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Evaluating the stresses from ECB monetary policy in the euro area

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Abstract

This paper investigates the extent to which euro area monetary policy has responded to evolving economic conditions in individual member states as opposed to the euro area as a whole. Based on a forward-looking Taylor rule-type policy reaction function, we conduct counterfactual exercises that compare the monetary policy behaviour of the ECB under alternative hypothetical scenarios: (1) the euro member states make individual policy decisions, and (2) the ECB responds to the economic conditions of individual members. Stress measures are then constructed to evaluate the degree of divergence of member state economies under these two hypothetical scenarios. The results we obtain reflect the extent of heterogeneity among the national economies in the monetary union, indicating that euro area policy rates have been particularly close to the 'counterfactual' interest rates of the largest euro members and countries with similar economic conditions, namely Germany, Austria, Belgium and France.

Maakohtaiset paineet euroalueen yhteiseen rahapolitiikkaan sopeutumisessa

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Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Tässä tutkimuksessa tarkastellaan, missä määrin euroalueen yhteinen rahapolitiikka on reagoinut koko euroalueen sijasta yksittäisten jäsenmaiden taloudellisiin olosuhteisiin. Keskuspankki käyttää korkoa rahapolitiikan välineenä. Keskuspankin ohjauskoron muutokset määräytyvät vallitsevien talouden liikakysyntäpaineiden sekä ennakoitujen tulevien inflaatiopaineiden perusteella. Tutkimuksessa verrataan kahta tosiasiallisten tapahtumien simuloitua vaihtoehtoa. Näistä ensimmäisessä rahapolitiikan päätöksenteko on delegoitu kunkin jäsenmaan keskuspankille, kun taas toisessa EKP:n toteuttama rahapolitiikka perustuu koko euroalueen sijasta yksittäisten jäsenmaiden talousnäkymiin. Työssä kehitetään painemittareita, joiden avulla voidaan verrata jäsenmaiden talouksien erkaantumista toisistaan näissä kahdessa vaihtoehtoisessa skenaariossa. Tutkimustulokset kuvastavat rahaliiton jäsenmaiden välisiä erilaisuuksia ja viittaavat siihen, että toteutuneet euroalueen ohjauskorot ovat olleet lähellä simuloituja korkoja sekä suurissa että taloudellisilta ominaisuuksiltaan samankaltaisissa jäsenmaissa, joihin tulosten mukaan kuuluvat Belgia, Itävalta, Saksa ja Ranska.

Avainsanat: Euroopan keskuspankki, rahapoliittinen toimenpide, Taylorin sääntö, kontrafaktuaali analyysi

JEL-luokittelu: E52, C53

Contents

1 Introduction

In 1999, all but four members of the then European Union participated in the final stage of the Economic and Monetary Union (EMU) process by adopting the euro as their national currency and transferring responsibility for monetary policy to the European Central Bank (ECB) – the hub institution of the Eurosystem. The official policy stance of the ECB is that monetary policy decisions are reflective of changing economic conditions of the euro area as a whole, and do not reflect the diversity among the national economies (Duisenberg, 2001). While the establishment of the ECB is necessary for a monetary union between EU member states, its 'one size fits all' monetary policy has faced criticisms on many fronts, and indeed it is now largely accepted that 'all will not fit one size' in most circumstances. The question is whether the strains are tolerable within the euro area this clearly requires empirical evaluation so as to judge which member states might encounter severe tensions by remaining in the monetary union. To begin to answer this question clearly requires empirical evaluation, so the research in this paper represents a first attempt at analysing the evolving situation in the euro area by member state.

The efficacy of a single monetary policy for all euro area members is similar to the issue of whether the member states participating in the euro area constitute an optimum currency area. Above all, the significant amount of diversity that remains among euro area members today constitutes a challenge to the implementation of a single currency or monetary policy which may or may not increase over time. A growing volume of literature (eg, Faust, Robers, and Wright, 2001; Carstensen, 2006; Arestis and Chortareas, 2006; Fendel and Frenkel, 2006, and Sturm and Wollmershäuser, 2008[1]) has attempted to evaluate the performance of the ECB in managing the aggregate economy of the euro area. For instance, Faust, Rogers, and Wright (2001) rely on the behavior of Germany's Bundesbank in the pre-euro period as a benchmark to evaluate the ECB policy. Many of these studies are, however, hampered by the short history of the euro area, so the results of these earlier studies appear to be rather fragile and/or anecdotal.

The objective of the present paper is to evaluate the performance of euro area monetary policy by comparing the historical policy behavior against the hypothetical monetary policies of its members. More specifically, we ask two related questions: (1) What would the policy interest rates have been if the ECB were to make policy decisions based on the economic conditions of individual euro area member states instead of the euro area as a whole?; and (2) What would the interest rates of euro area member states have been if their central banks were given the power to make individual policy decisions? The two questions are addressed using counterfactual exercises with a popular

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[1]The research in this paper was conducted separately from but almost concurrently with Sturm and Wollmershäuser (2008), who also construct policy stress measures using a Taylor rule. Despite the similar goals and theoretical frameworks between the two papers, the data and estimation methods differ. More specifically, Sturm and Wollmershäuser (2008) apply OLS estimation with survey data as a proxy for inflation expectations. We instead apply recursive estimation to account to structural change and a GMM estimator to capture inflation expectations. The key results of both papers are, nevertheless, comparable.

Taylor rule-type policy reaction function. Based on these exercises we can construct aggregate 'stress' measures which indicate how divergent economic conditions are within the euro area. Following Clarida, Gali, and Gertler (1998), policy 'stress' refers to the extent to which actual policy deviates from optimal policy. In the case of the ECB, its policy at a given period may not necessarily be appropriate for each of the euro area member states or what they individually would prefer. The more heterogeneity among the economic conditions of individual countries, the greater is the extent of policy stress for the ECB's single monetary policy for the whole euro area.

In addition to the counterfactual analysis – an approach different from the traditional regression-based methods in earlier studies – our work contributes to the existing monetary policy literature in three directions. First, our results benefit from nearly a decade of ECB history as opposed to earlier studies with limited data observations. Second, we implement recursive estimation to accommodate observed instability in feedback coefficients of the reaction functions. This method allows us to model evolving monetary policy conduct, particularly in terms of central banks' changing weights on individual economic variables. Third, we include monetary aggregates in the Taylor rule as a representation of the ECB's 'second pillar' of the official ECB monetary policy strategy, and also include inflation targets which represent the Maastricht criteria for inflation for the pre-1999 period.

The rest of this paper is organized as follows. The second section discusses the methodology and data. The third section presents the estimation results based on a Taylor rule-type reaction function. The fourth section discusses the results of some counterfactual exercises in order to evaluate the monetary policy implications of disparate economic experiences among euro area member states. The fifth section concludes the paper.

2 Empirical methodology

2.1 The Taylor rule

We explore central bank behavior using the Taylor rule, which has become the most popular formulation of a monetary policy reaction function.[2] As interest rates are not expected to instantaneously adjust to changes in interest rates and the output gap, a dynamic version of the Taylor rule can be used thereby incorporating 'interest rate smoothing' so that interest rates are adjusted through time to any new developments in inflation and output.

Following Clarida, Gali, and Gertler (1998) and Faust, Robers, and Wright (2001), among others, the baseline specification of a dynamic version of the Taylor rule for a central bank's policy instrument is expressed as

$$i_t = \rho i_{t-1} + (1 - \rho)i_t^* + \varepsilon_t \qquad (2.1)$$

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[2]See Fernandez and Nikolsko-Rzbevskyy (2007) for a recent comparison of different specifications of the Taylor rule.

where ε is an i.i.d. error term with a zero mean. The term i^* denotes the central bank's 'target' interest rate, and the parameter ρ captures the interest-rate smoothing behavior in monetary policy conduct, or policy inertia.

According to this forward-looking version of the policy reaction function, the central bank responds to (i) the expected rate of inflation (π_t) between periods t and t+n that is above its targeted rate π_t^* and (ii) the current expected value of the output gap, which is the difference between expected output level (y_t) and the potential output level y_t^*. Price stability and output stabilization are widely considered as the dual objectives of many central banks. From 1999 to 2003 the ECB officially followed a two-pillar strategy (European Central Bank, 2003),[3] putting equal emphasis on targeting both inflation and the money supply, but in recent years the emphasis on the money supply (the 'second pillar') has waned, leading to pressure from various quarters to reinstate money supply targeting as an important component of monetary policy.[4] The central objective of ECB monetary policy is price stability, and that is supported by the first pillar of economic analysis of dynamics and shocks (what is traditionally incorporated into a typical Taylor rule) and the 'second pillar' reflects monetary analysis, that is, developments in monetary growth, particularly in the broad M3 monetary aggregate.[5] Because of this so-called 'second pillar' of monetary policy, we augment the conventional Taylor rule with an additional variable, namely the growth rate of a monetary aggregate. From this perspective, the ECB's 'target' rate might be expressed as

$$
\begin{aligned}
i_t^* &= \beta_0 + \beta_1(E\left[\pi_{t+n} \mid \Omega_t\right] - \pi_t^*) + \beta_2(E\left[y_t \mid \Omega_t\right] - y_t^*) \qquad (2.2)\\
&\quad + \beta_3(E\left[m_t \mid \Omega_t\right] - m_t^*)
\end{aligned}
$$

where m_t denotes money growth, m_t^* its targeted rate, and E is an expectation operator given the information available to the central bank at time t, Ω_t.

To facilitate cross-country comparisons, we do not follow recent studies (eg, Clarida, Gali, and Gertler, 1998) and instead calculate the inflation rate that would satisfy EMU membership[6] for the pre-1999 period and then for the post-1999 period we use a 2% fixed 'target' rate as ECB officials

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[3]In May 2003, the ECB announced its revised monetary policy strategy that no longer explicitly assigned monetary growth a 'prominent role' in its policy conduct (Carstensen, 2006).

[4]'The second perspective or pillar – the 'monetary analysis' – focuses on a longer-term horizon, exploiting the long-run link between money and changes in the general price level.' and 'Our two-pillar approach is designed to ensure that no relevant information is lost in the assessment of the risks to price stability and that appropriate attention is paid to different perspectives and the cross-checking of information in order to come to an overall judgement of the risks to price stability'. Extracts from speech given by Axel Weber, President of the Bundesbank in York, UK, 10th June, 2008.

[5]In 2003 the two pillars were reversed, with economic analysis gaining greater prominence, and monetary analysis having a secondary role, but the ECB continues to defend a separate monetary pillar (see speech by Member of the ECB's Executive Board, Otmar Issing, at http://www.ecb.int/press/key/date/2005/html/sp050603.en.html).

[6]The Maastricht Treaty specifies that the criteria for the inflation rate for member states to qualify for membership of EMU is the lowest three inflation rates in the European Union plus 1.5 per cent.

