets)

(2.87) (6.17)

That being said, the deviation between the desired rate and the actual interest rate can be quite large in some quarters. This is, for example, the case at the start of the working of the ECB (first half of 1999) and in the first quarter of 2001 and of 2002. The ECB started with an interest rate (3%) that was too high in comparison with the computed Taylor rate, but the gap between the two interest rates was closed very soon and by the end of the year the two rates coincided. In the first quarter of 2001 the sharp decline in the interest rate as derived from the Taylor rule (mainly as a result of a sharp decrease in inflation, especially in Germany, France and Spain) was only gradually mirrored by the actual interest rate movement. The same holds for the sharp increase in the Taylor rate (which can mainly be explained by a sharp rise in inflation, especially in Germany, France and Ireland) in the first quarter of 2002. The ECB interest rate mirrors the Taylor rate but is less volatile, which is consistent with a policy of interest rate smoothing followed by the ECB (Castelnuovo, 2003).

Figure 1: EONIA compared with the Taylor-based EMU short term interest rate

(insert figure 1 here)

ECB interest rate setting and the needs of the individual member countries

In this section we concentrate on the current EMU members and compare the desired Taylor-based interest rate for each individual member country with the interest rate set by the ECB, the latter being proxied by the EONIA. In the next section we include the future EMU members too. To assess the appropriateness of the ECB's interest rate setting to the needs of the individual member countries we derive for each member country the root mean squared interest rate gap, defined as:

$$RMSIG_i = \sqrt{\frac{\sum_{t=1}^{T}\left(r_{i,t}^{*} - EONIA_t\right)^2}{T}} \qquad (4)$$

With T the number of quarters. The results of this computation are shown in figure 2.

Figure 2: Root mean squared interest rate gap: 1999-2003[4]

(insert figure 2 here)

In equation (4) we use the EONIA and not r^*_{EMU} because this variable reflects the interest rate policy of the ECB directly. The results clearly indicate that the ECB's interest rate setting has not fit all individual countries in the Eurosystem equally well. This result should not at all be surprising since the ECB conducts monetary policy for the EMU as a whole and therefore is oriented towards the EMU average of the variables. Output gap and inflation rates differ among countries, so in principle the Taylor rates will also differ. (see also e.g. De Grauwe, 2003). The lowest gaps are found for Italy, France, Austria, Finland and Belgium, whereas larger gaps apply to Greece, Portugal and the Netherlands. For Ireland the root mean squared interest rate gap is remarkably high, whereas Germany and Spain take an intermediate position. Since large countries have a greater weight in the euro area GDP and therefore also in the computation of the Taylor interest rate for the ECB, one might expect that for them the ECB rate to some extent automatically reflects their domestic desired rate. Figure 2, however, shows that although countries with a high RMSIG are all small countries, there is no relation between the size of the country and the RMSIG.

[4] Greece is included for the period 2002-2003

Figure 3 shows the mean interest rate gap, computed as:

$$MIG_i = \frac{\sum_{t=1}^{T} \left(r_{i,t}^{*} - EONIA_t \right)}{T} \tag{5}$$

Figure 3: Mean interest rate gap for the current EMU

(insert figure 3 here)

It is readily seen that there is a high correlation between the root mean squared interest rate gap in figure 2 and the mean interest rate gap in figure 3, summarized by the spearman rank correlation coefficient of 0.952. Countries for which the ECB interest rate was the least suited to their domestic needs were generally confronted with a too low European interest rate from their domestic point of view. This was the case for Spain, Greece, Portugal, the Netherlands and Ireland (in the latter country the desired domestic interest rate was on average 6.5 percentage points higher then the ECB rate). The explanation is as follows: all these countries suffered from a high inflation rate, in comparison with the European average. Germany is a well known example of the opposite situation: the ECB's interest rate was on average 100 basis points too high for this country.

Too high or too low interest rates, in relation to the domestic economic situation, not only will fail to stabilize the economy, but may also contribute to a further deterioration of the economic situation (in the sense of prolonging the recession or the inflationary boom), thereby further increasing the interest rate gap. To investigate this point the evolution of the interest rate gap is examined over time. This is shown in figure 4 for the countries with the highest squared gaps, but the conclusion extends to the whole sample of countries. It shows that, with the exception of the Netherlands, the results do not contradict the view of a widening deviation. The interest rate gaps have gone up and down since the start of the EMU, but are larger at the end than at the beginning of the EMU period.

