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E-mail address: Fritz.Breuss@wifo.ac.at
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Was ECB's monetary policy optimal?

Fritz Breuss[*)]

Austrian Institute of Economic Research (Wifo),
P.O. Box 91
A-1103 Vienna/Austria
breuss@wifo.ac.at

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Abstract:

Overall, the ECB managed monetary policy quite satisfactory in the first phase of EMU. Nevertheless, this paper asks whether monetary policy could not have been improved. In the last three years, Euroland was confronted with the first external shock. Oil prices increased considerably, leading to an increase of headline inflation of over one percentage point in 2000/2001. With a specific Taylor rule one can very well understand, how the ECB sets interest rates, but it turns out that monetary policy based on the estimated Taylor reaction function was rather backward than forward-looking. While it reacted with a lag to the actions of US's Fed, it was overly cautious by targeting total HICP inflation. Here it is strongly argued and also demonstrated with model simulations that a monetary policy oriented towards "core" inflation would have resulted in a much better economic performance. The business cycle downturn could have been mitigated with no additional inflation risks.

Keywords: EMU, Monetary Policy, Euro, Model Simulations
JEL-Classification: E5, E52, E58, E47

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1. Introduction

Given the external conditions the Economic and Monetary Union (EMU) of the European Union (EU) was quite a success so far. When the EMU started its third stage with 11 out of 15 EU member states in January 1999, the European and US business cycle were still on an upswing. GDP growth was satisfactory, inflation was low, even some kind of convergence of the European business cycle was visible. However, the high value of the Euro at the start was not sustainable, its exchange rate against major currencies depreciated continuously. Then, in 2000, oil prices increased sharply, fuelled inflation in the industrial world and initiated a faltering of the cycle in the second half of that year, starting in the USA and followed by Europe. In 2001 (Greece became the 12th member of Euroland), the decline continued, accelerated by the terrorist attacks on the World Trade Center on September 11, 2001. At the eve of the change-over from a "virtual" Euroland to a real one (the Euro is becoming legal tender as of January 2002), the world economic situation is characterized by a unique constellation: the triad (USA, EU and Japan) is in a recession simultaneously. However, whereas the USA and Japan are counteracting with an active fiscal policy, the EU and Euroland in particular are standing aside. Fiscal policy, still decentralized and in the responsibility of the EU member states has to fulfill – in a complicated co-ordination process - the targets of the Stability and Growth Pact (SGP), which should result in a balanced budget over the cycle. Monetary policy, conducted centrally by the European Central Bank (ECB) reacted by reducing interest rates, but more backward than forward looking and – compared to US's Fed - partly too late. So, Europe can only hope that the upswing in the USA will spill over and induce an export-led growth.

The major argument which is put forward in this paper is that the ECB's reaction to the first external shock, the oil price surge in 2000 and 2001, was not optimal. The second chapter – after a short description of the economic policy framework in EMU - discusses the two pillar strategy of the ECB and its performance so far. It questions whether really two pillars are necessary and estimates a specific Talyor rule to understand the interest-rate setting of the ECB. The implications of the oil price shock are the topic of the third chapter. It is demonstrated that this shock led to an asymmetric impact on Euroland's Member States and hence increased inflation and output dispersion. In the fourth chapter the economic outcome of an alternative monetary policy reaction to this shock is analyzed. It turns out that the overall economic performance could have been improved when targeting not headline but core inflation. Conclusions are drawn in section five.

2. ECB's Two Pillar Strategy in Action

2.1 The asymmetric economic policy framework in EMU

The introduction of the euro and the conduct of the single monetary policy by the independent European Central Bank (ECB) have fundamentally changed the framework within which the European Community and its Member States conduct their economic policies. Building on the existing framework of the Single Market, the specific design of Economic and Monetary Union (EMU), as laid down by the Maastricht Treaty (now in the version of the Nice Treaty), transfers the competence for monetary and exchange rate policies to the Community level (see the EC Treaty chapter entitled "Monetary policy" – Title VII, Chapter 2), while leaving the responsibilities for fiscal policies (see the EC Treaty chapter entitled "Economic Policy" - Title VII, Chapter 1), labor market and employment policies (see the EC Treaty chapter entitled "Employment" – Title VIII) and for many microeconomic and structural policies in the hands of the national or subnational authorities. In contrast to the USA with its coherent centralized economic and monetary policy framework in EMU we are confronted with a complex system of multi-level economic governance – characterized by the interplay of central monetary policy-making and decentralized economic (mainly fiscal) policy-making. This asymmetry may be either considered as a "design flaw" (see Breuss, 2000, p. 275) or as a strength for the EU (see ECB, 2001b, p. 54).

Due to this asymmetric design, the EC Treaty foresees a structured interaction among policy-makers, ranging from more or less constraining forms of policy co-ordination (e.g. via the Stability and Growth Pact - SGP)[1] to a free play of competing policy designs. As EU Member States regard their economic policies as a "matter of common concern" (EC Treaty, Article 99(1)), they shall co-ordinate them. Economic policy-co-ordination (postulated in EC Treaty, Article 4 and Article 99) is necessary to avoid potential negative spillovers across countries and across policies (see ECB, 2001b, pp. 55-56). It is executed in a complicated multilevel process (see ECB, 2001b, p. 65; Breuss, 2000, pp. 285 ff.). In order to give coherence to the overall economic policy framework, the EC Treaty establishes the annual Broad Economic

[1] Canzoneri-Cumby-Diba (2001), within a new "fiscal" theory of price determination approach, come to the conclusion that a common currency area is not viable if fiscal policy in two or more of the EMU members is Non-Ricardian. They find that constraints written into the SGP are sufficient for a Ricardian regime. In a Ricardian regime, fiscal policy has discipline in the sense that current and/or future primary surpluses are actively adjusted to satisfy the government's public sector's present value budget constraint (PVBC) for any real

Policy Guidelines (BEPG; see EC Treaty, Article 99(2)) as the principal and overarching policy instrument for the co-ordination of economic policies at Community level. These guidelines, which – with due respect for the independent and statutory mandate of the ECB – do not apply to monetary policy, render operational the fundamental principles of close co-ordination. BEPG is the pivot of the more specialized co-ordination and consultation process of multilateral surveillance (for fiscal policy – via the SGP with stability and convergence programs on the budgetary stances (debt/deficit data); employment policy – via the "Luxembourg Process" with employment guidelines and National Action Plans; micro/structural policies – via the "Cardiff Process" with multilateral review of economic reforms; macroeconomic dialogue among social partners, governments, ECB, Commission – via the "Cologne Process"; "open method of co-ordination" – via the "Lisbon Process" providing a more coherent setting of targets and periodic monitoring and evaluation of the results) and gives the principal policy messages. The role of monetary policy in the overall economic policy framework is somewhat unique. Although the single monetary policy represents a fundamental pillar of the system of economic governance in the euro area and the ECB is part of the overall economic policy framework there is no overall co-ordination of economic and monetary policy in EMU. There is only a structured exchange of information and views with other policy-makers (e.g. in the major co-ordination body, the Economic and Financial Committee ; see EC Treaty, Article 114(2)). However, the contacts between the independent ECB and the finance ministry are to be understood only as a non-binding open policy dialogue and should be "... in no way misunderstood as an ex ante co-ordination of monetary and fiscal policy stances. In the same vein, the regular and structured dialogue between the ECB and national governments clearly excludes any ex ante policy co-ordination or joint agreements aimed at achieving a predetermined policy-mix" (ECB, 2001b, p. 64). This attitude of only an informal policy dialogue may of course lead to non-optimal outcomes with respect to an overall (monetary and fiscal policy) co-ordination (see Breuss-Weber, 2001)[2]. In contrast to the US system, the EMU is missing an arrangement of fiscal federalism. Even more, the individual responsibility of the Member States in the field of budgetary policy is explicitly underscored by the EC Treaty's "no bail-out" clause (Article 103), which

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value of current government liabilities. In this regime, monetary policy provides the nominal anchor, and the price level is determined in a conventional manner. Non-Ricardian regimes, by contrast, lack fiscal discipline.

[2] Beetsma-Debrun (2001) investigate the circumstances under which co-ordination may be disirable. It turns out that co-ordination is beneficial when the correlation of the shocks hitting the various economies is low. Generally, the scope for fiscal co-ordination is larger under asymmetric shocks, because the ECB remains passive as average inflation in the union is unaffected.

stipulates that neither the Community nor any Member State shall be liable for the commitments of another Member State.

2.2 Two or only one pillar in ECB's monetary policy strategy?

In October and December 1998 the Governing Council of the ECB announced the main elements of its stability-oriented monetary policy strategy to the public (see ECB, 1999a). The strategy guides the single monetary policy of the Eurosystem, i.e. the ECB and the national central banks (NCBs) of the Member States which adopted the euro. The stability-oriented strategy of the Eurosystem consists of three main elements: a quantitative definition of the Eurosystems's primary objective, namely price stability (EC Treaty, Article 105(1)), and the "two pillars" of the strategy used to achieve this objective. These pillars are represented by giving money a prominent role (pillar one), as signaled by the announcement of a quantitative reference value for the growth rate of a broad monetary aggregate (M3), and by a broadly based assessment of the outlook for price developments (pillar two) and risks to price stability in the euro area as a whole (see ECB, 1999a).

In contrast to the Fed, the Governing Council of the ECB has adopted a concrete definition for price stability: "price stability shall be defined as a year-on-year increase in the Harmonized Index of Consumer Prices (HICP) for the euro area[3] of below 2%"[4]. Price stability according to his definition "is to be maintained over the medium term" (see ECB, 1999a, p. 46). Setting a fix target has the advantage of credibility, the disadvantage is the loss of flexibility. A medium-term orientation of monetary policy ensures genuine and meaningful accountability. It implies the need for monetary policy to have a forward-looking, medium-term orientation. It also acknowledges the existence of short-term volatility in prices, resulting

[3] De Grauwe-Piskorsi (2001) investigate whether it makes a difference as far as the effectiveness of alternative loss functions of the ECB is concerned whether its policy is based on the union-wide aggregates (as is done in practice) or on the national data (on output, inflation and interest rates) of the member states. The main conclusion is that the monetary policy strategy of the ECB based on the union-wide aggregates may be a reasonable proxy of the optimal policy rule based on the national data of the member states.

[4] Benigno (2001) investigates the optimal monetary policy in a currency area within the framework of a two-region, general equilibrium model with monopolistic competition and price stickiness. His framework delivers a simple welfare criterion based on the utility of the consumers that has the usual trade-off between stabilizing inflation and output. Only if the two regions share the same degree of nominal rigidity, the optimal outcome is obtained by targeting a weighted average of the regional inflation rates. These weights coincide with the economic size of the regions (which is done when calculating the actual HICP inflation for the euro area). If the degrees of rigidity are different, the optimal plan implies a higher degree of inertia in the inflation rate. But an inflation targeting policy, in which higher weight is given to the inflation in the region with higher degrees of nominal rigidity, is nearly optimal. Highest wage rigidity can be found in Spain, Belgium-Luxembourg, Finland, Ireland and Germany. The highest wage flexibility was measured in France, Italy and Austria (see Benigno (2001), p. 52).

from non-monetary shocks to the price level (e.g. the result of indirect tax changes or variations in international commodity – in particular oil – prices; see ECB, 1999a, p. 47). Nevertheless, as will be seen, in practice these sound arguments are mere wishful thinking. If the primary objective is satisfied, the ECB shall support the general economic policies of the EU, laid down in Article 2 of the EC Treaty (" ... to promote a harmonious and balanced development of economic activities, sustainable and non-inflationary growth respecting the environment ...").