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(European Central Bank, 1998; and European Central Bank, 2003) have explicitly defined price stability as an inflation rate below 2% over the medium term. Although the ECB has announced a reference value of 4.5% for annual M3 growth (European Central Bank, 1998), Huchet (2000) asserts that it has never attempted to keep monetary growth at that reference value by changing interest rates. Moreover, various studies (eg, Favero, Freixas, Persson, and Wyplosz, 2000; Svensson, 2000) have shown that monetary growth has never played a leading role in the monetary policy practice of the ECB, but various studies (associated with the ECB) have given credence to the use of the second pillar as a long term indicator of inflationary pressures (see Assenmacher-Wesche and Gerlach, 2007; and Assenmacher-Wesche and Gerlach, 2008). We therefore do not explicitly incorporate a monetary growth target rate for the period under study, but in econometric terms even if we inserted a 4.5% growth rate throughout the period, (as long the target were constant) this would drop out of the Taylor rule as a constant.

Against this background, we consider the following dynamic version of the Taylor rule

$$i_t = \rho i_{t-1} + (1 - \rho) \left\{ \begin{array}{c} \beta_0 + \beta_1(E\left[\pi_{t+n} \mid \Omega_t\right] - \pi_t^*) + \\ \beta_2(E\left[y_t \mid \Omega_t\right] - y_t^*) + \beta_3(E\left[m_t \mid \Omega_t\right] - m_t^*) \end{array} \right\} \ (2.3)$$

The policy feedback coefficients reflect the central bank's respective attention to price stability, economic activity and monetary growth in making monetary policy decisions. Various studies (eg, Arestis and Chortareas, 2006; Carstensen, 2006; Fendel and Frenkel, 2006; Hayo and Hofmann, 2006; Huchet, 2000) have used the above Taylor-type reaction function with or without the monetary variable to examine monetary policy for the euro area. Clarida, Gali, and Gertler (1998) also finds that this reaction function specification provides a good representation of monetary policy for major central banks in periods particularly after the early 1980s.

An earlier version of the Taylor (1993) rule employs only lagged values of the independent variables, implying a backward-looking monetary policy behavior. However, Clarida, Gali, and Gertler (1998), Faust, Rogers, and Wright (2001), and Fernandez and Nikolsko-Rzbevskyy (2007) find that the forward-looking model specification, as captured by equation (2.2), better reflects monetary policy conduct of major central banks than do its backward-looking counterparts.

2.2 Estimation issues

There are two issues in estimating the policy reaction function captured by equation (2.3). Both issues arise from the fact that data for the independent variables are not directly observable at the time that monetary policy decisions are made. First, the forward-looking specification of the Taylor rule assumes that policymakers react to their expectations about future inflation and the output gap, not their past realized values. Second, data for the output gap

requires information about the potential output level, which is also not directly observable.

For inflation expectations, we consider central banks' policy responses to one-period ahead expectations of inflation ($n = 1$). The central banks' published forecasts serve as reasonable measures for the expected inflation and output gap data, but such forecasts, however, are largely unavailable for countries other than the U.S. and the U.K. Following most studies in the recent literature, including Clarida, Gali, and Gertler (1998) and Muscatelli, Tirelli, and Trecroci (2002), we instead adopt the errors-in-variables approach that involves the generalized method of moments (GMM) to estimate *ex post* realized data along with a set of instrumental variables. To reflect the policymakers' information set at the time of an interest rate decision, the instruments include four lagged values of the policy interest rate, inflation and output gap series. GMM estimations are carried out using an optimal weighting matrix that accounts for potential heteroskasticity and serial correlation in the error term.

Another estimation issue concerns the data for potential output. A popular method to obtain estimates for potential output is to extract a nonlinear trend from GDP data using the Hodrick-Prescott (HP) filter or a band pass filter. However, Laubach and Williams (2003) argue that these univariate filters ignore information from movements in inflation and thus provide a misleading picture of the recent trends in such variables as interest rates and output. These filters are also inappropriate from a conceptual perspective. As Muscatelli, Tirelli, and Trecroci (2002) point out, they are commonly executed using the full sample of estimation data, meaning that policymakers are assumed to possess information about future GDP data that they in fact do not know in real time.

To better model policymakers' decision making process, we obtain a measure of the output gap using a structural approach. Following King, Stock, and Watson (1995) and Lee (2000), among others, we extract the unobservable trend component of the output series in line of an expectations-augmented Phillips curve model

$$\pi_t = \sum_{i=1}^{4} \phi_i \pi_{t-i} + \theta(y_t - y_t^*) + \sum_{i=1}^{4} \phi_i oil_{t-i} + \nu_t \qquad (2.4)$$

where the variable *oil* controls for the influence of supply shocks and is measured by the first-difference of the log world crude oil price level. In equation (2.4), potential output captures the level of output consistent with stable inflation, ignoring the transitory shocks to aggregate supply. The term y_t^* is an unobservable component that is estimated by a recursive Kalman filter in state-space form along with the assumption that follows a random walk (plus drift).[7]

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[7]The Kalman filter recursive updating procedure is executed in a state-space representation, in which equation (2.4) is as the measurement equation and equation (2.5) the state equation.

$$y_t^* = \delta + y_{t-1}^* + \upsilon_t \tag{2.5}$$

2.3 Data

We examine quarterly data beginning in 1994, when the forerunner of the ECB – European Monetary Institute – was created. Except for M3, the data are available through the OECD's Main Economic Indicators[8] database, and all variables are collected on a quarterly basis. Today, the euro area consists of 15 member states, including the 11 original stage three members of the EMU, Greece (joining in 2001) and Slovenia (joining in 2007), Cyprus and Malta (both joining in 2008). Because our dataset ends in 2007, the euro area here consists of the first 12 member states, excluding Slovenia, Cyprus and Malta.

Inflation is measured by the year-over-year percentage change in the Harmonised Index of Consumer Prices (HICP). To gain some perspective on the extent of heterogeneity across national economies in the euro area, we plot the inflation data for individual member states in Figure 1 along with the area-wide data. The dotted line shows the targeted inflation rates which varies according to the Maastricht Treaty inflation criteria for membership of EMU before 1999, but from 1999:1 and thereafter is fixed at two per cent.

The output gap is measured by 100 times the log level of real GDP less the log level of potential GDP. Following Clarida, Gali, and Gertler (1998), among others, the measure of monetary policy instrument is the equivalent of the overnight interbank lending rate. For example, such a rate for Germany before 1999 is its call rate. Interest rate data for the ECB between 1994 and 1998 are taken for all banks included in the calculation of the Euribor. Beginning in 1999, the interest rates for euro area member states are identical to the policy rate of the ECB, as proxied by the 1-month Euribor rate.[9]

The money growth variable is measured by the year-over-year percentage change in M3. Even though the ECB publishes M3 data for the euro area as a whole, corresponding data for individual member states are not publicly available. To deal with this problem, we use updated versions of the estimates from Mehrotra (2007) for the national contributions to euro area M3. The data are available only for 9 member states (excluding Greece, Ireland and Luxembourg) so we include the monetary variable only when available.

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[8]Euro area data refer to the evolving composition of the euro area. Data for periods prior to 2001 refer to EU11 (Austria, Belgium, Finland, Germany, Ireland, France, Italy, Luxembourg, the Netherlands, Portugal, and Spain). Data for periods between 2001 and 2005 refer to EU12 (EU11 plus Greece).

[9]Although the European Overnight Index Average (EONIA) is at first pass the best candidate, there are widely-reported problems with using this variable as a central bank policy rate because of the 4-week reserve averaging in use at the ECB, which led to very volatile rates towards the end of averaging periods.

3 Estimation results

3.1 Full sample period results

Table 1 reports GMM estimation results for the euro area as well as its member states over the period 1994:1–2007:4. Judging by the standard errors of estimates (SEE) in the sixth column of Table 1, the Taylor rule fits the data of Austria and Germany better than other euro area member states as well as the euro area as a whole. It is also noteworthy that all of the reported J-statistics (seventh column) for testing overidentifying restrictions indicate that the selected set of instruments in model estimations is relevant. In other words, the statistics support the exogeneity property of the instrumental variables with respect to monetary policy decisions.

For most member states, the estimated coefficient for the lagged policy rate (ρ) is fairly close to one, implying a great deal of 'inertia' in monetary policy.[10] The intercept term (β_0) in the 'target' rate equation represents the equilibrium or long-run 'target' rate. The respective estimates vary remarkably across member states and one is even negative (Portugal): though not statistically significant.

Similarly, the coefficient estimates for the future inflation gap (inflation rate minus targeted inflation rate) variable vary widely across member states. The estimate for the euro area as a whole is about -0.4 and statistically insignificant, which differs remarkably from those of individual member states. The estimates for Finland, Greece, Italy and Spain are relatively higher, suggesting aggressive responses to expected inflation from these member states. On the other hand, the estimates for other member states are mostly statistically insignificant, but with negative estimated coefficients for France, Ireland and the Netherlands. Unlike the estimates for inflation, the output gap coefficient estimates are mostly positive, except for the case of Portugal.

For the 9 member states that we have M3 data for, the reaction function includes M3 growth in addition to inflation and the output gap. For the euro area, the coefficient estimate for the money growth variable enters with a significant and negative sign for Austria, Germany, the Netherlands and Spain, reflecting the expected relationship between money growth and interest rates[11] but with a significant and postive sign for Portugal. The evidence of such a relationship is, however, much weaker among most member states.

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[10]Despite possible non-stationarity in the interest rate series, we follow the majority of the existing literature by specifying the interest rate variables in levels in order to compare our results with those in the literature. Alternatively, for interest rates identified with a unit-root (Finland and Ireland), we have followed Judd and Rudebusch (1998) and estimated the Taylor rule with an error-correction approach. The overall results are nevertheless the same as those reported here.

[11]A negative estimate implies that the liquidity effect dominates the expected inflation effect of an increase in money supply.

3.2 Structural change

Before proceeding further with the estimation results, it makes sense to first test for structural stability in the estimated model parameters. Particularly for euro area member states, handing over monetary policy to the ECB could lead to a change in policy feedback coefficients and thus parameter instability in the estimated policy reaction functions.

To explore possible parameter instability, we consider Chow-type tests with *a priori* unknown break points. Specifically, we compute Andrews and Ploberger (1994) MeanF and SupF, and Hansen's (Hansen, 1997) L_C statistics for estimating equation 2.3 as described in the preceding section. The Andrews-Ploberger tests are primarily for detecting a sudden break, while the Hansen test is for a smooth change.

Test results for the estimated Taylor rule are reported in the last three columns of Table 1. The null hypothesis for all tests is constancy in all estimated parameters. Parameter instability is evident for most member states the sample and the euro area, even though not all alternative statistics are significant. The L_C statistics overall provide stronger evidence of structural change than the MeanF or SupF statistics do. In other words, the bulk of euro area member states witnessed a gradual rather than abrupt change in monetary policy reaction over the estimation period.