Figure 4: Interest rate gap over time for current EMU members

(insert figure 4 here)

Converging needs?

Is there a tendency over time for the ECB interest rate setting to be more in line with the needs of the individual countries? To investigate this question the evolution over time of the root mean squared interest rate gap of the euro area is examined, where this is defined as:

$$RMSIG_{EMU} = \sqrt{\frac{\sum_{i=1}^{n}\left(r_{i,t}^{*} - EONIA_{t}\right)^{2}}{n}} \qquad (6)$$

Figure 5 reports the result of this computation. It can be seen that there is no tendency for the root mean squared interest rate gap to decrease over time. The obvious explanation for this observation the lack of convergence in output and inflation gaps among the member countries. The lack of convergence after the launch of the EMU is also noted by Duarte (2003), Honohan and Lane (2003) and Altavilla (2004).

An interesting question is whether this phenomenon is related to the business cycle. In times of expansion such as in 1999, there could be more convergence among the EMU members and the ECB might experience less problems of finding a suitable interest rate that meets the needs of the individual countries well. In periods of recession, for example in 2002, on the other hand, the EMU members might experience more divergence in their economic situation and the task of the ECB might become much more difficult. There is, however, no clear evidence of a systematic relation between a business cycle indicator such as the output gap (figure 6) and the root mean squared interest rate gap (figure 5), lending no support to the hypothesis of a business cycle effect in convergence.

Figure 5: Root mean squared interest rate gap for the current EMU area

(insert figure 5 here)

Figure 6: Output gap over time for current EMU members

(insert figure 6 here)

Including the new EMU members

On May 1, 2004 ten new member countries have joined the EU. It is to be expected that they will also join the EMU in a not so distant future. The first entrants are, in fact, expected to join in 2006-2007.

Therefore, in this section we investigate to what extent the ECB's interest rate setting could be in line with the individual needs of these new member countries, and to what extent they in turn might influence the desired interest rate of the ECB. This, of course, can only be done in retrospect, so we will have to wait until the end of the decade to give answers to these questions based on the actual data. In the meantime we can perform a rough approximation by assuming that the new countries were already members of the EMU from the start. It goes without saying that this approach is highly theoretical and therefore the results should be considered as no more than a way to clarify the main points, viz. the impact of the potential newcomers on ECB interest rate setting and the degree of convergence of these new EU members with the existing ones.

To start we recomputed equation (3), including 21 countries instead of the original 11 EMU members. For the newcomers we do not compute a desired interest rate but we take the actual interest rate of the specific countries[5]. We name the resulting desired interest rate for the enlarged euro area $r^*_{EMU\text{-}ext}$ and compare it with the previous r^*_{EMU}. This is done in figure 7. The total share of the new countries' GDP in the extended EMU area equals only 4.6% in 2003 (almost half of which is accounted for by Poland). The effect of including the newcomers in the computation of the desired interest rate will therefore only be small. It could be argued that the Taylor interest rule for the new member states is different from the old that that, for example, the equilibrium interest rate for these countries is higher than 2%. However, using equilibrium real interest rates of 3% and 4% does only marginally affect the results.

Figure 7: Taylor-based short term interest rate for actual and extended euro area

(insert figure 7 here)

Figure 7 shows that including the new countries would nevertheless have resulted in a higher desired interest rate for the euro area. The average increase for the period 1999, Q1 - 2003, Q4 is 40 basis points and 38 basis points for the last quarter. This is quite high given the small share of the newcomers in the GDP of the extended Eurozone. The explanation is that the inflation rates of the new members were very high and the output gaps were also higher than those of the old members.

[5] It is hard to find data on the output gap for the accession countries. Further, we are of the opinion that the actual interest rates can be seen as a Taylor rate for the given countries. We therefore do not compute a desired interest rate as we did for the current EMU members.

Given that the desired interest rate of the ECB was on average too low for a number of individual countries (Ireland, the Netherlands) and too high for some other countries (Germany in particular), this would have improved the situation of the former group of countries at the cost of deteriorating the situation in the latter.