Table 1: Macro-economic performance of EU member states

As one sees from table 1, the inflation rate objective in the first years of EMU was nearly fulfilled in the euro area as a whole with a HICP inflation rate of 2.1% on average 1999-2001. However, the dispersion over the Euroland member states was considerable, ranging from 1.4% in France to 3.9% in Ireland. Since the early nineties one sees a strong convergence of inflation rates starting with a standard deviation value for EUR-12 (euro area with 12 member states) of over 5 in 1990 to below one in 2001. The expectation of a "zero dispersion" for the EU as a consequence of the "law of one price" due to the impact of the Single Market (more competition on an integrated market) and additionally because of the Single Currency in the EMU is an illusion[5] (see EU, 2001c). But also the other macro variables – be it GDP growth (varying from 1.8% in Germany to 9.6% in Ireland with an EUR-12 average of 2.6% over the period 1999-2001) or unemployment (varying from 2.3% in Luxembourg to 14.3% in Spain with an EUR-12 average of 9% between 1999-2001) – exhibit still considerable differences in Euroland. Besides the progress made in bringing down inflation, due to the pressure of the SGP the fiscal position of the member states of Euroland improved considerably. However, whereas some countries have already reached surpluses in their budget balances (e.g. Luxembourg and Finland with +4 ½% of GDP, Ireland with +3% - all countries with higher than average GDP growth in the last years), some countries are still running deficits – although on a minor scale (e.g. France, Germany, Italy with around –1% of GDP). Similarly, the debt to GDP ratios are still above 100% of GDP in Belgium, Greece and Italy, whereas all

[5] The European Commission (EU, 2001c) demonstrated why the "law of one price" (an integrated market with no transport costs product prices expressed in the same currency should not geographically differ) in the EU fails and is also an elusive goal when taking the US economy as a benchmark. There are many factors behind the large and persistent price dispersion in the EU: the Balassa-Samuelson effect; growing importance of services; price-setting behavior for branded goods depending on local preferences. In 1998, price dispersion was higher in the EU (15%) than in the USA (12%). However, EU price dispersion declined – due to the Single Market – during the 1990s.

the other Euroland member states are already below or close to the Maastricht reference value of 60% of GDP (see table 1).

Figure 1: Euro exchange rates

Figure 2: World oil price

Figure 3: HICP inflation rates in the euro area – headline and core

An important factor behind the increase in inflation in 2000 and 2001 has been import price development, in particular oil price and exchange rate movements. The euro devalued against the US-Dollar continuously after the start of EMU in 1999, resulting in a decline of around 25% (see figure 1). Whether the dispersion of inflation within the euro area is only due to diverging business cycles or whether the higher inflation is an equilibrium phenomenon due to the working of the Balassa-Samuelson effect is undecided[6]. Additionally, the oil price shock certainly has hit the Member States of Euroland asymmetrically, as will be demonstrated in chapter 3 when investigating the economic impact of the first external shock. The world oil price which is still denominated in US-Dollars increased from 11 $/barrel in the first quarter of 1999 to a peak of 30.3 $/barrel in the third quarter of 2000. The terrorist attack on the World Trade Center on September 11, 2001 only very shortly accelerated the oil price which plummeted afterwards in view of a drastic demand shortage because of the recessions in the USA and in Europe. In figure 2 the actual development of the world oil price since 1996 is confronted with a "smoothing" of the price development since 1999. This implies an oil price increase over this period of around 30%. As a consequence, energy prices contributed somewhat more than half of the 2.1% rise in overall HICP inflation in the euro area in 1999-2001 (see ECB, Monthly Bulletin, June 2001, p. 37; see also EU, 2001a, p. 45). Although there are many concepts to calculate "core" inflation (see ECB, 2001a for an overview), the most prominent and widely used method is that which extracts the most volatile components of overall ("headline") HICP inflation. Excluding unprocessed food and energy, the so defined "core" HICP inflation (see ECB, Monthly Bulletin, June 2001, p. 37) was below the ECB target of 2% (see figure 3) and around one percentage point lower than "headline" HICP inflation (see ECB, 2001a, p. 58). Such or similar reflections are undertaken

[6] Whereas Alesina-Blanchard-Gali-Giavazzi-Uhlig (2001, pp. 16-18) dismiss the Balassa-Samuelson effect (relative price increase of fast-growing (catching-up) countries – more precisely as a consequence of faster growing productivity in the tradable sector compared to the non-tradable sector of an economy) as quantitatively relevant for the inflation dispersion in Euroland, Reutter-Sinn (2000) find that as a result of the Balassa-Samuelson effect relative prices change rapidly between and within the euro countries. They derive a minimum inflation rate for Euroland (compatible with the requirement that no country face a deflation) of 0.94% for EUR-11 and of 1.13% for an enlarged Euroland (EUR-21). Within EUR-11 the minimum inflation varies between 0%

by the ECB under the pretext of the "second pillar" of monetary strategy via a broadly based assessment of the outlook for price developments. As will be argued in this paper, the concentration on "core" instead of "headline" HICP inflation would have optimized monetary policy and resulted in a better overall economic outcome in the EU.

Before analyzing the concrete monetary policy reaction of the ECB to the first external shock (the sharp oil price increase), the importance of the "first pillar" of monetary strategy, the prominent role for money, defined as the annual growth rate of the broad monetary aggregate (M3) is looked at. On December 1, 1998 the Governing Council of the ECB has chosen to announce a reference value for the aggregate M3, defined in an encompassing manner to include not only currency in circulation and the conventional deposit components of broad money, but also both the shares/units of money market funds (MMFs) and debt securities issued by monetary financial institutions (MFIs; see ECB, 1999b, p. 35). The announced reference value was derived from the quantity theory of money, based on the following medium-term assumptions (see ECB, 1999a, p. 48-49): $Mv = PQ$. P is the inflation rate (HICP), defined as below 2%; Q is the trend of real GDP growth in the range of 2-2.5% per annum; v is the velocity of circulation of M3 which, in the medium term, should decline by 0.5-1% each year. Taking into consideration that the actual trend decline in velocity is likely to lie below the stated values, this results in an annual growth of M (M3) of 4.5% per annum, the reference value set by the Governing Council for M3. A look at figure 4 indicates that since the start of EMU the self-declared reference value was mostly failed. M3 growth exhibited a continuous decline since the mid-eighties (see ECB, 1999b, p. 37), from annual rates of over 10% to 7% in the early nineties and declining to 5% at the eve of the third phase of EMU starting in 1999. When, however, the reference value for M3 is missed all the time, one may ask whether one should not give up this "first pillar" anyway. Some, like Svensson (2000, p. 97) mean that "the first pillar is actually a brick". In its third report "Monitoring the European Central Bank" Alesina-Blanchard-Gali-Giavazzi-Uhlig (2001, pp. 47-48) are somewhat more mild in evaluating the M3 pillar. First, they remark that it may be somewhat absurd to talk about monetary policy without talking about money. However, in its mission, to maintain price stability in the medium term, the growth rate of M3 can only be a servant in this quest and not a target in itself. Whether it is a useful servant (given that the longer-term trends in the growth of money stock M3 are only very loosely correlated with the annual rate of consumer price inflation; see ECB, 1999b, p. 39), has to be evaluated. However, they

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in Germany and 2.7% in Finland and 2.4% in Ireland, 1.5% in Spain and Italy, 1.4% in the Netherlands, Austria conclude by stating, that “to demonstrate the overriding importance of price stability, it would be useful to move the growth rate of M3 to the side” (Alesina-Blanchard-Gali-Giavazzi-Uhlig, 2001, p. 48).

Figure 4: Growth of money M3 in the euro area

For a while, the ECB treated the exchange rate with benign neglect. It has argued, correctly, that its task is to maintain price stability in the euro area, not to target a particular exchange rate. But in September 2000, an intervention by the ECB and the Federal Reserve to shore up the weak euro – mainly because the coincidence of boosting oil prices and devaluation of the euro could endanger the main objective of price stability in the euro area - was publicly discussed an then implemented for the first time. The effect was only fleeting: after a short blip, the euro depreciated even further. The decline of the euro stopped only with news that the economy in the United States has started to slow down. A striking example was the very short-lived blip after September 11, 2001. Should the ECB be concerned about exchange rate fluctuations? Alesina-Blanchard-Gali-Giavazzi-Uhlig (2001, p. 40) answer with a qualified no. No, because official interventions are small in comparison to the amounts traded daily on the foreign exchange rate markets. No, unless the ECB’s intervention signals a shift in policy and such a signal is enough to change market beliefs. And the EC Treaty lays down that any exchange rate policy should be consistent with the primary objective of the ECB’s monetary policy, which is to maintain price stability. Article 111 of the EC Treaty foresees a close interaction between the EU Council and the ECB with regard to the exchange rate policy (e.g. to conclude formal agreements on an exchange rate system for the euro in relation to non-Community currencies or to formulate general orientations for exchange rate policy; see also ECB, 2001b, pp. 57-58).

2.3 How does the ECB set interest rates?

The Governing Council of the ECB sets three kinds of interest rates: a) those for main refinancing operations, b) those for marginal lending facility (over-night money) and c) those for deposit facilitiy. The main instrument in the following analysis is the interest rate for main refinancing operations (MFO). A comparison with the main instrument of US’s Board of

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and France, 0.8% in Belgium and Portugal (Reutter-Sinn, 2000, p. 13).

Governors of the Federal Reserve System (in the following shortened “Fed”), the Federal Funds rate shows the following policy stance of both regions (see figure 5).
Figure 5: Interest rates in the euro area and in the USA

The ECB started with an interest rate for MFO of 3% and made the first interest rate cut in April 1999 to 2.5%. In November 1999 it raised the rate again to 3% and thereafter several times up to the peak of 4.75% in October 2000. After staying on this level for seven months, in Mai 2001 the ECB began to cut the rates consecutively down to 3.25% till November 2001. The Federal Funds rate of the Fed was already at a higher level at the beginning of 1999 (at 4.6%) and was increased continuously to a peak of 6.5% in May 2000. After staying at this level for four months in January 2001, the Fed continuously cut the rates in several steps to 1.75% in December 2001, the lowest level since the Second World War. Shortly after the terrorist attacks on the World Trade Center, on September 17, 2001, in a co-ordinated action the Fed and the ECB cut their interest rates by ½ percentage point.