3.3 Recursive estimation results

In light of the evidence of structural instability in the estimated policy reaction function, we follow a procedure similar to Boivin (2006) and allow for evolution in parameters by applying recursive estimations. For each country, we first run GMM estimation of equation 2.3 using data over the period 1994:1–1999:1. Sequentially, we re-estimate the model by adding data one period at a time until the estimation reaches the end of our observation period in 2007:4. Because Greece did not become part of the Eurosystem until 2001, its Taylor rule estimation ends at 2000:4 and the first period for recursive coefficient updating is 2001:1.

Figures 2 to 4 illustrate recursive estimates of the coefficients over time for the lagged interest rate (ρ), intercept (β_0), inflation (β_1), the output gap (β_2), and money growth (β_3) for each member state. The time periods shown in the plots refer to the final period of recursive estimation. The solid lines are coefficient estimates, encapsulated by the plus and minus two standard error intervals (shaded bands). To facilitate comparisons, we also superimpose the respective coefficient estimates for the euro area (dotted lines).

The plots for the estimated coefficients on the lagged interest rate reflect very little adjustment in monetary policy behavior in the face of changing economic conditions. For the euro area as a whole, the estimate is around 0.8 in the first two years of ECB operation before reaching 0.85 in 2004. The overall high degree of interest rate smoothing across member states, particularly Germany, is widely observed in the literature of policy reaction functions, eg, Clarida, Gali, and Gertler (1998), and Faust, Rogers, and Wright (2001).

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| | Explanatory Variables | | | | | | | | | |
	Lagged Interest	Intercept	Inflation Gap	Output Gap	M3	SEE	J	MeanF	SupF	L_c
Austria	0.88 *** (24.28)	4.20 ** (3.74)	0.28 (0.79)	3.16 *** (8.04)	-0.32 * (1.73)	0.25	7.62	4.73 *	12.24	1.71 **
Belgium	0.79 *** (15.07)	3.44 *** (3.36)	-0.19 (0.76)	2.51 *** (6.41)	-0.06 (1.13)	0.33	6.93	5.13 **	15.11 *	2.52 ***
Finland	0.93 *** (22.20)	0.59 (0.70)	2.40 * (2.60)	1.29 (1.40)	0.22 (1.51)	0.28	6.39	6.35 **	16.11 *	2.37 **
France	0.82 *** (18.54)	4.44 *** (4.73)	-1.14 ** (2.24)	5.46 *** (7.47)	-0.05 (1.18)	0.46	7.22	3.55	11.09	1.34 *
Germany	0.77 *** (21.18)	3.21 *** (2.98)	0.63 * (1.78)	2.34 *** (6.02)	-0.20 ** (2.46)	0.28	7.91	3.47 *	10.96	0.87
Greece	0.82 *** (12.75)	4.50 *** (3.94)	2.72 *** (4.36)	1.77 * (1.72)		1.26	5.72	3.14	8.84	1.76 **
Ireland	0.94 *** (17.34)	5.38 ** (2.64)	-0.94 * (1.69)	2.34 *** (4.38)		0.63	6.90	4.84 *	12.57	1.95 *
Italy	0.87 *** (26.13)	2.99 *** (4.26)	2.59 *** (5.03)	2.64 *** (5.24)	-0.06 (0.90)	1.18	8.63	6.10 **	16.17 *	1.07
Luxembourg	0.77 *** (8.70)	4.90 * (1.87)	0.05 (1.58)	0.85 (1.19)		0.37	7.81	7.63 ***	19.55 **	2.87 ***
Netherlands	0.95 *** (14.60)	4.76 * (1.88)	-1.12 ** (2.39)	4.31 *** (6.33)	-0.41 *** (2.82)	0.51	6.00	3.83	12.98	1.85 **
Portugal	0.78 *** (12.74)	-0.61 (1.02)	1.96 *** (3.73)	-0.77 * (1.68)	0.59 *** (5.48)	0.49	7.52	2.49	7.89	1.07 *
Spain	0.90 *** (18.43)	2.38 ** (2.33)	6.27 *** (4.82)	9.98 *** (5.06)	-0.71 *** (4.20)	0.41	8.26	3.09 **	10.26 *	1.51 **
Euro Area	0.90 *** (10.97)	2.44 ** (2.99)	-0.39 (1.04)	2.86 *** (2.75)	-0.29 *** (3.17)	0.32	7.38	2.65	8.21 **	1.48 *

Table 1.   GMM estimation and test results 1994–2007. Notes: Absolute t-statistics are in parentheses. *, **, *** denote statistical significance at the 10%, 5%, and 1%, respectively.

The intercept term represents the long-run 'target' interest rate. The estimate for the euro area hovers around four percent, but the corresponding estimates for Portugal are negative during much of the observation period and the rate for Finland is close to zero for much of the period. The declining trend in the long-run 'target' rate measures across many member states is associated with declining inflation trends over the observation period.

For the inflation coefficients, the recursive estimate in the case of the euro area is rather stable at about 1 percent before 2004, after this it declines over time. There is evidence of convergence over time between the euro area coefficient estimates and the corresponding estimates for some member states (Belgium, France, Ireland and the Netherlands), but divergence for some others (Finland, Greece, Italy and Spain). At the end of the observation period, however, there is no statistically significant discrepancy between the two coefficient estimates for Austria, Belgium, France and Ireland, but for all the other member states there is a statistically significant discrepancy, indicating divergence in inflation rates.

The fourth column of plots shows the output gap coefficient estimates. In contrast to the downward trend in the inflation coefficient estimate, the output gap coefficient estimate for the euro area shows an upward trend, reaching nearly 2.86 by 2007. The ECB's output coefficient estimates are higher than the corresponding estimates for most member states, except Spain, although it is interesting that the coefficient for France converges on that of the ECB by the end of 2007. Luxembourg and Portugal have coefficients that are either not significantly different from zero or significantly negative for much of the period. The comparative results highlight the extent of heterogeneity among individual economies within the euro area. As emphasized by ECB officials (Duisenberg, 2001), the ECB responds only to the euro area-wide economic conditions. The estimation results imply that policy might appear to be too tight for some euro area member states while too loose for others. More specifically, the ECB's weights on inflation and the output gap are higher than the corresponding weights for some member states while lower than some others.

A few studies of European monetary policy have focused on comparing the behavior of the ECB with the Bundesbank. For example, Faust, Rogers, and Wright (2001), and Hayo and Hofmann (2006) assert that the ECB in its early years put a higher weight on the output gap relative to the weight on inflation than the Bundesbank would have. However, our estimations that allow model coefficients to drift over time suggest the opposite for a much longer observation period.

The last column of plots in Figures 2 to 4 show the coefficient estimates for money growth. For the euro area, the recursive estimates remain negative over the entire observation period, even though they vary noticeably over time. For individual member states, however, the coefficients are positive in the case of Portugal. In addition, the estimates are largely indifferent from zero in the cases of Belgium and Finland and negative in the cases of Austria, France, Germany and Spain, with the most dramatic change noted for Italy and Spain where the sign of the coefficient starts significantly positive and ends up as significantly negative. These findings suggest that the ECB policy rate reflects the monetary conditions of the entire euro area, but not necessarily all its

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individual member states, but they also imply that in some member states the liquidity effect dominates and in others a (Fisher) expected inflation effect dominates.

The disparities between the coefficient estimates for the euro area and individual member states highlight the difficulty of managing different economies with a single monetary policy. However, it remains difficult from the individual plots in Figures 2 to 4 to judge whether the monetary policy might be too tight or too loose at a given period of time. For instance, as argued by Judd and Rudebusch (1998), an increase in the coefficient on the output gap may reflect central bank officials' increased emphasis on using developments in the output gap to forecast future inflation. Similarly, monetary growth is widely conceived (eg Gerlach and Svensson, 2000) as an indicator of future inflationary pressures.

4 Counterfactual analysis

4.1 Counterfactual analysis for policy rates

Given the estimation results for the Taylor-type reaction function, we ask the following questions:

1. What would the policy rates have been if the ECB made decisions based on the economic data of individual member states instead of the euro area as a whole?; and

2. What would interest rates for a euro area member state have been if its central bank were to make its own policy decisions instead of adopting the ECB policy?

To address the first question, we perform a set of counterfactual exercises as follows. For each country, we calculate the path of its interest rate using the estimated coefficients for the ECB but using its own historical values for the explanatory variables. More specifically, we generate 'counterfactual' interest rates for each member state as

$$\widetilde{i}_t = \widehat{\rho}^a \widetilde{i}_{t-1} + (1 - \widehat{\rho}^a) \left\{ \widehat{\beta}_0^a + \widehat{\beta}_1^a (\pi_{t+1} - \pi_t^*) + \widehat{\beta}_2^a (y_t - y_t^*) + \widehat{\beta}_3^a m_t \right\} \quad (4.1)$$

where an 'a' superscript denotes the corresponding estimate for the euro area and a coefficient with a hat represents a (time-varying) recursive coefficient estimate obtained from the preceding section. Only coefficient estimates that are statistically significant at the 10% level or higher in full-sample estimation (Table 1) are included in generating the 'counterfactual' interest rate paths. In addition, the last term is ignored for member states (Greece, Ireland and Luxembourg) without M3 data. Equation (4.1) essentially generates the hypothetical interest rate series for the ECB by assuming that it made monetary policy decisions for each member state individually based on its national data.

Alternatively, the second question deals with a hypothetical situation in which central banks in the euro area were to set interest rates individually. We assume that the central banks followed a policy rule established prior to 1999:1, as captured by the same Taylor rule in equation (2.3) estimated over the period 1994:1-1998:4. In other words, we generate another set of 'counterfactual' policy interest rates by replacing the coefficients in equation (4.1) with the estimates for the pre-1999 subperiod. Because Greece did not become part of the euro area until 2001, the Taylor rule estimation ends at 2000:4 and the first period of simulation is 2001:1.

Figure 5 shows the results of the counterfactual exercises. The solid lines are in-sample forecasts of the policy rate using the inflation targeters' own recursive coefficient estimates. The shaded bands are the 95% confidence intervals around the in-sample fitted values, and these are used as 'baseline' values to assess the appropriateness of ECB monetary policy. For each country, a dotted line is a 'counterfactual' series obtained from fitting equation (4.1) with the recursive coefficient estimates for the ECB reaction function but the values of the explanatory variables for that member state. A dashed line is a 'counterfactual' series obtained from fitting equation (4.1) with the fixed coefficient estimates for individual member states over the pre-1999 subperiod instead of using the ECB coefficients.

The majority of 'counterfactual' series implied by the estimated ECB reaction function (dotted lines) mirror the general trend of the fitted interest rates (in-sample fitted values) but they are more volatile. This implies that ECB monetary policy has been more rigid over time than the hypothetical interest rates that responded to the economic conditions of individual euro area member states. In the case of Finland, France, Germany, Ireland, Luxembourg, the Netherlands and Portugal the two series are overall not qualitatively different from each other over the simulation period, as judged by the 95% confidence bands. The two series are the closest for Germany.