Next we compare the desired interest rate for the extended EMU area with the desired interest rate of the potentially new candidates. This comes down to recalculating expression 4 and 5[6].

$$RMSIG_j = \sqrt{\frac{\sum_{t=1}^{T}\left(r^*_{j,t} - r^*_{EMU-ext}\right)^2}{T}} \qquad (7)$$

$$MIG_j = \frac{\sum_{t=1}^{T}(r^*_{j,t} - r^*_{EMU-ext})}{T} \qquad (8)$$

with j the country index for the new entrants.

The results can be found in figures 8 and 9. Comparison of figure 2 with figure 8 shows that the RMSIG of the potential new entrants is not systematically higher than for the existing EMU members. The average RMSIG for the EMU and the extended

[6] since we do not have an actual policy interest rate of the ECB (like the EONIA for the present EMU members) we use $r^*_{EMU-ext}$ as the ECB policy interest rate for the group of 21 countries.

EMU do not differ a lot, viz. average $RMSIG_i$=0.505 and average $RMSIG_j$=0.573. The Czech Republic, the Baltic countries, Malta and Cyprus range among the current EMU members with a low RMSIG. Slovenia, Poland and the Slovak Republic are similar to the group including Greece, Portugal and the Netherlands. The highest RMSIG however is found for Poland.

Figure 8: Root mean squared interest rate gap for potential new members

(insert figure 8 here)

This conclusion is confirmed by looking at the mean interest rate gaps in figure 8. It shows that the ECB's interest rate would have been on average too low for Slovenia, the Slovak Republic and especially for Hungary and Poland. On the other side it would have been on average too high for Lithuania and Latvia, yet these deviations of the ECB's interest rate with the desired domestic interest rate are not larger than those observed for the current EMU members (see figure 3). The gap is highest for Poland as a potential new member with 8 percentage points and 6 for Ireland as an old member state. The lowest gap for the old members is displayed by Germany around -1 percentage point compared to Lithuania as a potential new member with around -1.9 percentage points.

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Figure 9: Mean interest rate gap for potential new EMU members

(insert figure 9 here)

Finally we look at the evolution over time of the RMSIG of the potential EMU members. In other words we compute:

$$RMSIG_{EMU-newcomers} = \sqrt{\frac{\sum_{j=1}^{k}\left(r_{j,t}^{*} - r_{EMU-ext,t}^{*}\right)^{2}}{k}} \qquad (9)$$

with j the country index for the new entrants and k the number of accession countries.

This is done in figure 9. Comparing this figure with figure 5 we can observe a striking difference. Until the fourth quarter of 2001 the root mean squared interest rate gap for the potential new EMU members was higher than for the euro area, but the difference declined until the first quarter of 2001 where the root mean square interest rate gap became lower for the potential new entrants than for the euro area. It stayed lower until the last quarter of 2003 where the root mean squared interest rate gap declined for the euro area but increased slightly for the newcomers.

Figure 10: Root mean squared interest rate gap for potential EMU members

(insert figure 10 here)

Conclusion

The conclusions of this exercise can now be summarized as follows:

First, the policy of the ECB can be well described by a simple Taylor rule giving equal weight to output and inflation stabilization.

Second, the ECB's interest rate policy did not fit all individual EMU members equally well. The interest rate was too high for some countries (e.g. Germany) and too low for others (e.g. Ireland).

Third, there is no tendency over time for the ECB's interest rate to correspond more to the needs of the individual countries or to the overall group of current EMU members. Also, there is no difference between times of expansion and periods of contraction for the ECB interest rate to be more in line with the needs of the individual countries.

Fourth, adoption of the new EU members of the Euro will only influence the ECB's interest rate setting in a marginal way.

Fifth, the potentially new EMU members do not differ systematically from the current EMU members with respect to the appropriateness of the ECB's interest rate setting to their individual domestic needs.

Finally in contrast to the old EMU members, the potential new entrants have witnessed a remarkable tendency for increased convergence during the last few years.