As a first observation, Figure 5 suggests that – given the different inflation and growth performance of both regions - the ECB is following the Fed in setting their interest rate with a certain time lag. In effect, a test for the period since January 1999 shows that the Federal Funds rate Granger-causes ECB’s interest rate for MFO with a lag of four months. Looking only on the 3-months interest rates one finds that US’s interest rates Granger-cause Euroland’s interest rates with a lag of three months. It is therefore not unplausible to implement Fed’s interest rate policy into the reaction function of the ECB.

Taylor’s (1993, 2001) original feedback policy rule described the monetary policy under Greenspan (see also Schuberth, 2000, p. 24):

(1) $$i_t = \bar{r} + \boldsymbol{p}_t + g_1(\boldsymbol{p}_t - \boldsymbol{p}^T) + g_2(y_t - y^*).$$

i_t is Fed’s nominal interest rate in quarter t; $\bar{r}$ is the steady-state equilibrium value of the short-term real interest rate (the “natural rate”); $\boldsymbol{p}_t$ is the actual inflation rate in quarter t; $\boldsymbol{p}^T$ is the inflation target; y_t is actual output in quarter t; y^* is potential output; g_1, g_2 are coefficients, determining the degree of the interest rate reaction of the Fed to deviations of inflation and output from its targets. Taylor did not estimate this equation, but calibrated it. He suggested the same weights for both coefficients $(g_1 = g_2 = 0.5)$. He also assumed that the “natural” interest rate and the inflation rate target were both equal to 2 $(\bar{r} = \boldsymbol{p}^T = 2)$.

As the ECB has as primary objective to maintain price stability, the same weights for inflation and output targeting are obviously not adequate for Euroland. Alesina-Blanchard-Gali-Giavazzi-Uhlig (2001, pp. 27 ff.) experimented with several variations of Taylor's rule. Simply calibrating the Taylor rule would have called for a tighter policy than that actually pursued by the ECB. Similarly, a simplified Taylor rule, called p -rule, because only inflation targeting (the first term of equation (1)) is considered, also would have led to a tighter monetary policy stance – at least after the rate cut in April 1999. The still important inflation differentials within the euro area could cause conflict, when implying that the National Central Bank (NCB) governors might choose to pursue exclusively their national interests and push for interest rate decisions that are consistent with inflation in their home country, rather than in the euro area as a whole. Alesina-Blanchard-Gali-Giavazzi-Uhlig (2001, p. 30) clearly rule out that hypothesis by calculating the hypothetical interest rates for all member states of Euroland implied by their simple p -rule. The interest rate set by the ECB at the beginning of EMU falls right in the middle of the distribution of the hypothetical national interest. Over time, however, the hypothetical national interest rates lay all above the actual ECB interest rate, with Ireland accounting for the largest deviation, followed by the Netherlands – right in line with the inflation performance since 1999. The assumption of nationalist voting would have introduced a contractionary bias in the ECB policy, which was not the case. Further more, the ECB appears to have pursued an interest rate policy that has been more attuned to inflation developments in three countries (France, Germany, and Austria), than to those in the euro area as a whole (Alesina-Blanchard-Gali-Giavazzi-Uhlig, 2001, p. 31). Finally, Alesina-Blanchard-Gali-Giavazzi-Uhlig (2001, p. 34) try an ad hoc hybrid rule, whereby the ECB responds quite aggressively (with a coefficient as high as 2) to both core inflation and the inflation forecasts (both expressed in terms of deviations from target, and receiving equal weights; assuming a steady-state real rate of 2.5%). This rule appears to track much better the actual pattern of interest rates in EMU. It takes into consideration the transitory price increase due to the oil price development and also implies a forward-looking behavior of the ECB.

In the following the Taylor rule for ECB's behavior since 1999 is not calibrated but econometrically estimated. Two kinds of reaction functions are offered. The first is the traditional Taylor rule, defined in equation (1) and results in the following estimated parameters (over the period 1999M1 to 2001M8), when considering the lagged dependent interest rate variable:

(2) $$i_t^{ECB} = +0.85 + 0.20*(\boldsymbol{p}_t - \boldsymbol{p}^T) + 0.07*(y_t - y^*) + 0.78*i_{t-1}^{ECB}$$

(2.96)	(2.15)	(3.19)	(9.84)	(t-values)
				R^2=0.97, DW=2.73
long-run coefficients:				
+3.85	+0.89	+0.34		

i_t^{ECB} is the monthly interest rate of the ECB for main refinancing operations (MFO). $\boldsymbol{p}_t$ is the monthly rate of HICP inflation. $\boldsymbol{p}^T$ is set at 2%, the official inflation rate target of the ECB. y_t is the monthly index of industrial production seasonally adjusted. y^* is the Hodrick-Prescott trend of y_t. The estimated constant (long-run value 3.85) of equation (2) represents the steady-state value of the real short-term interest rate plus inflation rate $(\bar{r} + \boldsymbol{p}_t)$. The long-run coefficients reflect pretty well the main preferences of the ECB: price stability is given much more weight (0.89) than deviations from potential output (0.34).

An alternative estimation of the Taylor rule according to equation (1) – here preferred - explains the interest rate setting of the ECB by substituting the term for $(\bar{r} + \boldsymbol{p}_t)$ with the lagged Fed's interest rate:

(3) $$i_t^{ECB} = +0.59*(\boldsymbol{p}_t - \boldsymbol{p}^T) + 0.10*(y_t - y^*) + 0.66*i_{t-7}^{Fed}$$

(11.36)	(3.39)	(98.33)	(t-values)
			R^2=0.95, DW=1.61

The interest rate of the Fed (i_t^{Fed}) enters in this ECB's monetary policy reaction function most significantly with a lag of seven months[7]. The results of the simple Granger-causality test, mentioned above, justifies this approach. Again this reaction function underlines the prominent preference of the ECB for price stability. Its weight (0.59) is six times higher than those for output-targets (0.10). If one estimates equation (3) by considering a constant term $(\bar{r} + \boldsymbol{p}_t)$, the term for output-targeting becomes insignificant, the weight for inflation targeting increases to 0.8, and the coefficient (0.4) of the optimal lags for ECB's reaction on

[7] In this context one could consider the interaction of the ECB and the Fed as a two-country monetary policy game where the reaction functions of both countries (central banks) depend on each other's reaction (see McKibbin-Sachs, 1991, p. 160). In a symmetric case (when both, the USA and Euroland are assumed to be of equal size) a cooperative policy stance would lead to a better overall outcome than a noncooperative (Nash-Cournot) policy stance: output would be higher, interest rates would be lower. In a noncooperative equilibrium, each country perceives that it can be made marginally better off by appreciating its currency and exporting inflation to the foreign country. Because both countries pursue this strategy in the symmetric case, the exchange rate does not change, but policies are overcontractionary. Considering the estimated adjusted Taylor reaction function of equation (3) and assuming that the Fed sets interest rates according to the original Taylor rule without taking the ECB action into account, one could rather think of a monetary policy game à la Stackelberg rather than of a Nash-Cournot game, seeing the Fed as the leader and the ECB the follower in monetary policy actions.

Fed's interest rate setting is reduced to four months. The estimate of the constant term amounts to a value of 1.4.

The Taylor rule of equation (3) can very well explain the actual interest rate setting of the ECB for MFO (see figure 6).

Figure 6: ECB interest rate policy and Taylor rules

If the ECB – instead of sticking to the total (headline) inflation rate, measured by the HICP – would have reacted to the "core" inflation rate in Euroland, by neglecting the effects of the transitory rise in oil prices, combined with the depreciation of the euro with respect to the US dollar, the monetary policy would have turned out much less restrictive in the years 2000 to 2001. This can be simulated by using the coefficients of equation (3) and substituting for p_t the "core" HICP inflation rate (see figure 6). On average, ECB's interest rate would have been lower by 0.6 percentage points from the second quarter 2000 to the third quarter 2001 with some months even exceeding this value[8]. The macroeconomic implications of such a monetary policy are analyzed in chapter four.

3. The economic impact of the first external shock in EMU

World oil prices started to increase – accidentally – when EMU started into its third stage in the first quarter 1999 at a level of 11.1 US-dollar per barrel (Brent crude spot oil). The oil price peaked in the third quarter 2000 at a level of 30.3 $/barrel. Since then it declined gradually, exhibiting a very short-lived jump after September 11, 2001 and declined afterwards when the economic outcome in the industrial world became more and more gloomy. As was demonstrated already (see figure 3) the oil price hike since 1999 together with the depreciation of the euro translated into an additional increase of headline HICP inflation in the euro area since mid-1999 of around one half of a percentage point and during 2000, until autumn 2001 of more than one percentage point.

With the oil price hike of 1999-2001 Euroland experienced the first baptism of fire. What was the macroeconomic outcome inside Euroland and outside of it? In order to estimate this one has to make an assumption as to a "normal" development of oil prices in this period. We assume a smoothing path between the second quarter of 1999 up to the third quarter of 2001. Exactly the effect of the oil price increase from this "normal" path by 12% in 1999Q2, by 30% from 1999Q3 to 2000Q4, by 18% from 2001Q1 to 2001Q2 and by 10% in 2001Q3 was simulated (see figure 3).

Box 1: NiGEM – A world macro model

The simulations were carried out by the NiGEM world macro model of the National Institute of Economic and Social Research (NIESR, London.). The model consists of the standard demand- and supply-side specifications with spill-overs via foreign trade. The model covers – among all industrial and many developing countries - all EU countries (except Luxembourg). So, one can differentiate between the 11 euro area countries and the three pre-ins (Denmark, Sweden and the United Kingdom). The simulations were done here with the rational forward-looking option for long rates, wages, exchange rates, equity prices and inflation. When the exchange rate is forward-looking its current value is determined by the current interest rate differential and contemporaneous expectations of the exchange rate next period. As policy options the European aggregation is chosen, that means European exchange rates for the Euroland members are fixed against each other and movements of interest rates are the same for the Euroland countries. Interest rates and exchange rates are then determined according to "European targeting", where monetary policy is determined by Euroland economic conditions (an alternative would be "German targeting" – a reminder to the EMS system). This option proxies EMU where the ECB decides monetary policy but allocates weights to economic conditions in all the countries included in the Euroland aggregation. There are several interest rate options: a) Nominal GDP and inflation targeting; this proxies best the "two pillar" strategy of the ECB and is used in the following simulations; b) Inflation targeting only looks at deviations from inflation target; c) Taylor rule.

Source: http://www.niesr.ac.uk/models/nigem/nigem.htm

Given the chosen assumptions of the oil price hike of around 30% in the period 1999 to 2001 the model simulations resulted in the following macroeconomic impact for the Euro area as a whole (see figure 7).

[8] For a similar evaluation with a Taylor rule, taking "core inflation" as the relevant inflation rate for the normative rule, see the European Commission (EU, 2001a, pp. 56-57), although the Taylor rule used there is not made explicit.

