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by

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Stefan Gerlach and Gert Schnabel *

Abstract

We demonstrate that average interest rates in the EMU countries in 1990–98, with the exception of the period of exchange market turmoil in 1992–93, moved very closely with average output gaps and inflation as suggested by the Taylor rule.

* We are grateful to Joseph Bisignano, Craig Furfine, John Taylor, Kostas Tsatsaronis and Frank Smets for comments.

Contents

1. Introduction

The establishment of European monetary union (EMU) raises important questions regarding how the European Central Bank (ECB) should conduct monetary policy. The ECB has announced that it will pursue its overriding objective of price stability using a policy framework consisting of three components: a numerical definition of price stability, a "reference value" for the growth of M3, and a broad-based assessment of the inflation outlook.[1] Recently several authors, including Peersman and Smets (1998) and Taylor (1998a,b), have discussed the potential usefulness of the Taylor rule (Taylor (1993), TR hereafter) as an informal benchmark for setting policy in the EMU area.[2] There are two reasons why this approach may be attractive. First, Peersman and Smets (1998) demonstrate that within the framework of a small econometric model for the EMU area (as Rudebusch and Svensson (1998) do for the US) a TR provides a degree of macroeconomic stabilisation close to that offered by an optimal rule. Second, using a rule known to the public may help reduce uncertainty about the future course of monetary policy and thus help avoid unnecessary macroeconomic instability.

In this paper we show that a TR captures the behaviour of average interest rates in the EMU area in the 1990–1997 period, with the exception of the period of exchange market turbulence in 1992–93, extremely well. Hence, adopting such a rule as a rough guideline for policy would lead to interest rates with the same correlations with average output gaps and inflation as in the past and would in this sense offer some continuity in the setting of monetary policy in the EMU area.

2. Preliminaries

The TR is given by:

(1) $$i_t = r^{eq} + \pi_t + 0.5\left\{y_t + (\pi_t - \pi^{ob})\right\}$$

where i_t, r^{eq}, π_t, π^{ob} and y_t denote the nominal interest rate, the equilibrium real interest rate (assumed constant), the rate of inflation over the past year, policymakers' inflation objective, and the output gap, respectively. To calculate the interest rate implied by the TR, we need data on EMU-wide output gaps and inflation, and assumptions regarding the policymakers' inflation objective and the equilibrium real interest rate.

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1 The ECB has made clear that the "reference value" for M3 should not be interpreted as a target.

2 Of course, if such a rule were adopted, it should be used in a flexible manner, and interest rates should be allowed to deviate from it in response to major unexpected disturbances.

Inflation and output gaps in the EMU area. Quarterly data on the output gaps for the EMU countries were constructed by interpolating annual/semiannual data on output gaps from the OECD. Inflation was defined as the annual change in quarterly averages of national consumer price indices. Aggregation for the EMU area was done using fixed weights provided by the OECD (GDP for 1990 expressed in US dollars at PPP exchange rates).[3] Graph 1 shows the resulting measures of CPI inflation and the output gap for the EMU area (except Luxembourg).

Inflation objective and equilibrium real interest rate. We assume that the inflation objective in the EMU area during the period under consideration was 2%, as did Taylor (1993). Estimating the equilibrium real interest rate is more difficult. One possibility is to use a weighted average of ex post real interest rates. However, since countries in which the credibility of monetary policy is low have had relatively high ex post real interest rates, this strategy will lead to an overestimate of the likely equilibrium real interest rate in the EMU area. We therefore attempt to purge the part of the domestic ex post real interest rate that may be due to low credibility. To do so, we compute the average realised real interest rate – calculated as the three-month nominal interest rate minus the rate of CPI inflation over the past year – over the period 1982–1997, and the average depreciation of the nominal exchange rate against the Deutsche mark over the same period for 13 European countries.[4] Regressing the average real interest rate on a constant and the average rate of depreciation (dep), we obtain:

$$\text{real rate} = \underset{(10.4)}{3.55} + \underset{(3.83)}{0.56}\ \text{dep} + \text{error}$$

(t-statistics in parenthesis) with $\overline{R}^2 = 0.53$. The “credibility adjusted” equilibrium real interest rate is given by the fitted value, assuming no depreciation vis-à-vis the Deutsche mark. The resulting estimate is 3.55%, with a standard error of 0.96%.