In comparison with the first set of 'counterfactual' series, there appears more disparity among the second set of 'counterfactual' series (dashed lines) that are constructed using the estimated Taylor rules of individual member states over the pre-euro subperiod. Except for Austria, Belgium, Italy, the Netherlands, Portugal and Spain, the 'counterfactual' series tend to follow the same trends as the fitted series. There is no meaningful discrepancy between the 'counterfactual' interest rate and the fitted rate over time in the cases of Finland, France, Germany, Ireland and Luxembourg. Similar to the first set of counterfactual exercises, these counterfactual exercises suggest that if the majority of national central banks in the euro area were to follow their own policy rules established prior to joining the monetary union, then their interest rates would have been meaningfully different from those set by the ECB. In particular, the results show that the economic conditions in the Netherlands, Portugal and Spain would have dictated higher interest rates than those set by the ECB.

4.2 Counterfactual analysis for 'target' rates

The results in the above counterfactual analyses are largely affected by the substantial amounts of interest rate smoothing in monetary policy conduct. As with Faust, Rogers, and Wright (2001), we alternatively perform counterfactual exercises on the 'target' interest rates instead of the actual policy rates. To gain some perspective on the importance of focusing on the 'target' interest rates, Figure 6 plots the actual interest rates (solid lines) and the fitted 'target' values (dotted lines). For each country, the fitted 'target' rates are the fitted values using the recursive coefficient estimates in equation (2.1). These values are essentially predictions of the ECB monetary policy rate as a function of the inflation and the output gap variables. In most cases, the fitted 'target' series is less smooth than the actual interest series and any deviation between the two appears temporary over time. The exceptions are the cases for Finland and Ireland. For Finland, the fitted 'target' rate is persistently lower than the actual ECB rate, reflecting the lower inflation that was sustained over much of the post-1999 period. The opposite is true of Ireland.

In light of the observed differences between the actual interest rates and the fitted 'target' values, we replicate the counterfactual exercises in the previous subsection for the 'target' rate instead of the actual policy rate. To do so, we generate a counterfactual 'target' rate $(\widetilde{i_t^*})$ path for each country using a procedure analogous to that captured by equation (4.1)

$$\widetilde{i_t^*} = \widehat{\beta}_0^a + \widehat{\beta}_1^a(\pi_{t+1} - \pi_t^*) + \widehat{\beta}_2^a(y_t - y_t^*) + \widehat{\beta}_3^a m_t \tag{4.2}$$

Analogous to the results for actual policy rates in Figure 6, Figure 7 shows the counterfactual results for the 'target' rates. Again, the solid lines are in-sample forecasts using the member states' own estimated coefficients, the dotted lines (exercise 1) are 'counterfactual' series using the ECB's reaction function, and the dashed lines (exercise 2) are 'counterfactual' series using the individual member states' pre-euro reaction function.

The overall findings stand in contrast to those observed in Figure 6. For the counterfactual exercises under the hypothetical scenario that the ECB responded to the economic data of individual member states, there is some discrepancy between the fitted interest rates and the 'counterfactual' path (dotted line) for every country. The 'counterfactual' path follows most closely the fitted 'target' rates in the cases of Austria, Belgium, France, Germany and the Netherlands. Overall, the two interest rate paths tend to be much closer in the second half of the observation period than the earlier years of ECB history. This reflects convergence of the euro member states.

Under the alternative hypothetical scenario that central banks were able to pursue individual monetary policy, the counterfactual 'target' rate path (dashed line) follows the fitted 'target' rates most closely in the cases of France and Germany. In those cases, the discrepancy between the two series is virtually nonexistent, implying that the ECB policy conduct is a natural extension of the policy of the Bundesbank and the Banque de France. Other than Germany and France, the counterfactual series and fitted 'target' rate series are quite close in the cases of Luxembourg and the Netherlands.

On the contrary, the counterfactual 'target' rate paths for other member states are persistently higher than their fitted 'target' rates over much of simulation period. This is attributable to the fact that those member states had experienced relatively high inflation prior to joining the monetary union.

Overall, the counterfactual results for the 'target' rates clearly reveal that the ECB monetary policy best reflects the economic conditions of the larger members, and most notably Germany and France. The divergence between the fitted ECB 'target' rate and the rate implied by a country's economic conditions is more pronounced for smaller euro area members. The results are supported by Huchet (2000), who finds asymmetric ECB policy effects among euro area members. Moreover, the findings in this subsection, which stand in contrast to the results for the observed policy rates in the preceding subsection, highlight the role of the interest rate smoothing behavior in monetary policy conduct.

4.3   Policy stress

The results of the counterfactual exercises in Figure 7 could be considered to reveal the extent of policy 'stress' for a monetary union like the euro area, as emphasized by Clarida, Gali, and Gertler (1998) and as implemented by Sturm and Wollmershäuser (2008) and Flaig and Wollmershäuser (207). Figure 8 plots the gaps between the fitted 'target' rate series and the counterfactual series constructed using equation (4.2). In particular, the point estimates in Figure 8 equal the fitted 'target' rates for each country (solid lines in Figure 7) minus the counterfactual 'target' rates using the ECB feedback coefficients (dotted lines in Figure 7). A positive value implies that the ECB target rate was higher than what would be expected by a euro area country using its country-specific data, while a negative value, on the contrary, implies that the ECB policy was more accommodative than expected. The shaded areas represent the 95% confidence bands using the bootstrap method with 1,000 replications.

Even though the results in Figure 8 vary markedly across member states as well as over time, it is apparent that the extent of monetary policy stress is overall not qualitatively significant for Austria, Belgium, France, Germany and the Netherlands. The results for these five member states are consistent with the argument of Sturm and Wollmershäuser (2008) that small euro area members have received more than proportional weights in ECB monetary policy decisions. On the other hand, the ECB 'target' rates beginning 2003 were more accommodative for such member states as Portugal and Greece, than the target rates warranted by the economic conditions of these individual member states.

Figure 9 illustrates the extent of policy stress of different member states, as measured alternatively by taking the difference between the fitted 'target' rates (solid lines in Figure 7) minus the counterfactual 'target' rates using the pre-euro coefficients of those member states (dashed lines in Figure 7). For three member states (France, Germany and Luxembourg), the point estimates are not qualitatively different from zero, meaning that the ECB 'target' rates

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were no different from the target rates implied by their policy rules adopted in the pre-euro period. By contrast, the estimates are overall negative for five member states (Austria, Greece, Italy, Portugal and Spain), meaning that the ECB 'target' rates tended to be more accommodative than if these member states were to set their own 'target' rates according to their individual policy rules established before joining the euro area. Taken together, Figures 8 and 9 suggest that the ECB 'target' rates might have been consistent with the rates preferred by some member states, but they have appeared too loose for some other members.

To gain some perspective about the 'stress' of using a single ECB monetary policy on the national economies of the euro area, Figure 10 plots the weighted averages of the respective policy stress indicators of individual members where the member states' annual GDP data are used to calculated the weights. The absolute value of a member state's policy stress data is used so that an ECB monetary policy decision that is tighter than optimal for an individual member state is treated equally to an ECB target rate that is too loose. The upper panel of Figure 10 corresponds to the counterfactual exercise 1 with the ECB coefficients. The plot reveals that the overall monetary policy stress in the euro area declined gradually in the first two years of the ECB operation and hovered around 2% over the rest of the observation period. The pattern in the early years of the ECB can be interpreted as evidence of convergence among EMU members. From around the middle of 2005 the stress indicator decreased to around 1.5%, but in more recent years (since roughly the 2nd quarter of 2007), however, the monetary policy stress has clearly shown an increase.

The lower panel of Figure 10 corresponds to the counterfactual exercise 2 with the pre-euro coefficients. In contrast to the pattern in the upper panel, this ECB policy stress indicator appears more stable and its size is around the same level at around 1.5%. The noticeable exception is the nearly zero policy stress in 2001 when most euro area members experienced an economic slowdown and then in 2006 when many member states also experienced significantly slower growth than before. Since the third quarter of 2006, however, there has been a sharp upturn in monetary policy stress, and as of the 3rd quarter of 2007, the indicator was higher than at any time since the inception of the euro area. Taken together, the plots in Figure 10 indicate that the ECB policy rates were on average 1% to 2% different from what would be optimal for its participating member countries.

4.4   Robustness check

How robust are our empirical findings? To answer this question, we have replicated the estimation and counterfactual exercises with several modifications. First, instead of the Kalman filter, we have employed the standard HP filter and band pass filter to extract the trend component in the GDP series. In either case, the output gap is measured as the deviation of actual output from a nonlinear low-frequency trend component. Second, instead of recursive estimations, we have performed estimations using a rolling window of five years. Third, we have alternatively estimated the Taylor

rule equation using contemporaneous and two-period-ahead data instead of one-period-ahead data for inflation. Overall, these alternative specifications have no appreciable qualitative effect on the results presented above.

5   Conclusions

ECB officials claim that monetary policy decisions take into consideration the aggregate economic conditions of the euro area and disregard divergent national developments. Against this background, this paper has investigated the extent to which the ECB has responded to changing economic conditions of individual euro area member states versus the euro area as a whole. To this end, we first estimated a Taylor-type policy reaction function for euro area member states as well as for the euro area as a whole. The estimation results exhibit substantial disparities across member states, reflecting the extent of heterogeneity among the national economies inside the euro area.

We also conducted counterfactual exercises based on the estimated reaction functions to explore two alternative hypothetical scenarios. Under the hypothetical condition that the ECB responded to the economic conditions of individual euro area members, the 'target' interest rates for most member states except France and Germany would have been quite different from those predicted by the area-wide data. This implies that the ECB policy rule best fits the economic conditions of certain member states.

Similar results for Germany and other contiguous member states (such as Austria and Belgium) hold in the counterfactual exercises under an alternative hypothetical scenario that individual euro area member states were able to set their own policy rates. On the other hand, had other euro area member states followed their own policy rule, then their interest rates would have been quite different from those predicted by the ECB policy rule.

The extent of heterogeneity across national economies within the euro area entails a challenge for delegating the responsibility of monetary policy to the ECB. Our empirical findings prompt concerns about the efficacy of a single monetary policy in reacting to changing economic conditions of individual euro area member states. Because economies of euro area member states have been somewhat unsynchronized, ECB policy actions, which might be adequate for the euro area as a whole, might have been too loose for such faster growing member states as Greece and Ireland but too tight for slower growing member states, such as Italy.

References

Andrews, D W – Ploberger, W (1994) **Optimal tests when a nuisance parameter is present only under the alternative.** Econometrica 62(6), 1383–1414.

Arestis, P – Chortareas, G (2006) **Monetary policy in the euro area.** Journal of Post Keynesian Economics 28(3), 371–394.

Assenmacher-Wesche, K – Gerlach, S (2007) **Money at low frequencies.** Journal of the European Economic Association 5, 534–542.