Figure 7: Euro area: Macro-economic effects of a world oil price shock

Real GDP in Euroland decreased by 0.4 percentage points until the end of 2001 and leveled off thereafter. HICP inflation increased by 0.8 percentage points. The oil price shock also contributed to a depreciation of the euro against the USD by 0.3%. Euro area's current account deteriorated by 0.8 percentage points of GDP due to the negative terms-of trade effects of the shock. Also the budget policy was negatively affected by around 0.4% of GDP. Short-term interest rates, the unemployment rate and the debt to GDP ratio increased. Overall, the oil price shock hit the economy of Euroland adversely[9].

The aggregate impact of the first external shock to Euroland is one aspect, but more important is the question how differently the shock affected real GDP of the Member States of the euro area (see figure 8) and those of the pre-ins area of the EU (see figure 9).

Figure 8: Euro area: GDP effects of a world oil price shock

Figure 9: Pre-ins area: GDP effects of a world oil price shock

In the euro area (see figure 8) the biggest negative GDP impact is found four Ireland, Spain and Austria (all exhibiting a decline of GDP of 0.8 percentage points until the end of 2001), followed by France and Italy. Portugal, Finland, Belgium, the Netherlands and Germany were hit the least by the shock. Nevertheless, the oil price shock increased the dispersion of the Euroland business cycle or stopped its convergence (see table 1). The pre-ins (see figure 9) - at least those countries – which more or less appreciated their currencies against the euro (the United Kingdom and Sweden) could isolate their economies from the negative impact of the oil price shock. The others, which either participated in the ERM-II (like Greece in 1999 and 2000, before entering EMU in 2001) or fixed their exchange rate to the euro (like Denmark) exhibited a negative output effect of the oil price shock.

Figure 10: Euro area: HICP inflation effects of a world oil price shock

[9] In its standard shock analysis with the INTERLINK model the OECD (see Dalsgaard-André-Richardson, 2001) find that a 50% oil price increase (corresponding to a $12 ½ rise if the oil price is $25 per barrel) results in a decline of real GDP in the euro area of 0.4% in the first and 0.2% in the second year after the shock. Inflation goes up by 0.6% in the first and 0.2% in the second year. Similar, but somewhat lower effects are found for the USA and for Japan. In a comparable exercise the European Commission (EU, 2001a, p. 28) simulating a $12 increase in oil prices with their QUEST world macro model, real GDP in the euro area would decrease by 0.2 in the first year, by 0.4 in the second year and by 0.2 percentage points in the third year after the shock; inflation would increase by 0.7 in the first, by 0.4 in the second and by 0.2 percentage points in the third year.

Figure 11: Pre-ins area: HICP inflation effects of a world oil price shock

Similarly to the output impact, the oil price shock increased dispersion of the inflation performance in Euroland. With the exception of Ireland, it worked against the dispersion which one would have expected from the Balassa-Samelson effect. This external shock brought the amazing divergence process of price inflation in Euroland to a stop in 2000. The oil price shock increased HICP inflation rates by 1.8% in Ireland, by over 1% in France and Italy and below 1% in the other euro area countries. The lowest inflation effect was felt in Portugal and Spain (see figure 10). Out of the pre-ins countries (see figure 11), Denmark exhibited an inflation shock above Euroland average, the United Kingdom inflation increase of 0.8 percentage points coincided with Euroland average, those of Sweden and Greece was below average, although Greece's inflation performance deteriorated after fixing its exchange rate when entering the EMU in 2001.

4. A better outcome by an alternative monetary policy reaction?

What are the conclusions after the first external shock to Euroland for monetary policy? First, one could be satisfied with the actual policy reaction by the ECB. Second – and this position is preferred here – one could look for ways to optimize monetary policy. In order to mitigate the oil price shock, monetary policy could have reacted not only to total ("headline") HICP inflation but to "core" inflation. This would also be consistent with the second pillar of the "two pillar" strategy, namely to broadly analyze all price developments. By sticking only to headline inflation – because its rate already overshot the self-declared target of 2% (see figure 3) – monetary policy was too tight during the past two years.

How should the monetary policy stance be evaluated? In practice this is often done by many NCBs (for an overview of the different approaches and problems associated, see Gerlach-Smets, 2000) as well as by private banks with the so-called Monetary Conditions Index (MCI). The MCI combines the transmission of two channels of monetary policy: the interest rate and the exchange rate channel. The MCI represents the relative size of the interest rate and exchange rate impacts in a country on either output (real GDP) and inflation. A ratio of X to 1 implies that a change in the exchange rate by X percent has the equivalent impact as a 100 basis point change in the interest rate. Thus the larger the ratio the weaker is the relative impact of the exchange rate. Generally, large and relatively closed economies such as the

USA or Japan are thought to have ratios of around 10 to 1 and very open (small) economies around 2 or 3 to 1 (see Mayes-Virén, 2000, p. 201). The MCI is defined as

(4) $$MCI_t = \sum_s w_s \left(P_{st} - P_{s0}\right),$$

where the P_s are variables related to monetary policy actions ($1,....,s$) A_j (j indicating the actions available: interest rates in levels, exchange rates in log form) and thought to affect demand (real GDP, Y) or inflation (π). Thus there will be relationships of the form

(5) $$Y = f\,(P_{1,...,s}, X), \qquad \text{or} \qquad \pi = g\left(P_{1,...,s}, X\right),$$

X representing all the other variables in the model that also have an impact on demand (real GDP, or inflation). The weights w_s will be computed from the partial derivatives of the appropriate elements in f (or g) including due allowance for the dynamic structure. An MCI is thus conditional on a particular model of the economy. Normally, MCIs are computed on the basis of the effects on real GDP.

Mayes-Virén (2000) suggest that the MCI for the euro area will be only 3.5 (compared to 10 for the USA and 6.0 used by the European Commission in its Autumn 2001 Forecast; see EU, 2001b, p. 6). The own calculations with the NiGEM world macro model confirm the value derived by Mayes-Virén (2000) of around 3.0. The European Commission in its Autumn 2001 forecasts for 2001 to 2003 (EU, 2001b, p. 6) evaluates the monetary conditions for the euro area. By combining real interest rates (approximated by the difference between the 3-month rate and core inflation) and real exchange rates (based on unit labor costs in manufacturing), the Commission derives the monetary conditions index (MCI) as a synthetic measures of the change in monetary conditions vis-à-vis a reference period. The loosening in monetary conditions in the euro area since January 1999 were mainly due to the real depreciation of the euro, which was only slightly reverted in the first three quarters of 2001. In contrast, since mid-1999 real interest rates increased and only since the end of 2000 they decreased. At the end of 2001 the real interest rates have returned to their starting level due to gradually increasing core inflation, and the recent cuts in policy rates. As a result monetary conditions remain – according to the European Commission conductive to growth.

The gradual increase of the MCI, indicating since 1999 a continuous loosening of ECB's monetary policy stance, does not preclude that it could not have been improved by a more adequate policy reaction after the oil price shock. The ECB – although it can (and did) intervene in foreign exchange markets – dispose only of one "instrument" for monetary policy, namely the ability to exert substantial control over short-term interest rates. The ECB therefore cannot exert any lasting control over the mix of monetary conditions between interest rates and the exchange rate. As the European Commission confirms, the easing of monetary conditions, measured by the MCI came from the euro depreciation[10].

What would have been the macroeconomic outcome of a monetary policy of the ECB, oriented to the core inflation? In order to simulate the effects of a looser monetary policy the impact of a one percentage point cut in the short-term interest rate of the euro area in the period 2000Q2 to 2001Q3 is simulated with the NiGEM world macro-model.

Figure 12: Euro area: Macro-economic effects of an interest rate cut

In the euro area as a whole a looser monetary policy (a 1% cut of short-term interest rates over seven quarters) would have resulted in a slight increase of real GDP (+0.2 percentage points)[11], a decline in the unemployment rate (of around 0.1 percentage points) and the debt to GDP ratio (by 0.4% of GDP), an improvement in the current account (by 0.2% of GDP) and in the fiscal balance (below 0.2% of GDP) and interestingly without much increase of inflation – below 0.1 percentage points till 2002 and thereafter up to 0.1 percentage points compared to base line. The interest rate cut by one percentage point would have led to an immediate depreciation of the euro against the dollar by the same amount leading to a real effective depreciation of the euro of 0.7%, but declining shortly thereafter. The peak of the transmission of the expansionary monetary policy to the real economy (GDP) is reached after 5 quarters, those of inflation peaks after 16 quarters after starting with the monetary shock.

[10] Own simulations of a sustained 10% depreciation of the Euro vis à vis the US-Dollar with the NiGEM world macro model indicate the following result: real GDP increased by 1% in the first, by 1.2% in the second, by 1% in the third and by 0.9% in the fourth year. Inflation increased by 0.4% in the first, by 1.1% in the second, by 1.9% in the third and by 2.5% in the fourth year. Behind the sustained 10% depreciation of the euro the real effective exchange rate of the euro depreciates by 4.2% in the first, by 3% in the second, by 2.1% in the third and by 1.3% in the fourth year.

[11] Dalsgaard-André-Richardson (2001) find with the OECD INTERLINK model that a sustained drop in short term and long term interest rates of 1 percentage point with fixed exchange rates leads to an increase in real GDP in the euro area of 0.4 percentage points in the first year and increasing to 0.6 percentage points in the second year and staying at that level thereafter. The transmission effects of interest rate cuts on the real economy and the price system, simulated with the NiGEM model are the higher, the longer lasting such cuts are. This is due to the forward-looking behavior of agents assumed in the model. If, e.g. the short term interest rates are cut not only over one year, but sustained over a period of seven years, real GDP increases by 0.8% in the first, by 1.3% in the second, by 1.4% in the third and by 1.3% in the fourth year. HICP inflation increases by 0.2% in the first, by 0.4% in the second, by 0.7% in the third and by 1.2% in the fourth year. By contrast, Mihov (2000, p. 383) finds output responses to a 1% interest rate cut over the same period of only half of that size with a simple VAR model.

This is in line with other simulations of the transmission of monetary policy in the literature (see e.g. Mihov, 2001 with a VAR model approach)[12].

Figure 13: Euro area: GDP effects of an interest rate cut

Figure 14: Pre-ins area: GDP effects of an interest rate cut

Again the interesting aspect of this exercise is the different impact in the Euroland member states. As the economies of Euroland are far from being equal and fully synchronized as far as the business cycle of real GDP is concerned (see table 1), the transmission of monetary policy to output (and other macro variables) must be different. As figure 13 shows, the more expansionary monetary policy over the last two years would have resulted in higher GDP stimulation in Germany and Austria than in Portugal or Belgium. The real GDP effects spreads from ¼ percentage points to only 0.1 percentage points. Additionally, the speed of adjustment differs between the Euroland Member States. Although the overall impact of a one percentage point increase of short-term interest rates is very modest, it nevertheless would have resulted in a mitigation of the downturn of the business cycle in the euro area. However, the experiment also indicates that each monetary shock leads to a general disturbance of the process of the synchronization of the European business cycle[13], often claimed as being necessary to fulfill the OCA (optimum currency area) criteria[14].