Figures

Figure 11: EONIA compared with the Taylor-based EMU short term interest rate

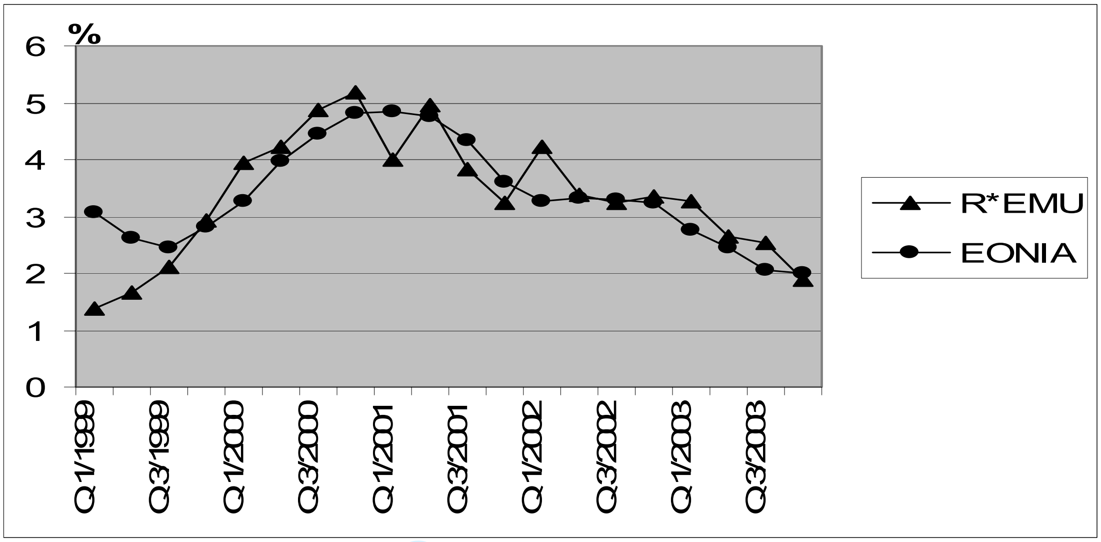
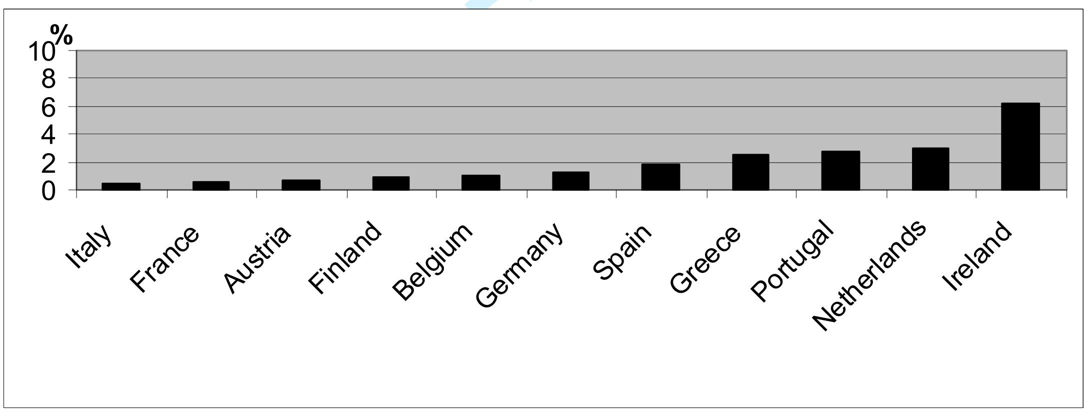


Figure 12: Root mean squared interest rate gap: 1999-2003[7]