Assenmacher-Wesche, K – Gerlach, S (2008) **Interpreting euro area inflation at high and low frequencies.** European Economic Review, Forthcoming.

Boivin, J (2006) **Has U.S. monetary changed? Evidence from drifting coefficients and real-time data.** Journal of Money, Credit, and Banking 38(5), 1149–1173.

Carstensen, K (2006) **Estimating the ECB policy reaction function.** German Economic Review 7(1), 1–34.

Clarida, R – Gali, J – Gertler, M (1998) **Monetary policy rules in practice: Some international evidence.** European Economic Review 42, 1033–1067.

Duisenberg, W (2001) **Some remarks on the euro in a U.S. context.** Speech by President of the ECB at a Breakfast Meeting of the Council on Foreign Relations, New York, April. 19th.

European Central Bank (1998) **A stability-oriented monetary policy strategy for the ESCB.** ECB Press Release, October 13, accessed at www.ecb.int.

European Central Bank (2003) **The ECB's monetary policy strategy.** ECB Press Release, May 8th, accessed at www.ecb.int.

Faust, J – Rogers, J – Wright, J (2001) **An empirical comparison of busnesbank and ECB monetary policy rules.** International Finance Discussion Paper No. 705, Board of Governors of the Federal Reserve System, Washington DC, USA.

Favero, C – Freixas, X – Persson, T – Wyplosz, C (2000) **One money, many countries: Monitoring the european central bank no.** Centre for Economic Policy Research, London, UK.

Fendel, R M – Frenkel, M R (2006) **Five years of single european monetary policy in practice: Is the ECB rule-based?** Contemporary Economic Policy 24(1), 106–115.

Fernandez, A Z – Nikolsko-Rzbevskyy, A (2007) **Measuring the Taylor rule's performance.** Federal Reserve Bank of Dallas Economic Letter 2(6).

Flaig, G – Wollmershäuser, T (2007) **Does the euro-zone diverge? A stress indicator for analyzing trends and cycles in real GDP and inflation.** CESifo Working Paper No. 1937, University of Munich, Munich, Germany.

Gerlach, S – Svensson, L (2000) **Money and inflation in the euro area: A case for a monetary indicator?** NBER Working Paper No. 8025, Cambridge, MA, USA.

Hansen, B (1997) **Approximate asymptotic p-values for structural change tests.** Journal of Business and Economic Statistics, 60–67.

Hayo, B – Hofmann, B (2006) **Comparing monetary policy reaction functions: ECB versus Bundesbank.** Empirical Economics 31, 645–662.

Huchet, M (2000) **Does single monetary policy have asymmetric real effects in EMU?** Journal of Policy Modelling 25, 151–178.

Judd, J – Rudebusch, G (1998) **Taylor's rule and the fed: 1970–1997.** Federal Reserve Bank of San Francisco Economic Review 3, 3–16.

King, R G – Stock, J H – Watson, M (1995) **Temporal instability of the unemployment-inflation relationship.** Federal Reserve Bank of Chicago Economic Perspectives 19(3), 2–12.

Laubach, T – Williams, J C (2003) **Measuring the natural rate of interest.** Review of Economics and Statistics 85(4), 1063–1070.

Lee, J (2000) **The robustness of Okun's law: Evidence from OECD countries.** Journal of Macroeconomics 22(2), 331–356.

Mehrotra, A (2007) **A note on the national contributions to euro area M3.** Bank of Finland Discussion Paper 2/2007, Bank of Finland, Helsinki, Finland.

Muscatelli, V A – Tirelli, P – Trecroci, C (2002) **Does institutional change really mater? Inflation targets, central bank reform and interest rate policy in the OECD countries.** The Manchester School 70(4), 487–527.

Sturm, J-E – Wollmershäuser, T (2008) **The stress of having a single monetary policy in europe.** CESIFO Working Paper No. 2251, University of Munich, Munich, Germany.

Svensson, L E O (2000) **The first year of the eurosystem: Inflation targeting or not?** American Economic Review 90, 95–99.