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[12] For an overview of the main determinants of the transmission of monetary policy to output and the different transmission channels (interest rates, exchange rates, credit and bank lending, balance-sheet), see EU (2001a, p. 58).The numerous attempts to estimate (via empirical macroeconomic models) the extent of possible asymmetries in output and price responses to the single monetary policy across Euroland countries have not provided a consistent and robust picture of cross-country differences in monetary transmission and they are affected by methodological problems (Lucas problem). This state of affairs has revamped interest in microeconomic studies comparing economic and financial structures across countries, as they are ultimately responsible for any differences in the way monetary impulses are transmitted throughout the economy (see EU, 2001a, pp. 57-59; Clements-Kontolemis-Levy (2001) and Suardi (2001); Angeloni-Kashyap-Mojon-Terlizzese (2001) for an overview of the present status of research for Euroland).

[13] Many attempts to find a “common European business cycle” have failed so far; see a recent exercise by Breitung-Candelon (2001). Accordingly, the common cycle hypothesis is clearly rejected for U.K. (industrial production) data whereas some weak evidence for a joint cyclical pattern is found for France, the Netherlands, Austria and Germany. Artis-Zhang (1999) show that the business cycle affiliation of the Exchange Rate Mechanism (ERM) member countries has shifted from the United States to Germany since the formation of the ERM. In the same period, however, the United Kingdom’s business cycle affiliation did not change.

[14] Mihov (2001, p. 385) demonstrated that neither a complete symmetric transmission mechanism of monetary policy nor a complete synchronization of the business cycle is a necessary condition for the functioning of a currency union. The diversity across five EMU countries he analyzed is not uniformly larger than across US regions. In fact, the USA is more diverse than the five EMU countries. May be that not ex ante OCA criteria (the intensity of trade with other members; the correlation of domestic business cycles with other members) have to be fulfilled when entering a monetary union, but that it is enough to fulfill them ex post. Frankel-Rose (1998) favor this position. As international trade patterns and international business cycle correlations are endogenous, they conclude that countries with closer trade links trend to have more tightly correlated business cycles. Hence, they derive the “endogeneity of the OCA criteria”.

In the pre-ins area of the EU, only the United Kingdom exhibited slight negative spill-overs from the interest rate cut in Euroland, a result consistent with the classical two-country Mundell-Fleming model with flexible exchange rates. The other pre-ins (Denmark, Greece and Sweden) hat effects comparable with those of Euroland average (see figure 14).

Figure 15: Euro area: HICP inflation effects of an interest rate cut

Figure 16: Pre-ins area: HICP inflation effects of an interest rate cut

The inflation effects of the temporary interest rate cut are generally very modest. Only Ireland (see figure 15) stand out at the beginning. But even in the medium run the inflation increasing effect is not higher than 0.15 percentage points. The dispersion of the inflation effects is weaker than those of real output effects. With the exception of the United Kingdom the inflation effects are similar in the pre-ins countries (see figure 16).

5. Conclusions

Overall, the ECB managed monetary policy quite satisfactory in the first phase of EMU. However, one may ask whether the monetary policy really was optimal. The estimated Taylor reaction function indicates that the monetary policy was rather backward than forward-looking. On the one hand it reacted with a lag to the actions of US's Fed. On the other hand it was overly cautious as it was targeting total HICP inflation. In this paper it is argued and also demonstrated with model simulations that a monetary policy that targets inflation measured by total HICP was not optimal given the fact that Euroland was confronted with the first external (oil price) shock. The oil price shock led to an increase in headline inflation of over one percentage point in 2000/2001. By setting interest rates according to the underlying or "core" inflation the monetary policy stance could have been looser without risking additional inflation. The latter is demonstrated in simulation experiments with a world macro model. For the future the ECB could – without giving up the "two pillar" strategy – orient its policy reaction more to "core" than to total inflation. Of course one could argue that it is difficult to orient monetary policy forward-looking as most of the price forecasts – in particular those for commodity prices (and therefore also those for crude oil) – are chronically false. In fact, the OECD as well as the European Commission in their 1999 December forecasts underestimated the oil price development for the year 2000 by 25% to 30% and those for the year 2001 by around 10%. In 2000, they gradually adjusted their forecast to the correct values!

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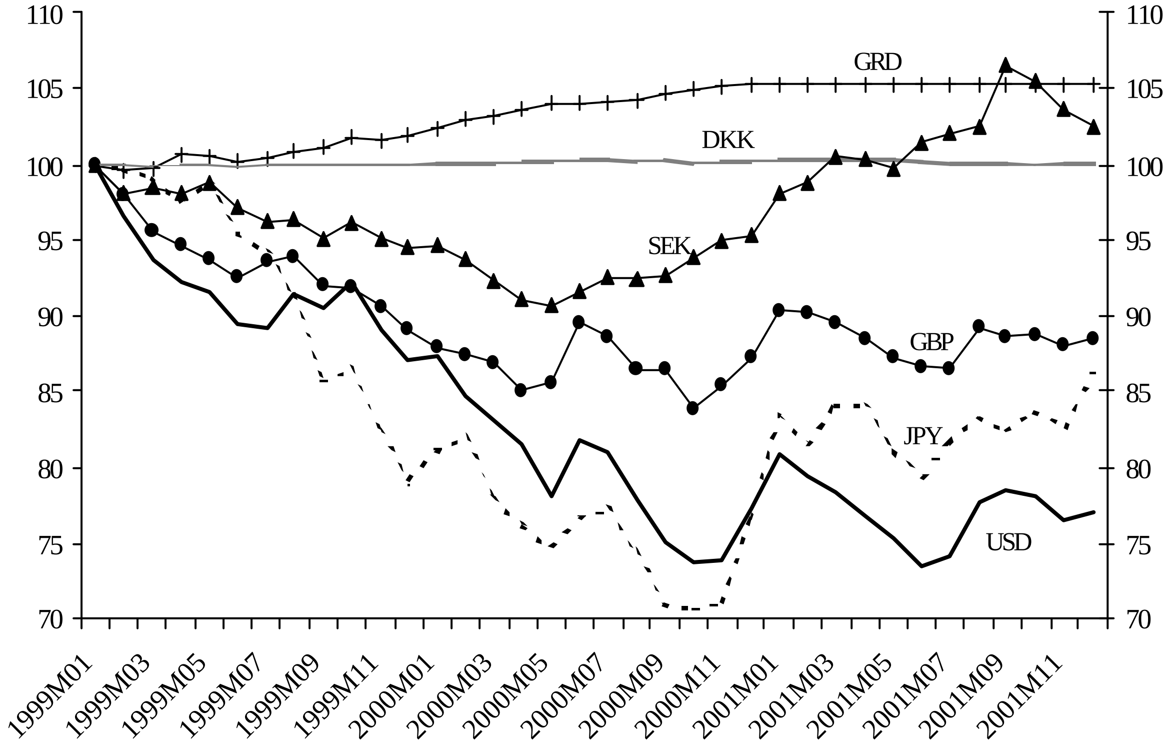
Table 1: Macro-economic performance of EU Member States
(averages 1999-2001)

	Euro area ins and outs	GDP, real annual %-change	HICP[1)] inflation annual %-change	Unemployment rate (in %)	General government budget balance (in % of GDP)	Gross public debt (in % of GDP	Current account (in% of GDP
Belgium	*B	2.77	2.07	7.57	-0.17	110.97	4.80
Denmark	DK	2.20	2.37	4.83	2.60	47.10	2.50
Germany	*D	1.83	1.70	8.10	-0.97	60.53	-0.63
Greece	*EL	3.93	2.87	11.10	-0.97	101.90	-4.00
Spain	*E	3.63	3.13	14.33	-0.43	60.70	-2.93
France	*F	2.67	1.40	9.80	-1.50	57.73	1.80
Ireland	*IRL	9.60	3.93	4.53	3.07	40.73	-0.57
Italy	*I	2.10	2.33	10.43	-1.10	110.93	0.43
Luxembourg	*L	6.40	2.47	2.33	4.73	5.53	20.03
Netherlands	*NL	2.90	3.17	2.90	1.30	57.00	4.97
Austria	*A	2.30	1.63	3.83	-1.17	63.37	-2.83
Portugal	*P	2.83	3.10	4.13	-1.87	53.90	-9.20
Finland	*FIN	3.40	2.33	9.73	4.53	44.67	6.80
Sweden	S	3.17	1.53	6.10	3.23	57.90	3.57
United Kingdom	UK	2.43	1.12	5.57	2.23	42.60	-2.00
EU-15	EU	2.53	2.10	8.33	-0.03	64.80	0.00
Euro area	*EUR	2.57	2.10	9.03	-0.70	70.57	0.23

[1)] HICP = Harmonized Index of Consumer Prices.

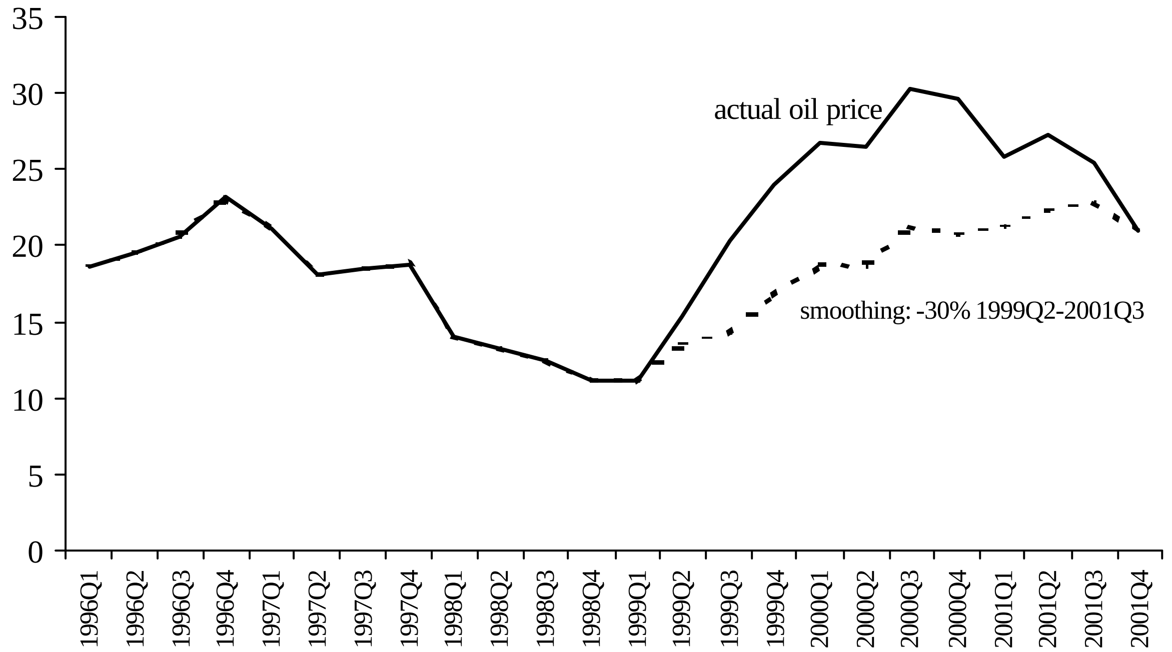
Source: Autumn 2001 Forecasts for 2001-2003, European Economy, Supplement A, No. 10/11 – October/November, Brussels, 2001.