Graph 2 shows that the interest rate implied by the TR and a weighted three-month interest rate for the EMU-area are very close, except for the period around the turmoil in the European foreign exchange markets in 1992–93, and a brief spell in late 1994–early 1995.[5] Of course, since the TR was originally developed to capture the setting of policy rates in a closed economy, it is by no means surprising that the rule fails to account for the movements in the EMU-11 interest rate during the period of exchange market turmoil.

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3 The weights are as follows: Austria, 2.9%; Belgium, 3.7%; Finland, 1.9%; France, 22.6%; Germany, 28.7%; Ireland, 0.9%; Italy, 21.2%; Netherlands, 5.5%; Portugal, 2.1%; and Spain, 10.5%.

4 All western European countries for which data were available were included in the sample. The sample thus included both the EMU countries (except Luxembourg, Finland and Portugal, due to data constraints) and Denmark, Norway, Sweden, Switzerland and the United Kingdom. The real interest rates were calculated on the basis of three-month eurorates, which typically did not deviate very much from the policy rates in the different countries.

5 The observation for 1999:1 is given by the actual three-month Euribor rate.

3. Econometric estimates

Next we regress the actual interest rate in the EMU area on the EMU output gap and inflation rate, and include dummies for the period 1992:3–1993:3 to control for policy responses to intra-European exchange market pressures in this period. The first column of Table 1 shows that the weight on the gap (0.45) and the weight on inflation (1.58) are strikingly close to those of the TR and highly significant. Not surprisingly, a Wald test does not reject the joint ("Taylor") hypothesis that the coefficient on the output gap is 0.5 and the coefficient on inflation is 1.5 (p = 64.1%). Furthermore, the dummies are strongly significant, and indicate that during the period of exchange market turmoil the weighted EMU-11 interest rate peaked in the fourth quarter of 1992 at a level 3.2% above the level expected on the basis of the TR. Since the Q-statistic reveals strong serial correlation, we re-estimated the equation allowing for AR(1)-residuals.[6] The results in the second column are similar to those in the first except that the Q-statistic no longer indicates any autocorrelation of the residuals. The estimate of the autocorrelation coefficient, ρ, is 0.32, indicating that half of a deviation is undone in about 0.47 quarters.

We end the empirical section by following Clarida, Galí and Gertler (1998, CGG hereafter) and estimate reaction functions of the type:

(2) $$i_t = \alpha + \beta E_t \pi_{t+4} + \gamma y_t + \theta z_t + \delta i_{t-1} + \varepsilon_t$$

where z_t denotes an additional variable.[7] As in CGG, we let this be either the lagged inflation rate (π_{t-4}), the federal funds rate, money growth or the change in the real euro/US dollar exchange rate over four quarters. The results are available in Table 2. The "benchmark" results shown in the first column of the table indicate that the inflation rate is highly significant and the short-run elasticity is 1.51. The short-run elasticity of the interest rate with respect to the output gap is 0.28 and significant at the 10% level. While this significance level is lower than the estimates for the Bundesbank reported by CGG, it should be remembered that the estimation period used here is much shorter.

Calculating the long-run elasticities, we note that they are 1.84 for inflation and 0.34 for the output gap. The fact that the coefficient on inflation is larger, and the coefficient on the output gap is smaller, when future rather than current inflation enters the regression suggests that central banks react to the output gap because it contains information about future price pressures. Since the results also indicate somewhat surprisingly that the lagged interest rate is not significant, the long-run elasticities provided

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6 This serial correlation may be due to omitted variables, or gradual responses of central banks to output and inflation.

7 We are grateful to an anonymous referee for suggesting this exercise. The equations are estimated using GMM, with π_{t+4} instrumented by a constant, the current inflation rate, the current output gap, the lagged interest rate and any other variable entering the model. Following CGG, we also use the lagged level of the real exchange rate in the regression in which the change in the real exchange rate enters among the regressors. Instead of using dummies for the 1992:3–1993:3 period, we drop these observations from the estimation period.

in the lower panel of the table are quite imprecisely estimated and it is not possible to reject the hypothesis that they are 1.5 and 0.5 as posited by Taylor (1993).