Taylor, J B (1993) **Discretion versus policy rules in practice.** Carnegie-Rochester Conference Series on Public Policy 39, 195–214.
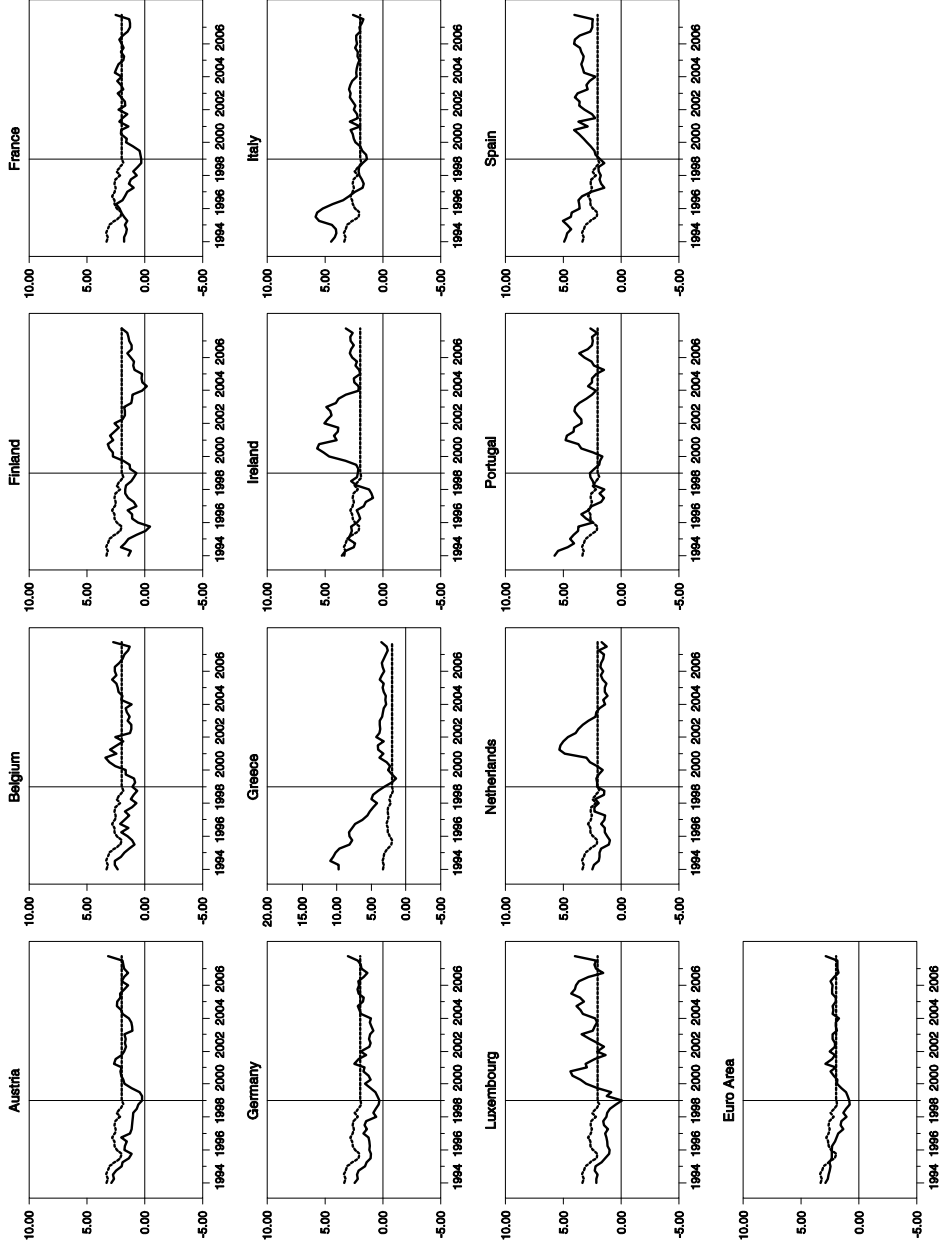
Figure 1.   Inflation rates. The vertical line marks the formal inception of the final stage of EMU in 1999. Solid lines represent HICP inflation rates. Dotted lines represent inflation targets (see text).
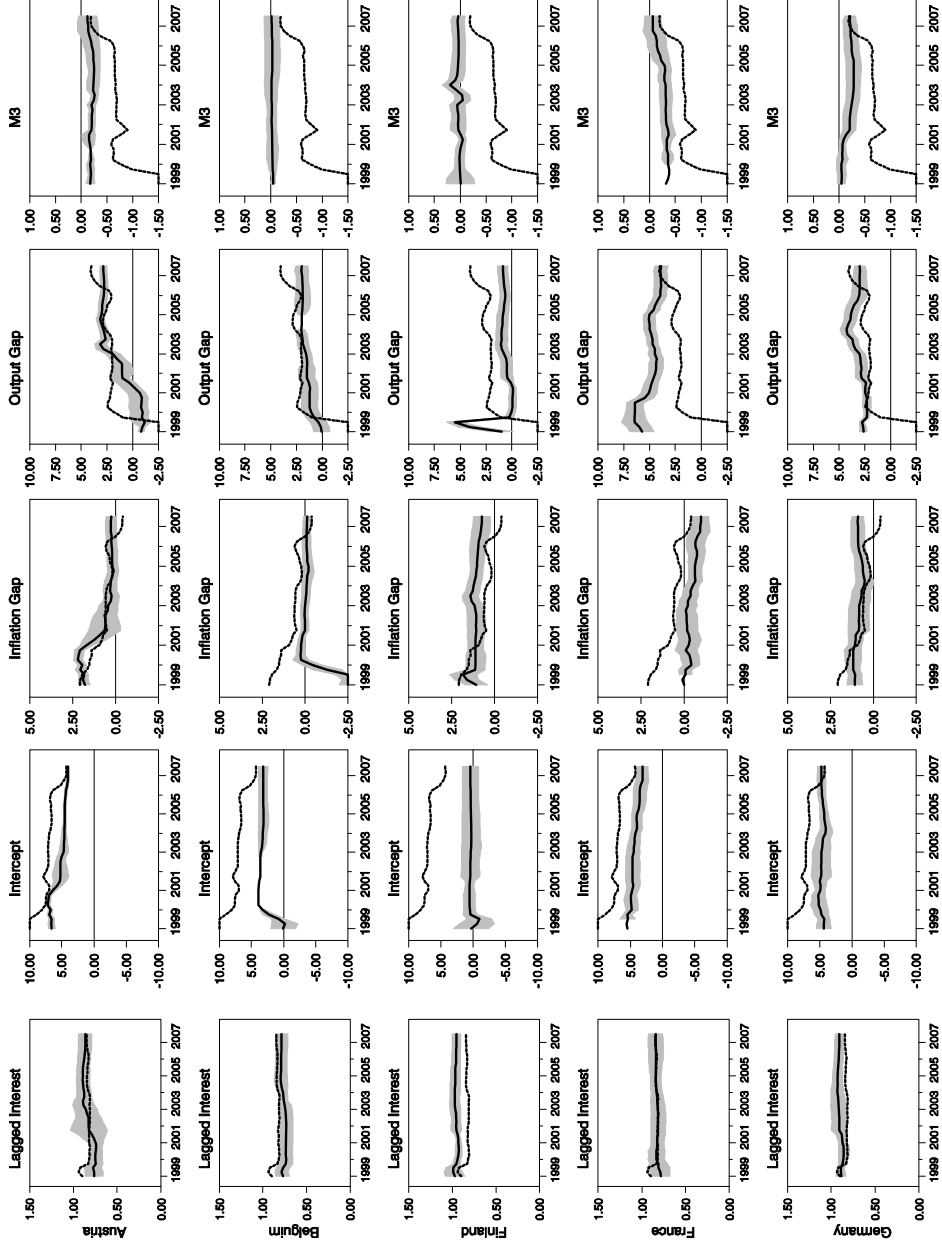
Figure 2.   Recursive coefficient estimates. Dotted lines represent estimates for the euro area. Shaded areas are +/− two standard error intervals around point estimates.
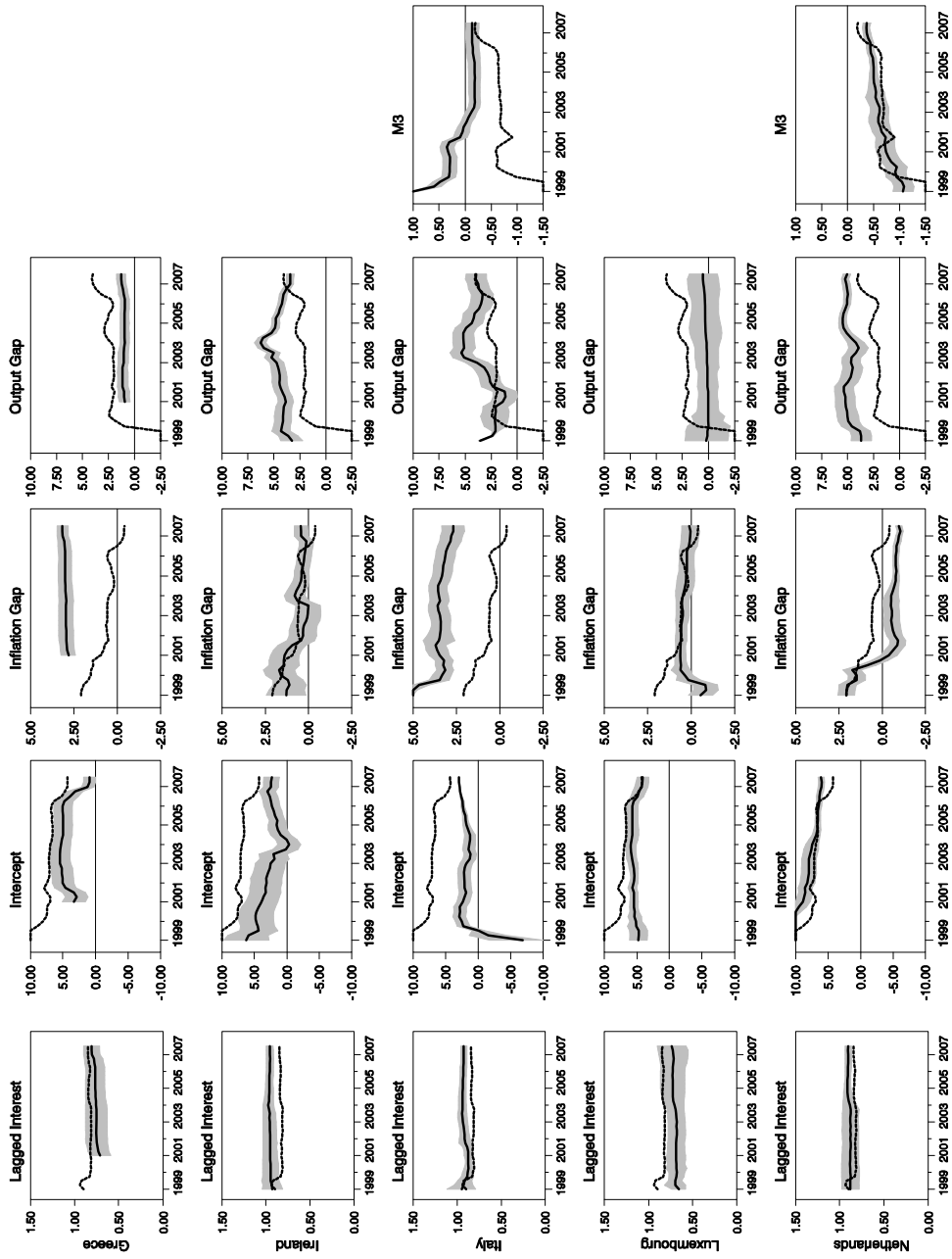
Figure 3.   Recursive coefficient estimates (continued)
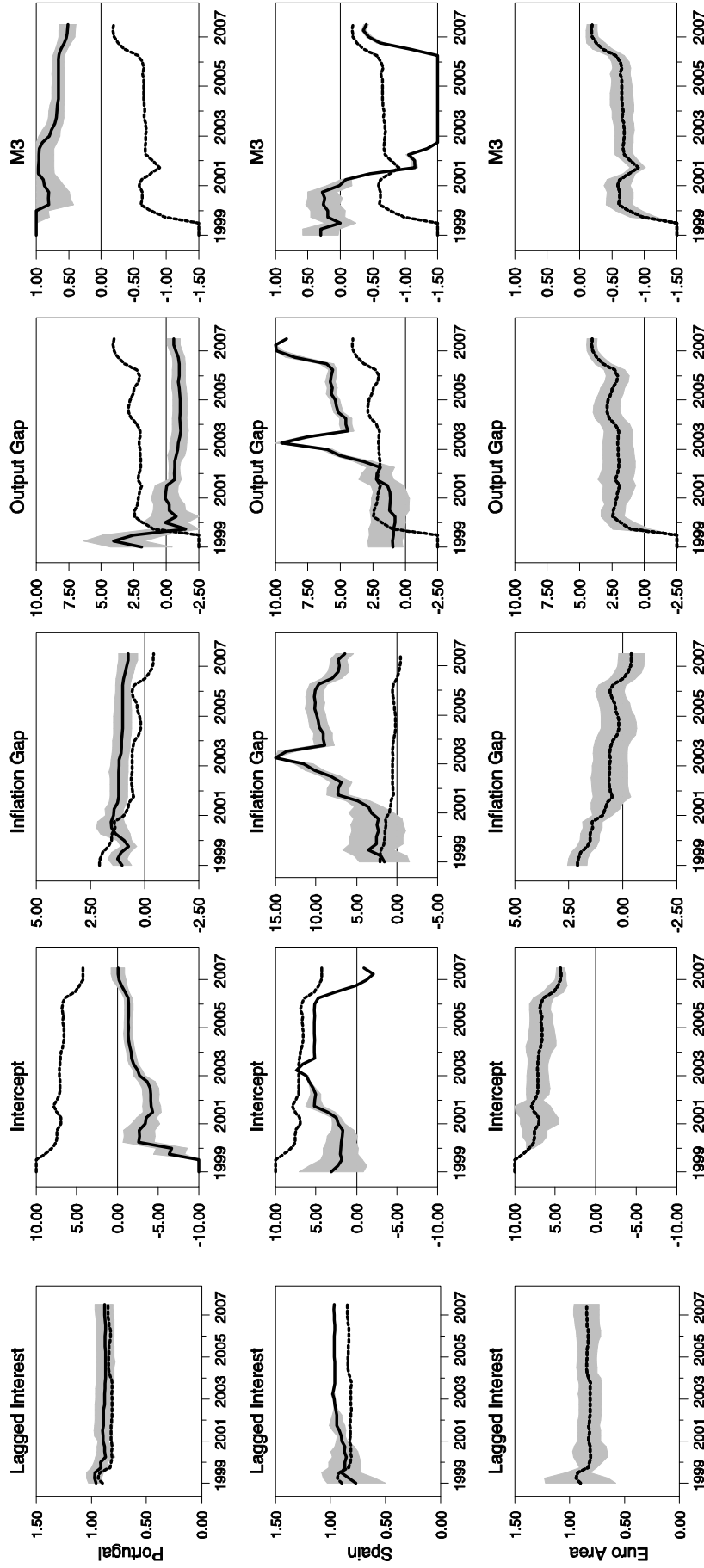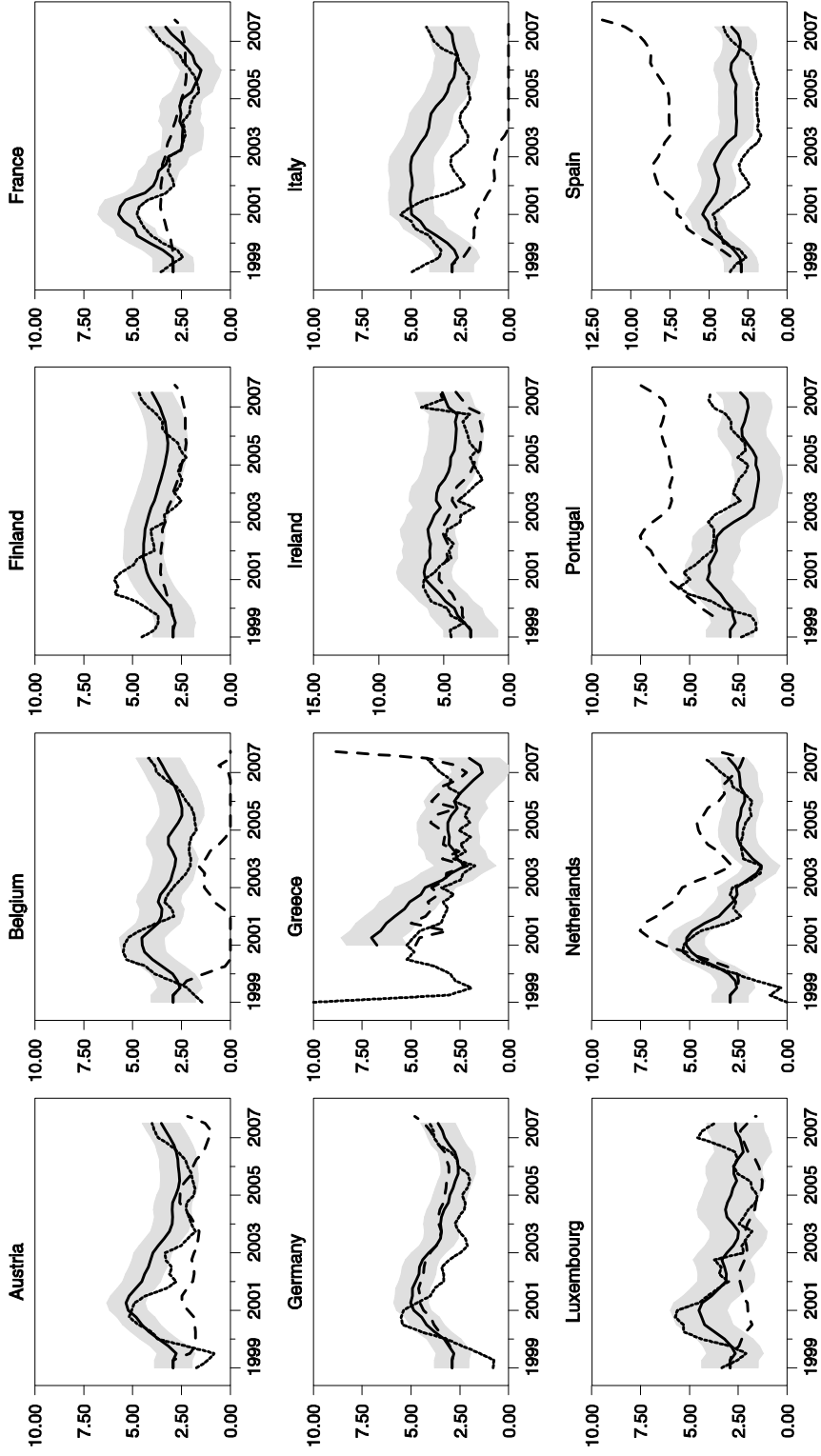
Figure 4. Recursive coefficient estimates (continued)