Figure 1: Euro exchange rates
(national currencies per Euro; 1999M01 = 100)



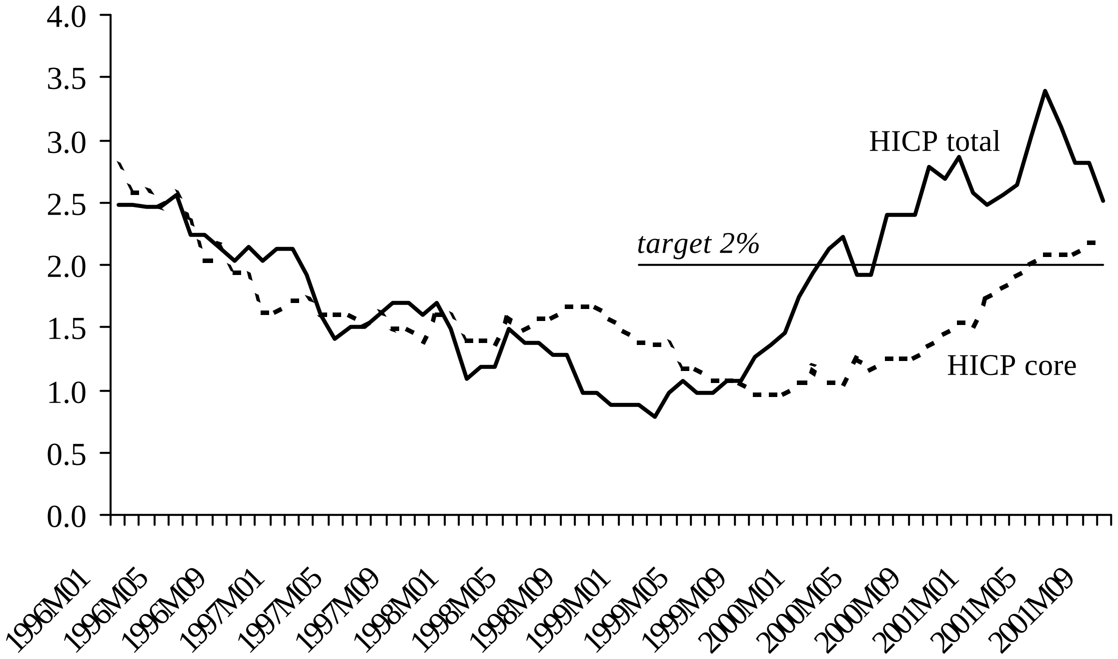
Source: European Central Bank (ECB).

Figure 2: World oil price (Brent crude spot; USD/barrel)



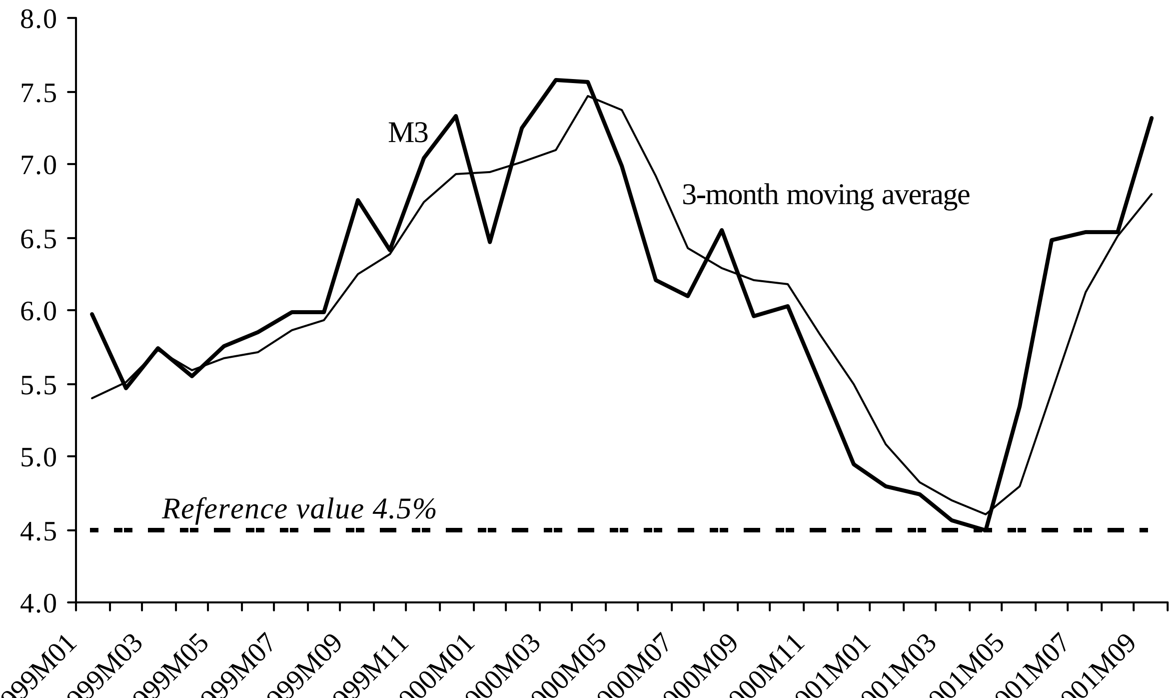
Source: Oxford Economic Forecasting world model.

Figure 3: HICP inflation rates in the euro area– headline and core



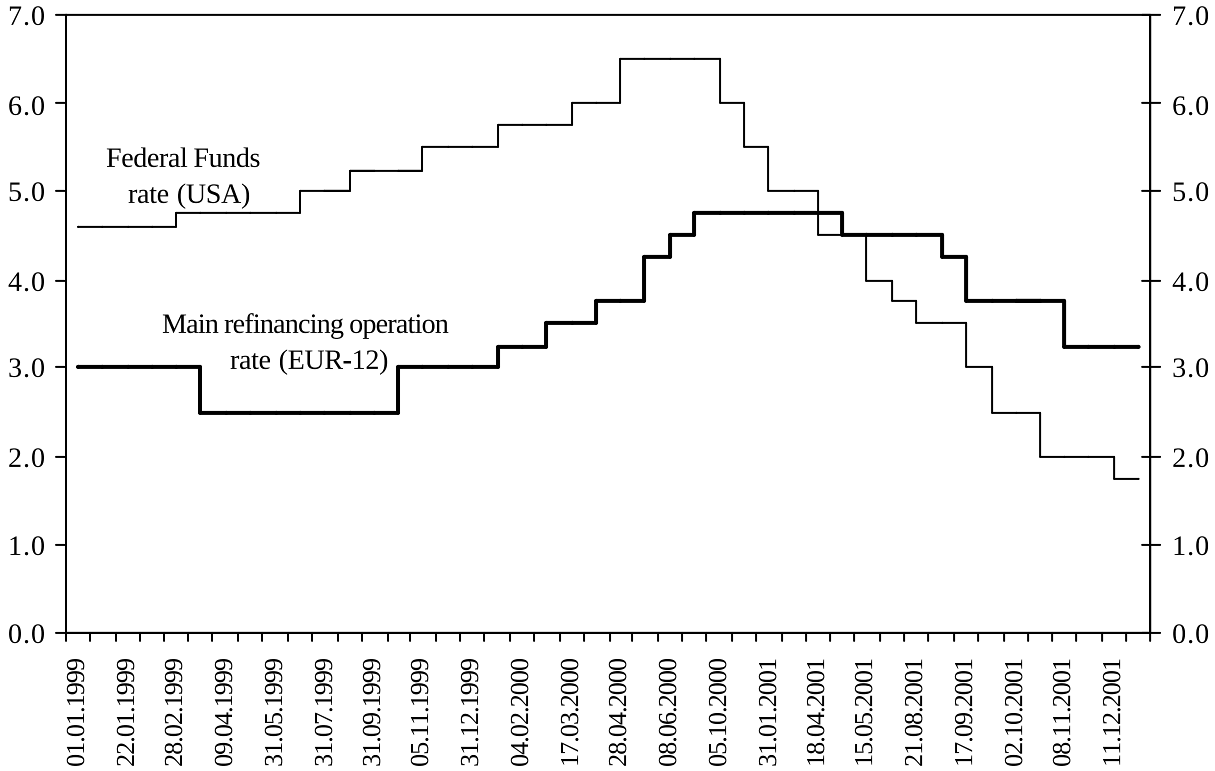
Source: OECD, Main Economic Indicators
HICP = Harmonized Index of Consumer Prices ("headline" = total index)
HICP "core" = HICP total excluding energy, food, tobacco, alcohol.

Figure 4: Growth of money M3 in the euro area (EUR-12)
(annual growth in %, seasonally adjusted)



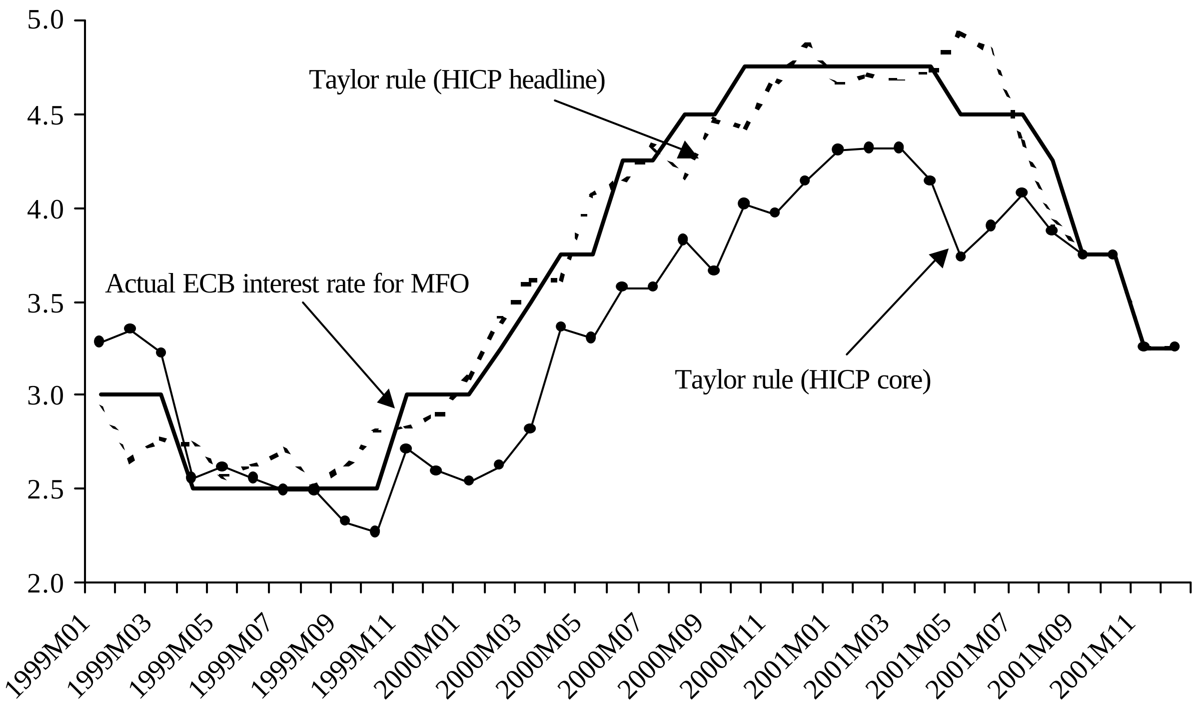
Source: OECD, Main Economic Indicators.