We next follow CGG and include a further variable in the analysis. In the second column of the table we add the inflation rate at time *t*–4 among the regressors; in the third column the growth rate of M3 in the euro area; in the fourth column the current federal funds rate; and in the fifth column the change over four quarters in the real euro/US dollar exchange rate. The future inflation rate remains strongly significant, except when money growth enters the equation. The output gap is typically also significant. While the coefficient on the federal funds rate is significant (but negative), the other variables are in all cases insignificant. All in all, these results suggest that the benchmark specification in the first column of the table does a good job of capturing the evolution over time of the EMU-11 interest rate.[8]

4. Conclusions

The results presented suggest that if the ECB were to conduct monetary policy using the TR, it would in fact not deviate much from past (weighted) interest rate setting behaviour in the countries forming the EMU area.

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[8] The fact that the Q-statistic indicates some fourth-order serial correlation may be because of the overlapping prediction interval arising from the use of inflation expected four quarters ahead, or because of an omitted serially correlated variable.

Table 1

Sample period 1990:1–1998:4

Dependent variable: level of EMU-11 interest rate

Constant	2.40***	2.65***
	(0.30)	(0.39)
y_t	0.45***	0.49***
	(0.06)	(0.12)
π_t	1.58***	1.51***
	(0.09)	(0.11)
Dummies		
1992:3	2.30***	2.37***
	(0.36)	(0.35)
1992:4	3.24***	3.28***
	(0.35)	(0.37)
1993:1	2.70***	2.80***
	(0.37)	(0.40)
1993:2	1.63***	1.73***
	(0.38)	(0.41)
1993:3	0.55	0.63
	(0.39)	(0.38)
ρ^1		0.32*
		(0.19)
Q-stat.[2]	1.8%	9.0%
Wald test[3]	64.1%	97.7%
Adj. R-squared	0.98	0.98

Note: */**/*** denote significance at the 10%/5%/1% level respectively; standard errors in parenthesis.
[1] First-order autocorrelation coefficient for errors. [2] p-value, null hypothesis of no fourth-order serial correlation. [3] p-value, null hypothesis that coefficient on income is 0.5 and on inflation is 1.5.

Table 2

Sample period 1990:1–1998:1
(dropping 1992:3–1993:3)

Dependent variable: level of EMU-11 interest rate

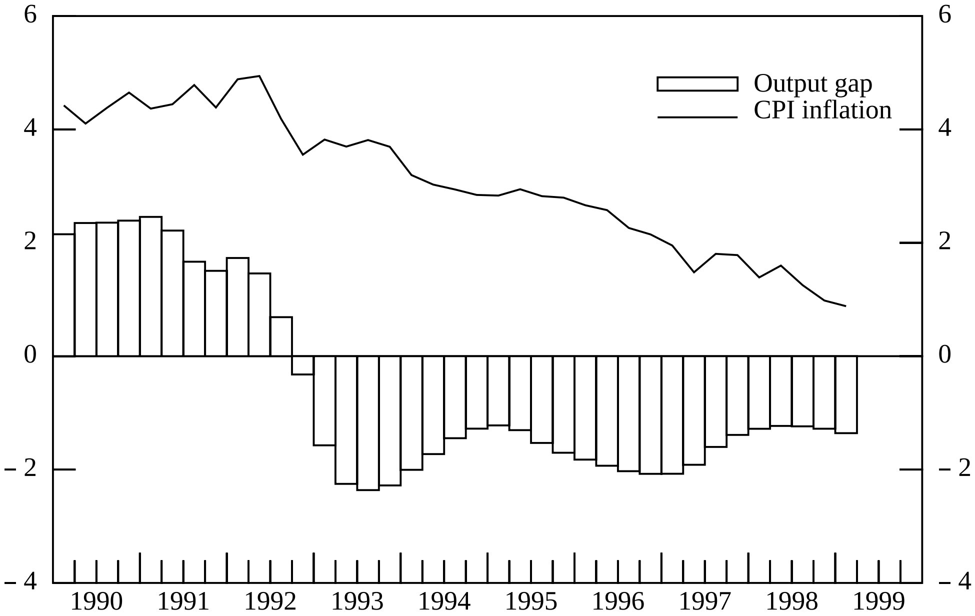
	1.95***	2.36**	1.76***	3.68**	1.40**
	(0.62)	(0.95)	(0.44)	(1.53)	(0.57)
π_{t+4}	1.51**	1.62***	0.98	1.54**	1.20*
	(0.44)	(0.47)	(0.64)	(0.72)	(0.70)
y_t	0.28*	0.22*	0.32**	0.29	0.23**
	(0.16)	(0.11)	(0.14)	(0.21)	(0.11)
i_{t-1}	0.18	0.34**	0.46	0.15	0.34
	(0.20)	(0.14)	(0.30)	(0.36)	(0.32)
Additional variable	—	Lagged inflation	Money growth	Fed. funds rate	Real euro/$ rate
		–0.56	–0.07	–0.28**	–0.03
		(0.56)	(0.07)	(0.13)	(0.02)
Q-stat.[1]	1.3%	5.5%	3.0%	2.7%	17.8%
Adj. R-squared	0.91	0.91	0.94	0.92	0.95
Implied long-run elasticities (with p-values for tests of the hypotheses that the long-run elasticities equal 1.5 and 0.5 respectively)					
π	1.84	1.61	1.81	1.81	1.82
	(25.7%)	(76.6%)	(41.7%)	(36.5%)	(41.4%)
y	0.34	0.33	0.59	0.34	0.35
	(54.5%)	(45.6%)	(84.4%)	(59.1%)	(63.1%)