Figure 5.   Counterfactual results for fitted policy rates (solid lines represent the fitted policy rates, encapsulated in 95% confidence bands. Dotted lines represent the counterfactual series projected by using the estimated Taylor rule for the ECB but data of individual euro area members. Dashed lines represent the counterfactual series projected by using the estimated Taylor rules for the pre-euro sample but historical data for explanatory variables).
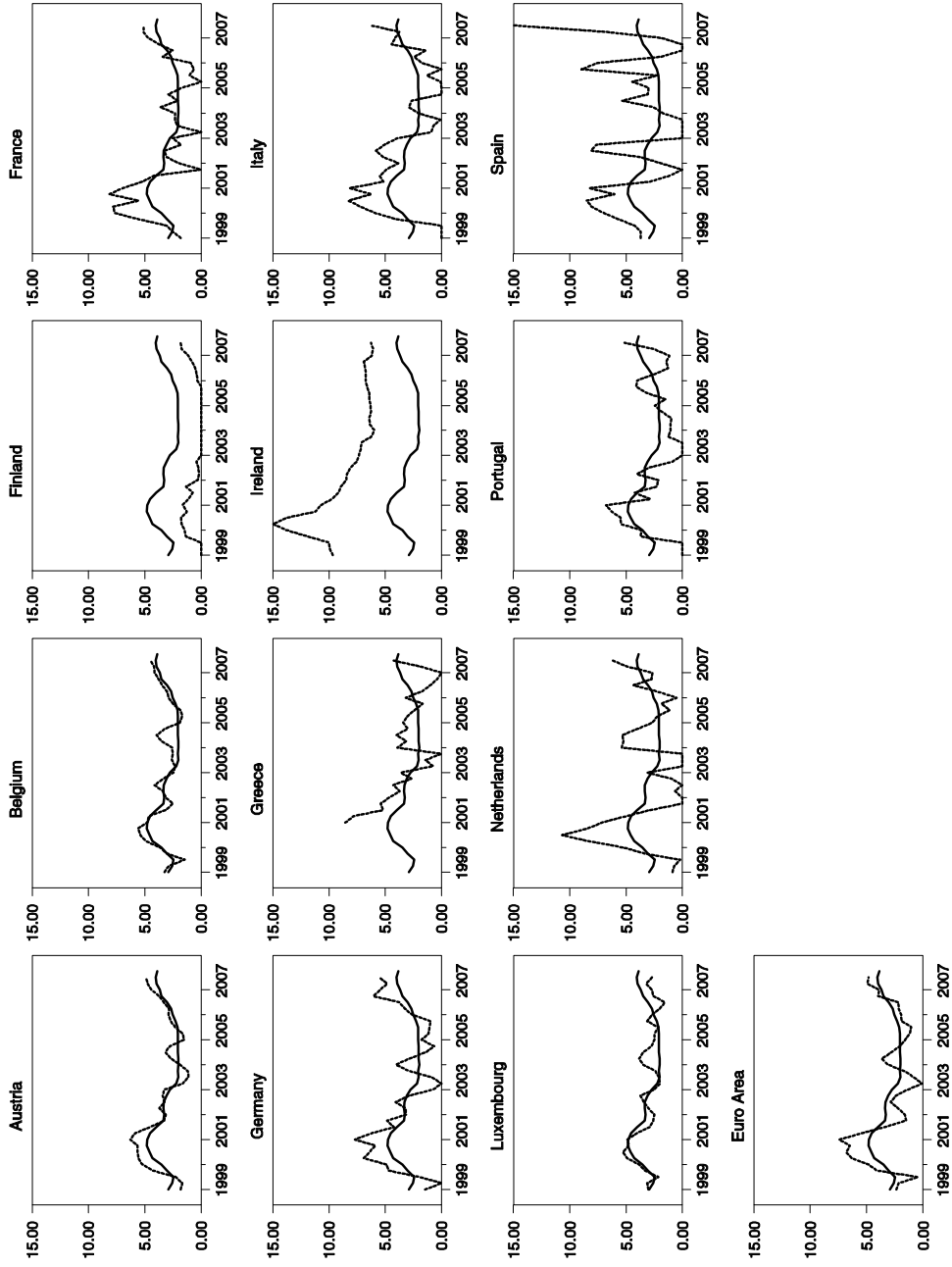
Figure 6.   Policy rates and fitted target rates. Solid lines represent actual policy rates. Dotted lines represent fitted target rates.
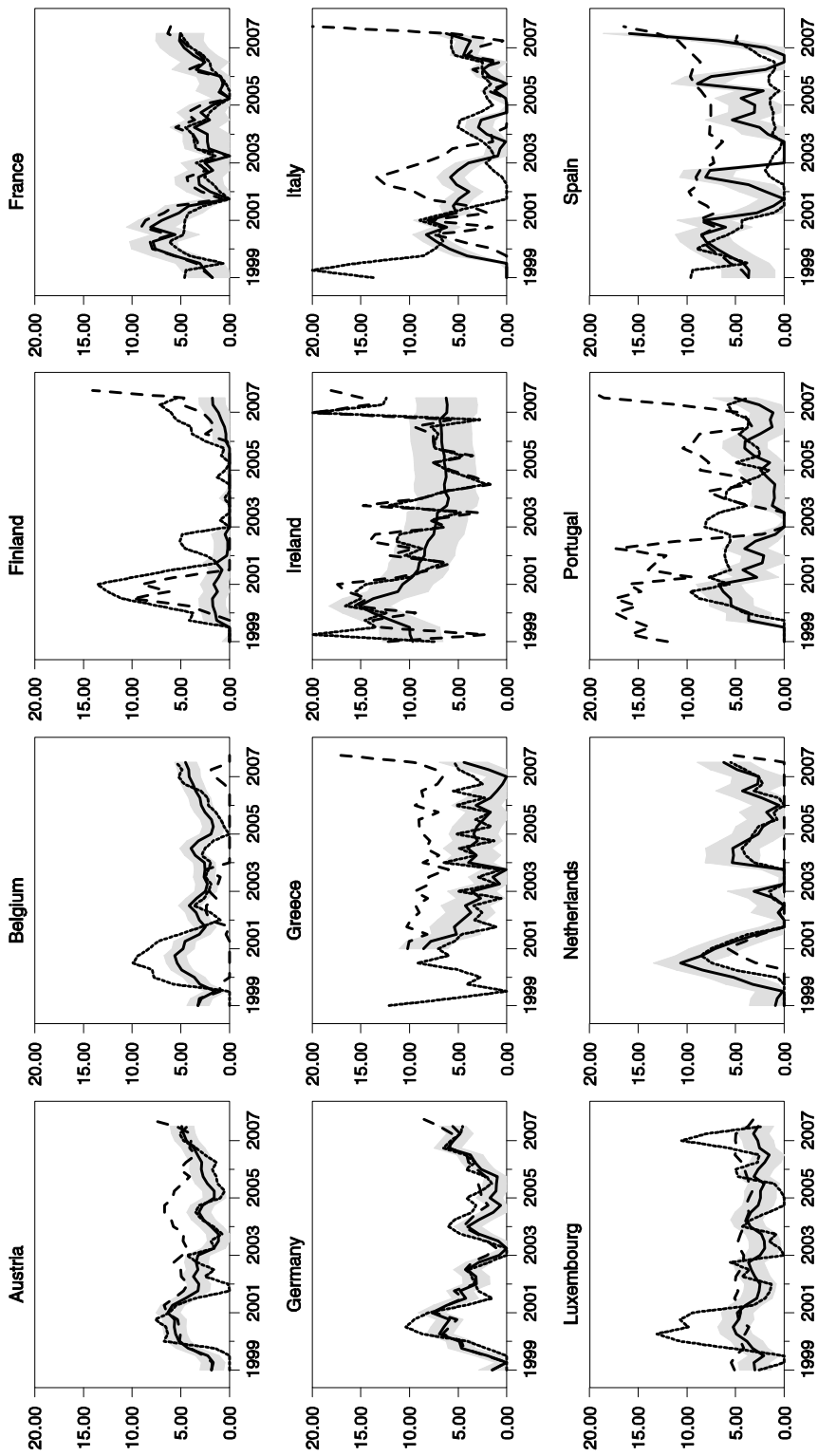
Figure 7. Counterfactual results for 'target' interest rates. (Solid lines represent the fitted 'target' rates, encapsulated in 95% confidence