Figure 5: Interest rates in the euro area and in the USA



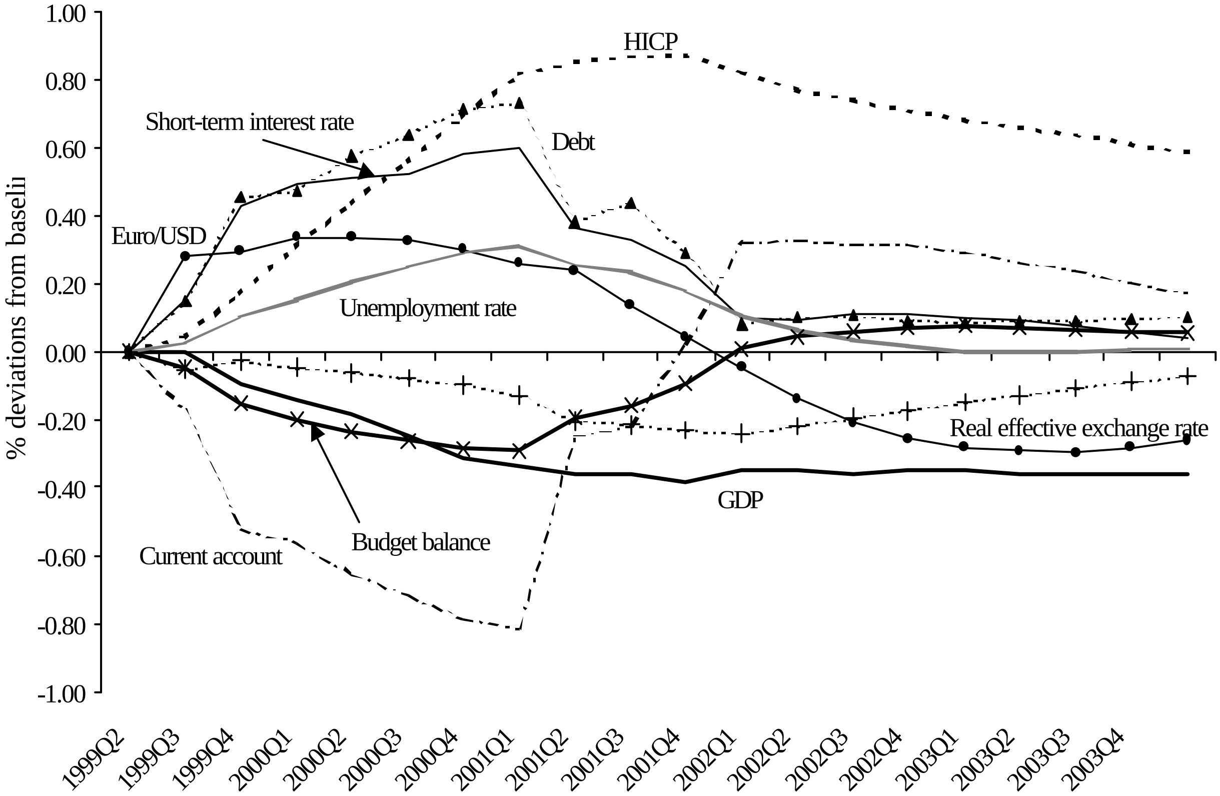
Sources: ECB and USA Federal Reserve Board.

Figure 6: ECB interest rate policy and Taylor rules
(ECB interest rate for MFO)



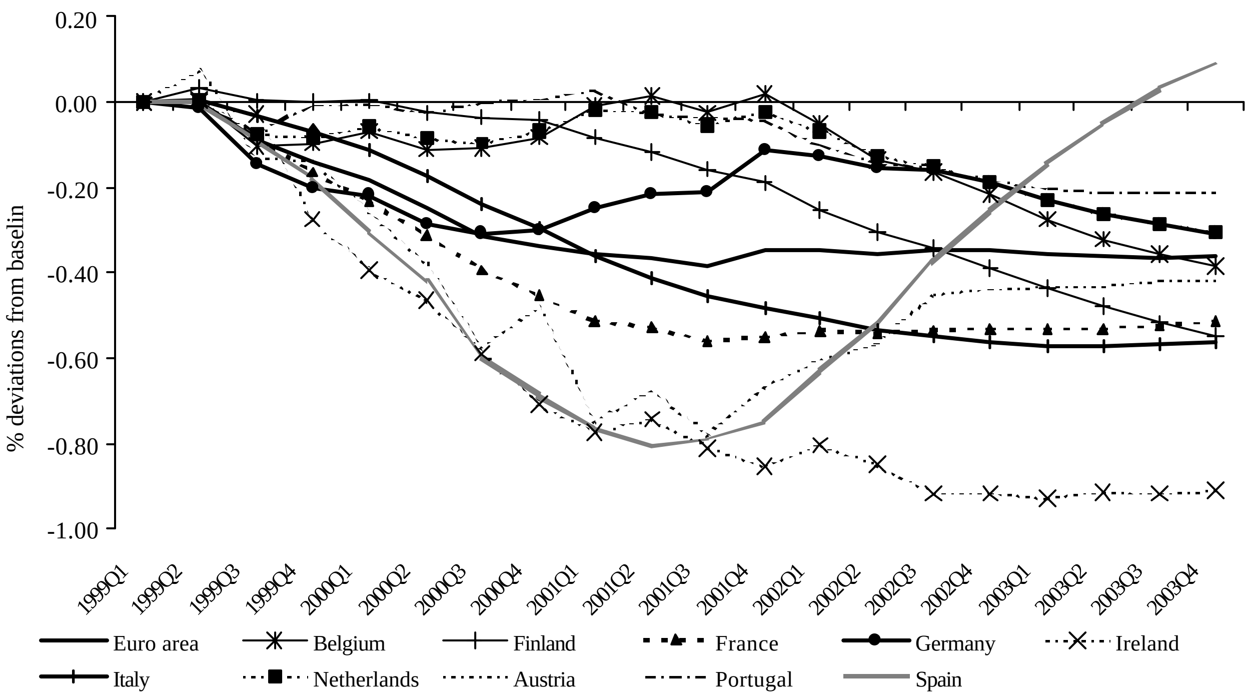
Source: Own calculations based on data from the ECB.

Figure 7: Euro area: Macro-economic effects of a world oil price shock
(30% increase 1999Q2-2001Q3)



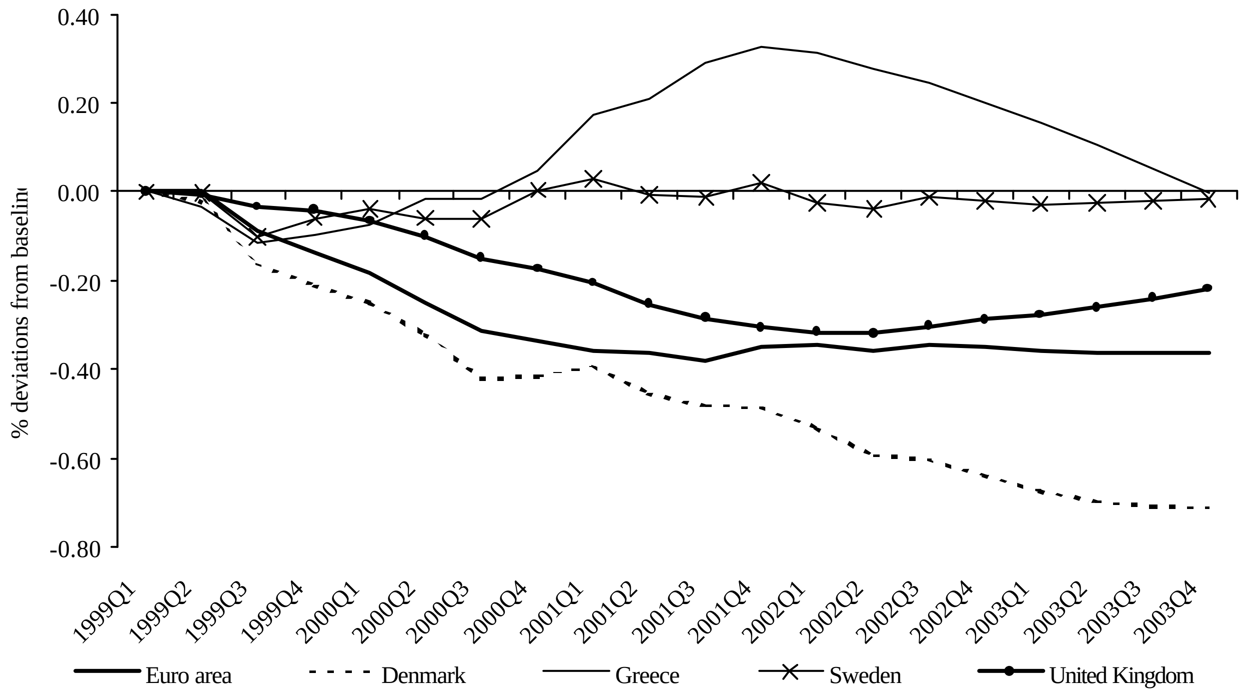
Source: Own calculations with the NiGEM world macro model.