Note: */**/*** denote significance at the 10%/5%/1% level respectively. The equations are estimated using GMM, with π_{t+4} instrumented by a constant, π_t, y_t, i_{t-1} and any other variable entering the model. Money growth and the real euro/US dollar rate are measured as a change over four quarters.

[1] p-value, null hypothesis of no fourth-order serial correlation.

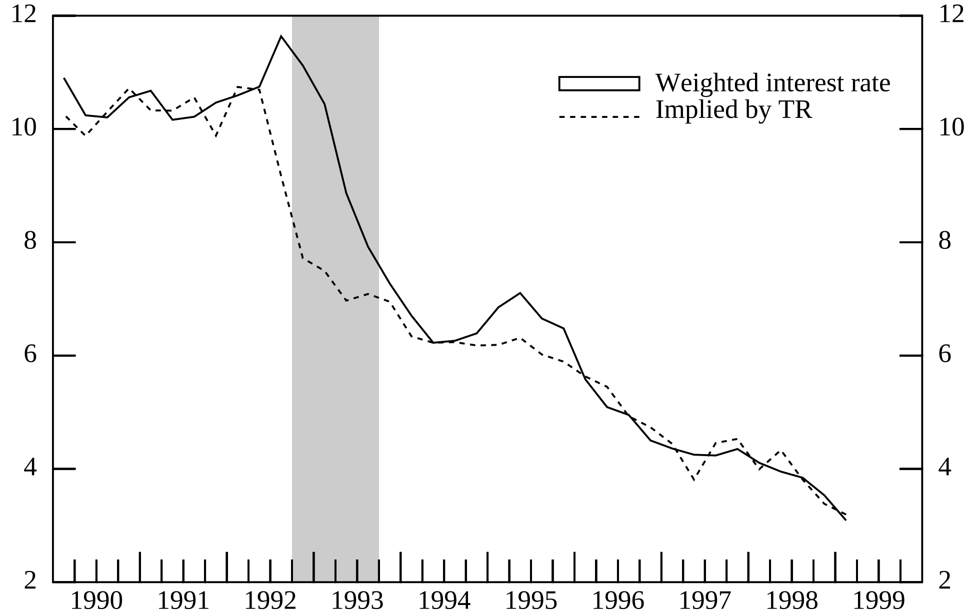
Graph 1

GDP-weighted output gap and CPI inflation in the euro area
in percentages



Graph 2

GDP-weighted three-month interest rate in the euro area together
with interest rate implied by the TR; in percentages



Note: The shaded area marks a period of exchange market turmoil.

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