[7] Greece is included for the period 2002-2003

Figure 13: Mean interest rate gap for the current EMU

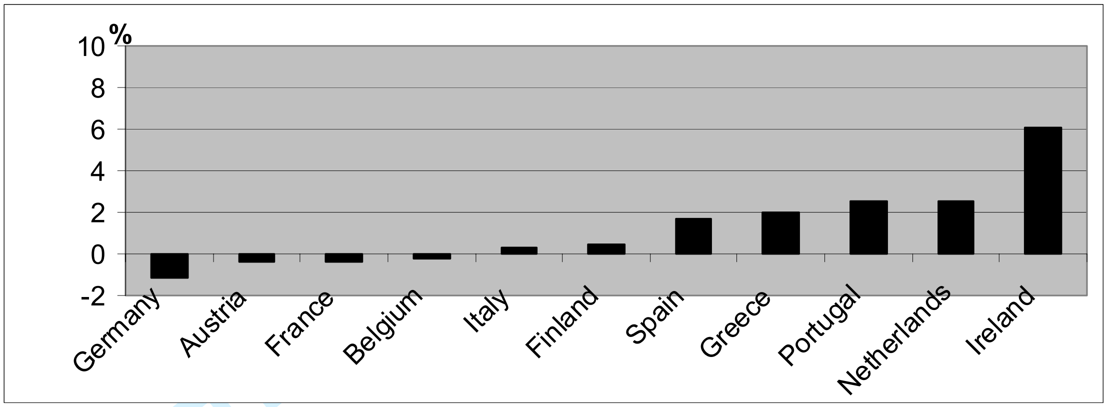


Figure 14: Interest rate gap over time for current EMU members

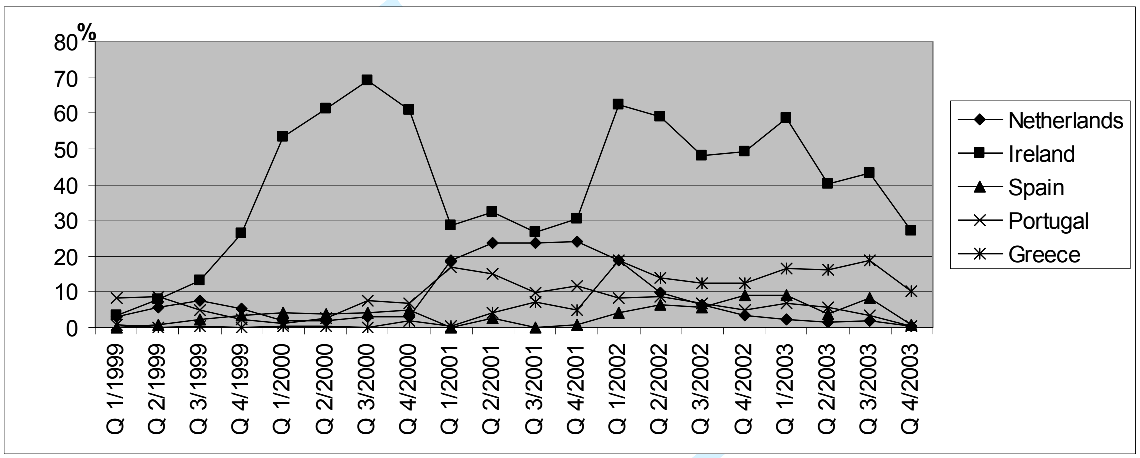