bands. Dotted lines represent the counterfactual series projected by using the estimated Taylor rule for the ECB but data of individual euro area members. Dashed lines represent the counterfactual series projected by using the estimated Taylor rules for the pre-euro sample but historical data for explanatory variables.)
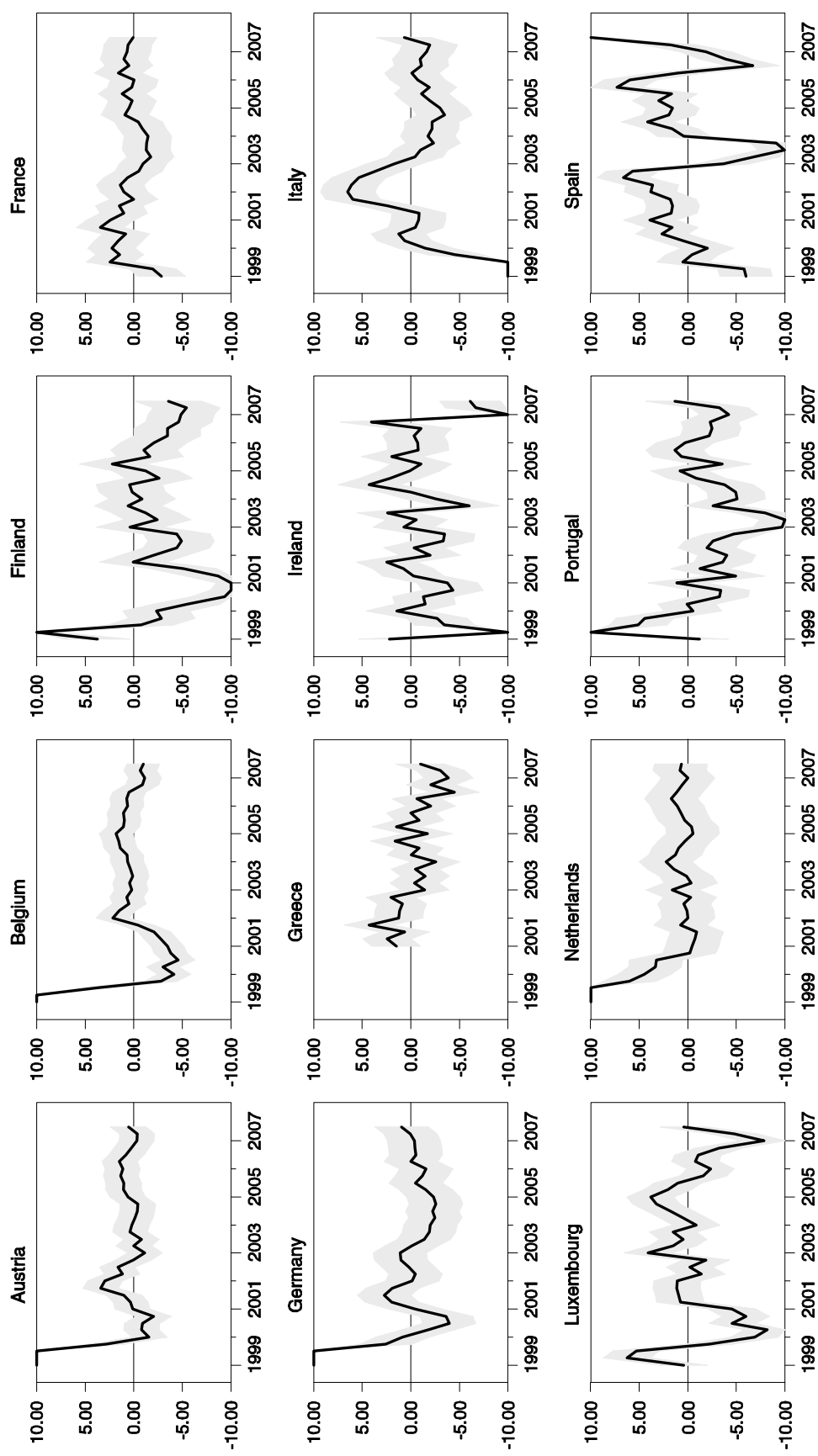
Figure 8. Difference between fitted 'target' rate series and counterfactual series with ECB coefficient.
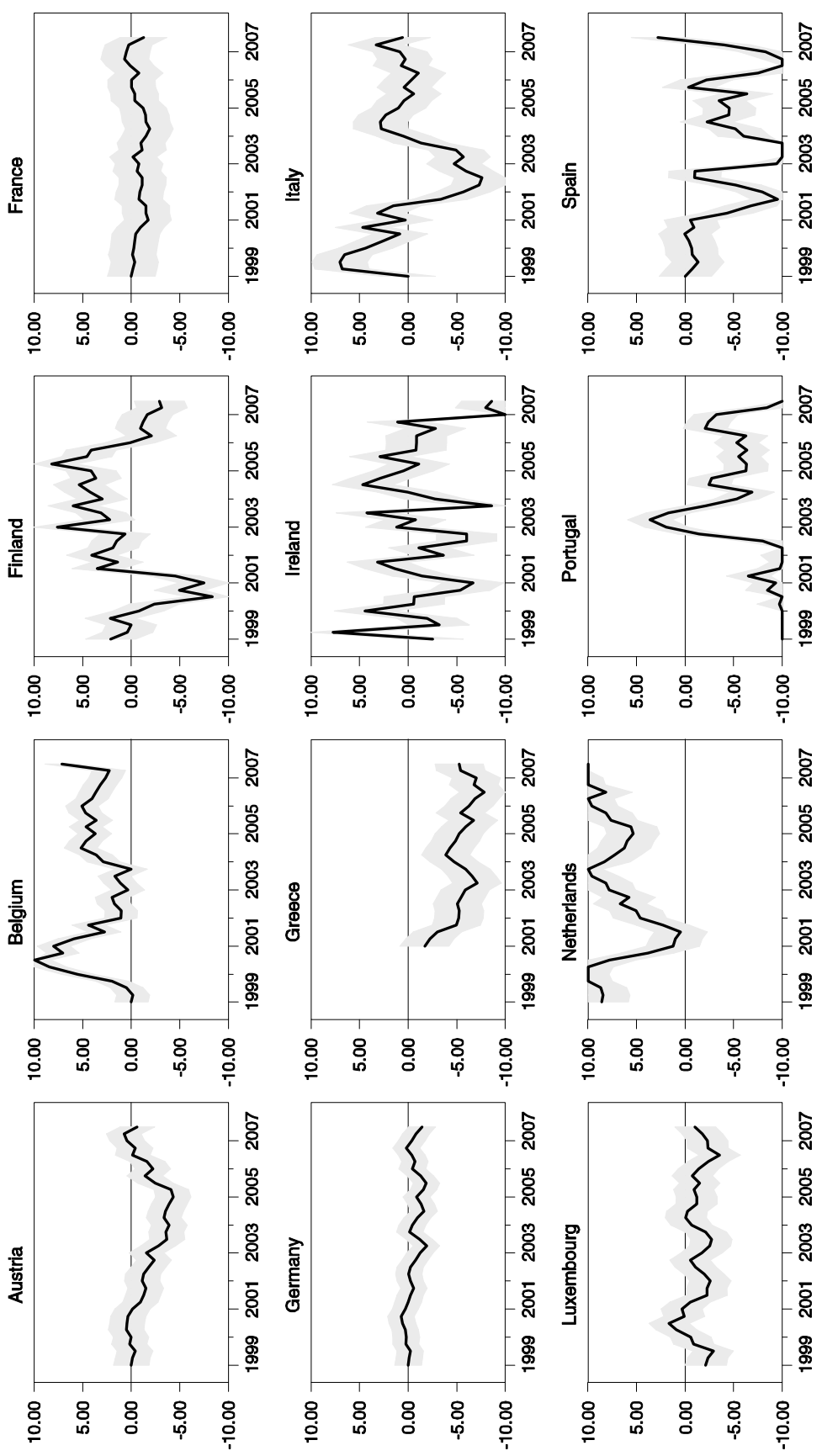
Figure 9.   Difference between fitted 'target' rate series and counterfactual series with pre-euro coefficients.
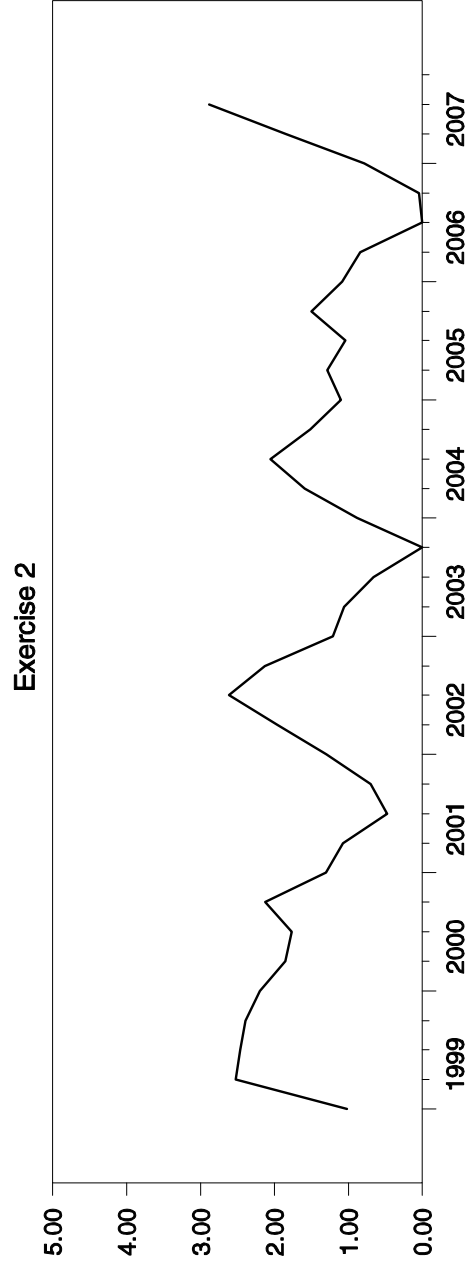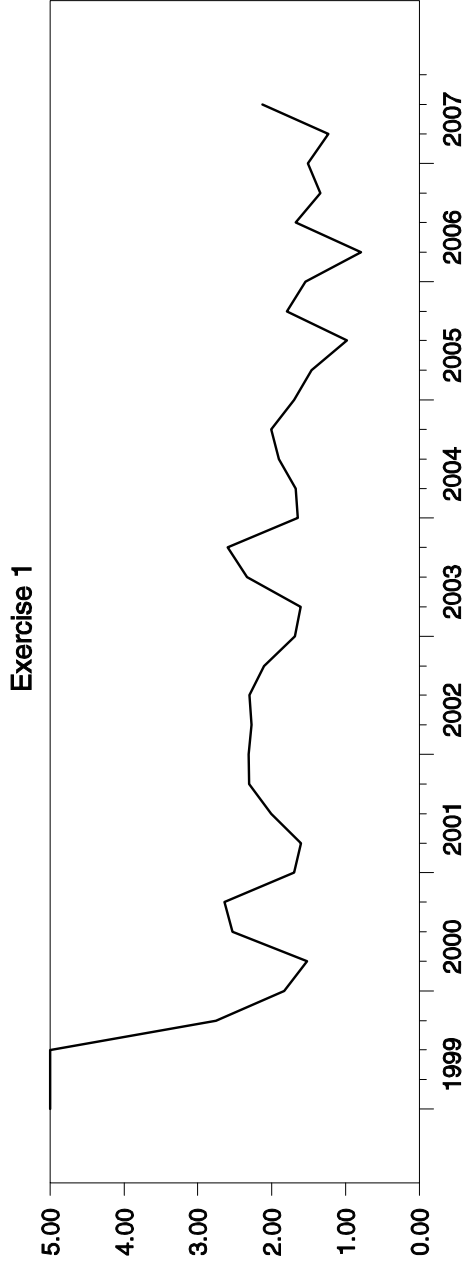
Exercise 1

Exercise 2

Figure 10.   Area-wide policy stress measures

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