Figure 15: Root mean squared interest rate gap for the current EMU area

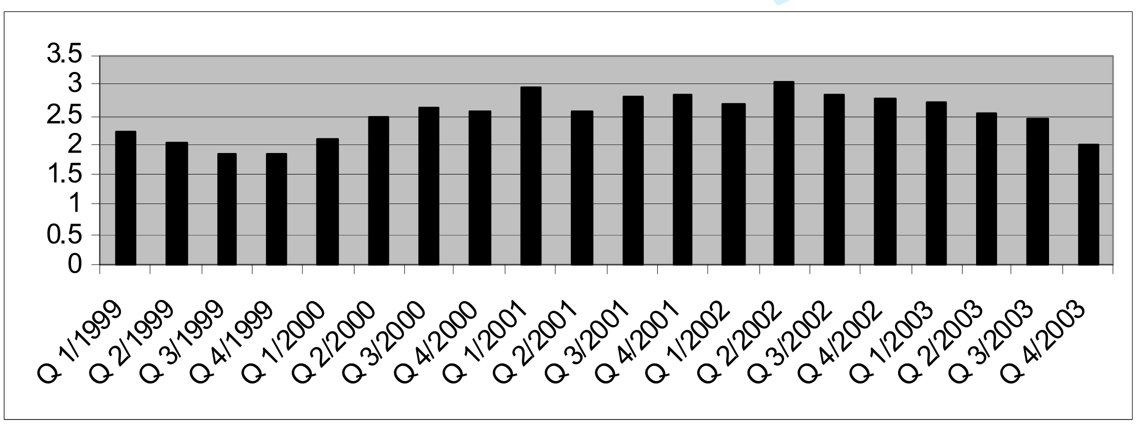


Figure 16: Output gap over time for current EMU members

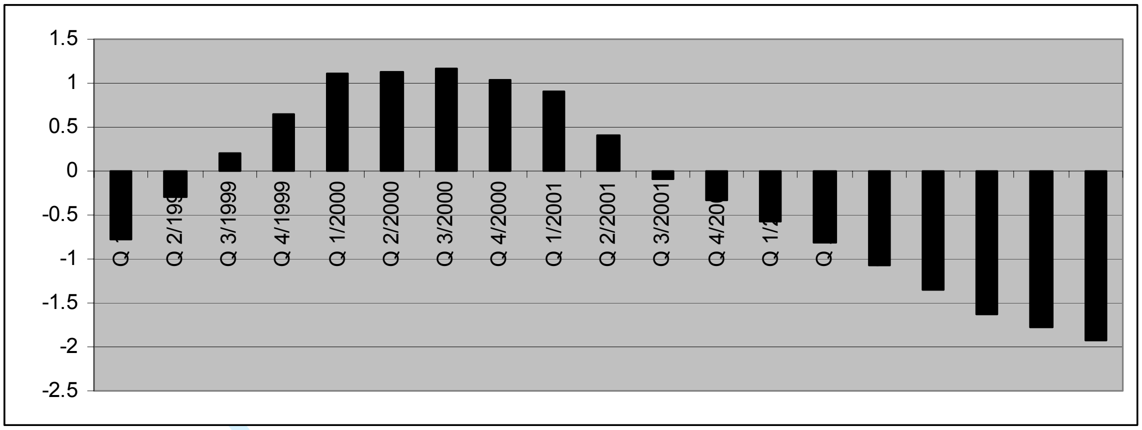


Figure 17: Taylor-based short term interest rate for actual and extended euro area

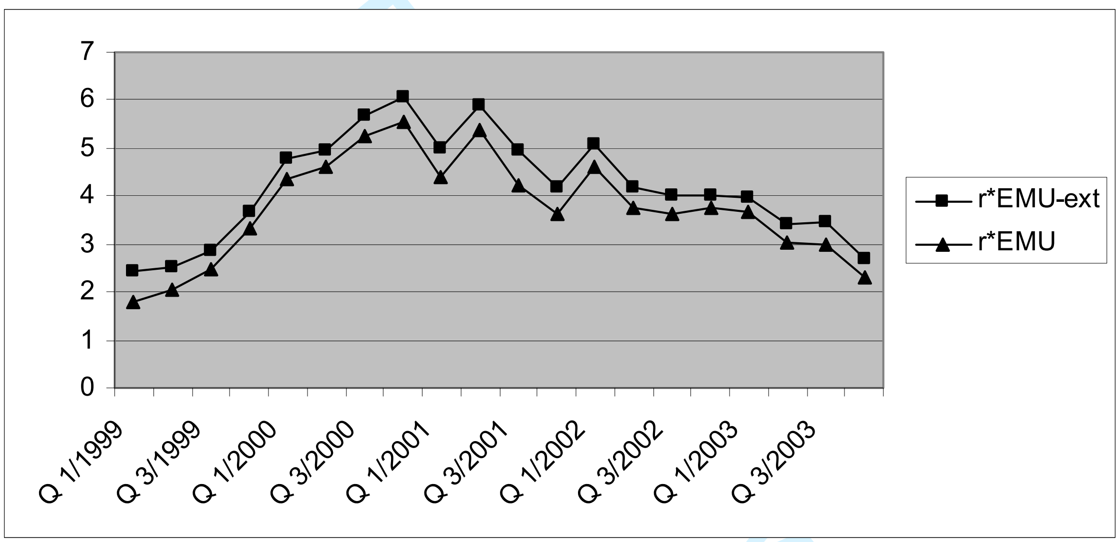


Figure 18: Root mean squared interest rate gap for potential new members

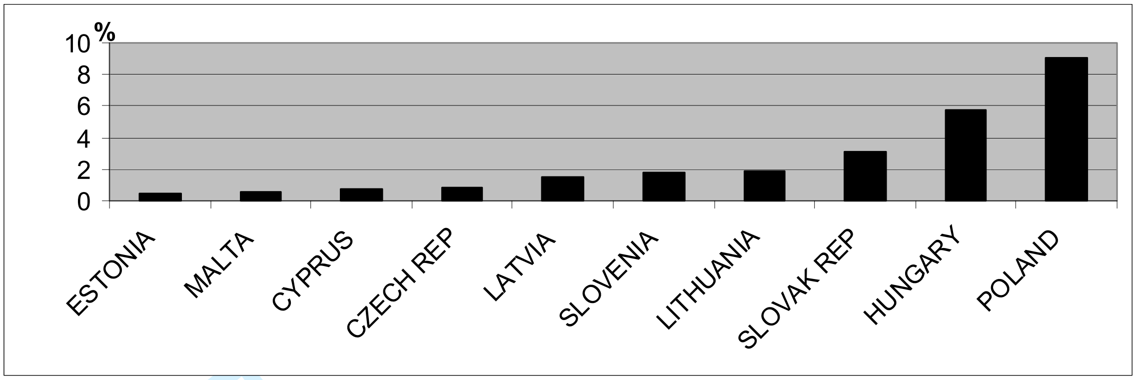


Figure 19: Mean interest rate gap for potential new EMU members

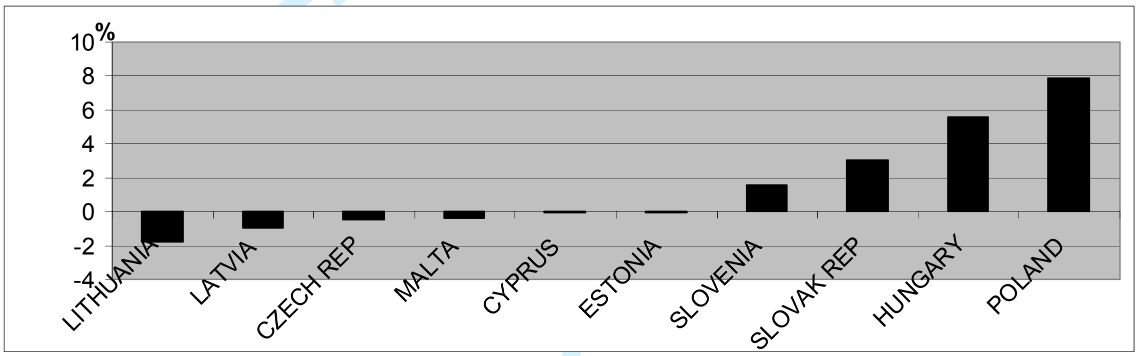
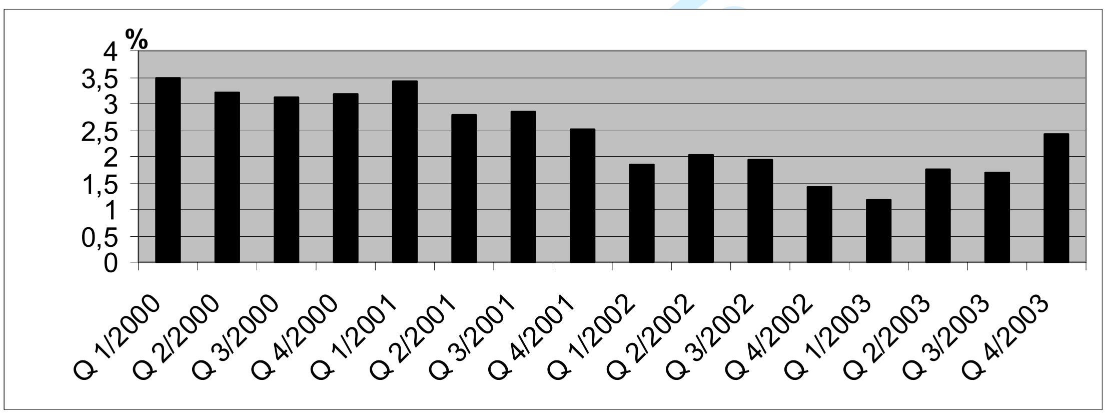


Figure 20: Root mean squared interest rate gap for potential EMU members



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