Figure 8: Euro area: GDP effects of a world oil price shock
(30% increase 1999Q2-2001Q3)



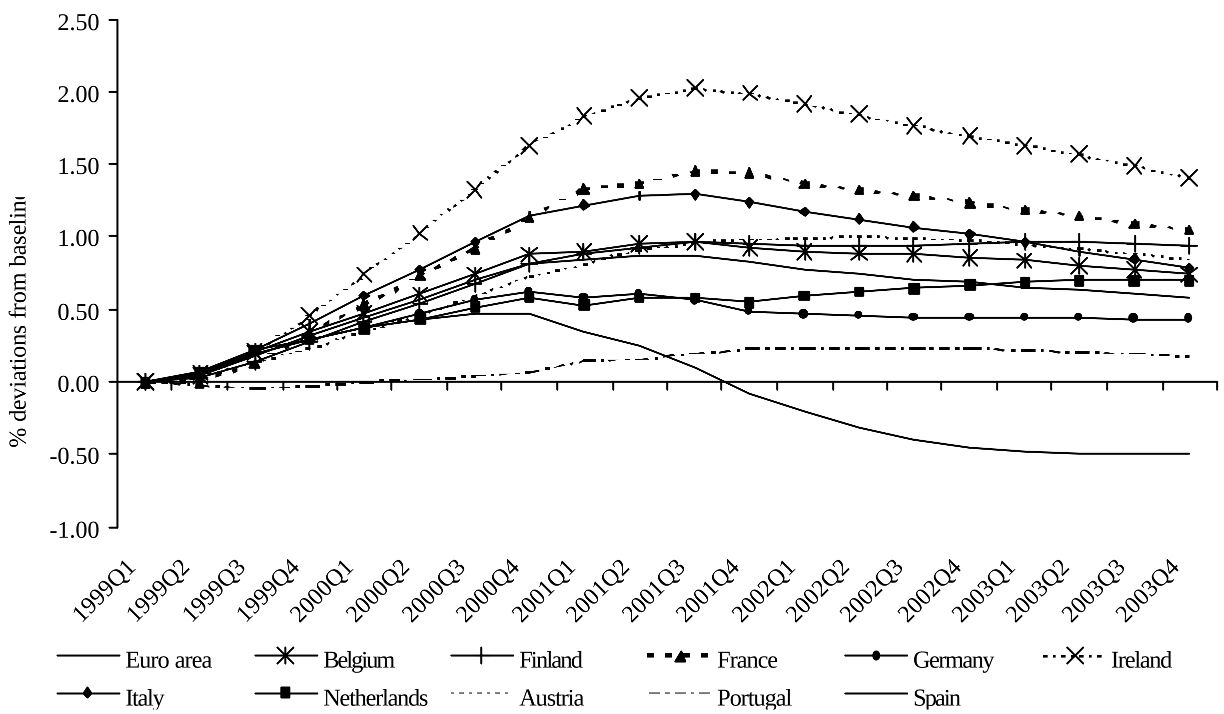
Source: Own calculations with the NiGEM world macro model.

Figure 9: Pre-ins area: GDP effects of a world oil price shock
(30% increase 1999Q2-2001Q3)



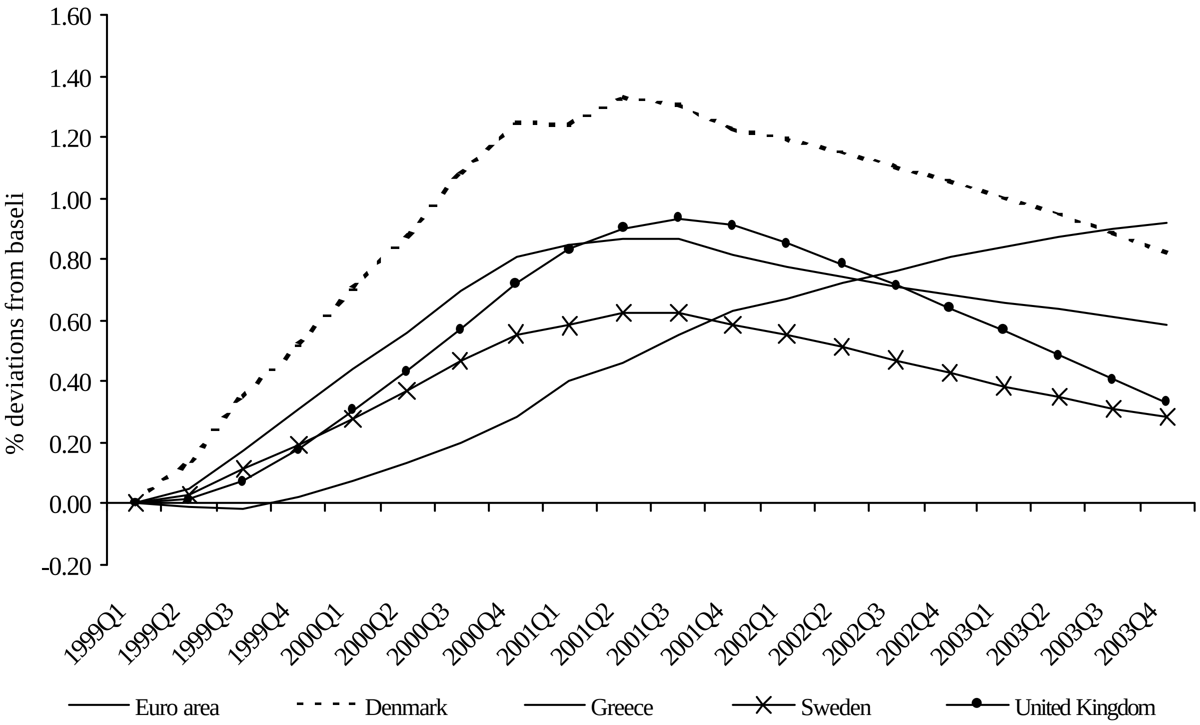
Source: Own calculations with the NiGEM world macro model.

Figure 10: Euro area: HICP inflation effects of a world oil price shock
(30% increase 1999Q2-2001Q3)



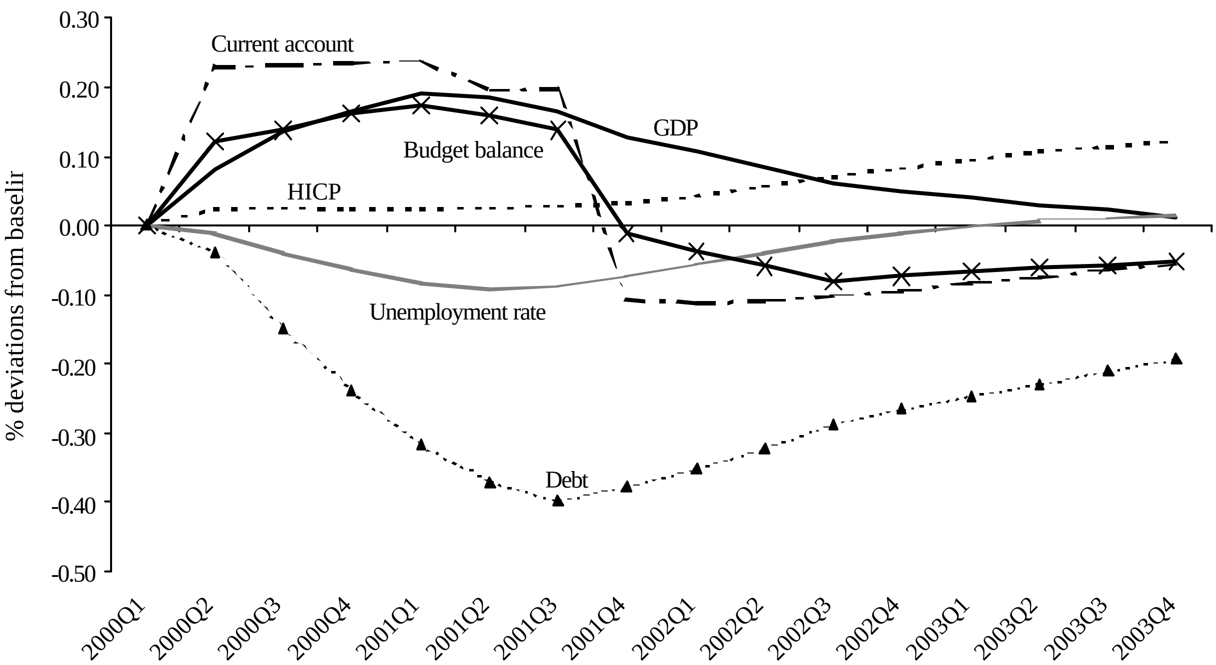
Source: Own calculations with the NiGEM world macro model.

Figure 11: Pre-ins area: HICP inflation effects of a world oil price shock
(30% increase 1999Q2-2001Q3)



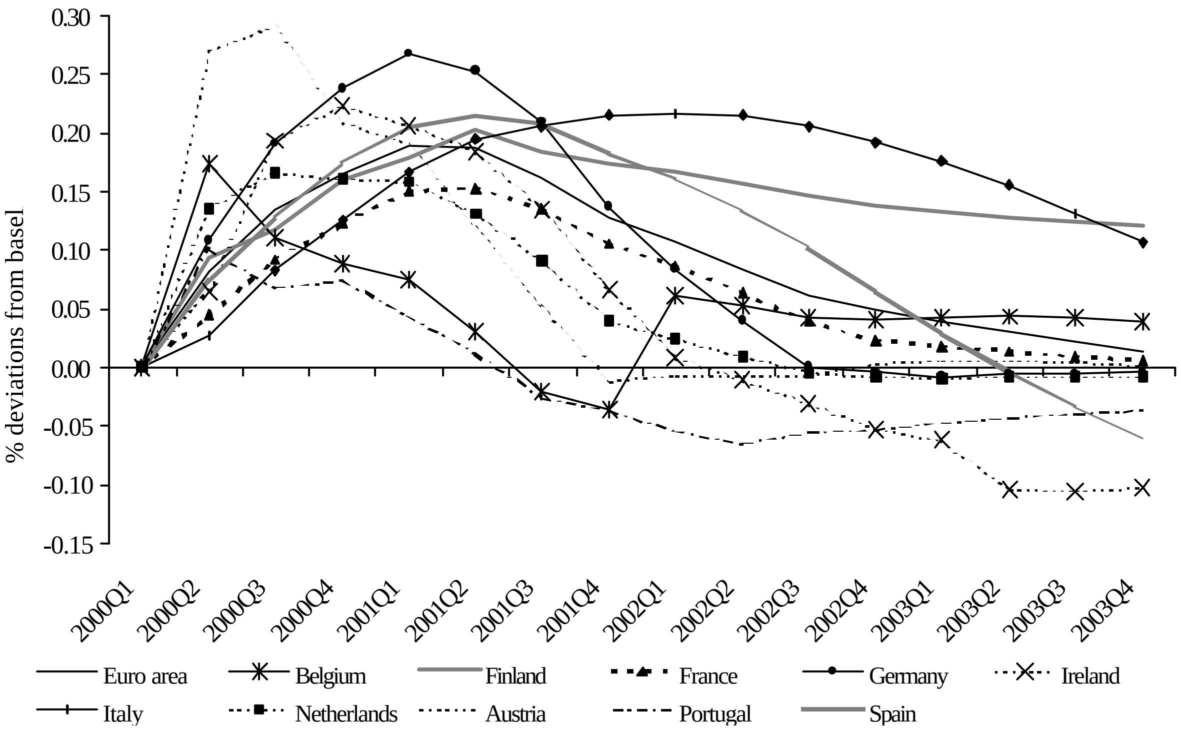
Source: Own calculations with the NiGEM world macro model.

Figure 12: Euro area: Macro-economic effects of an interest rate cut
(1% decrease of short-term interest rates in the euro area 2000Q2-2001Q3)



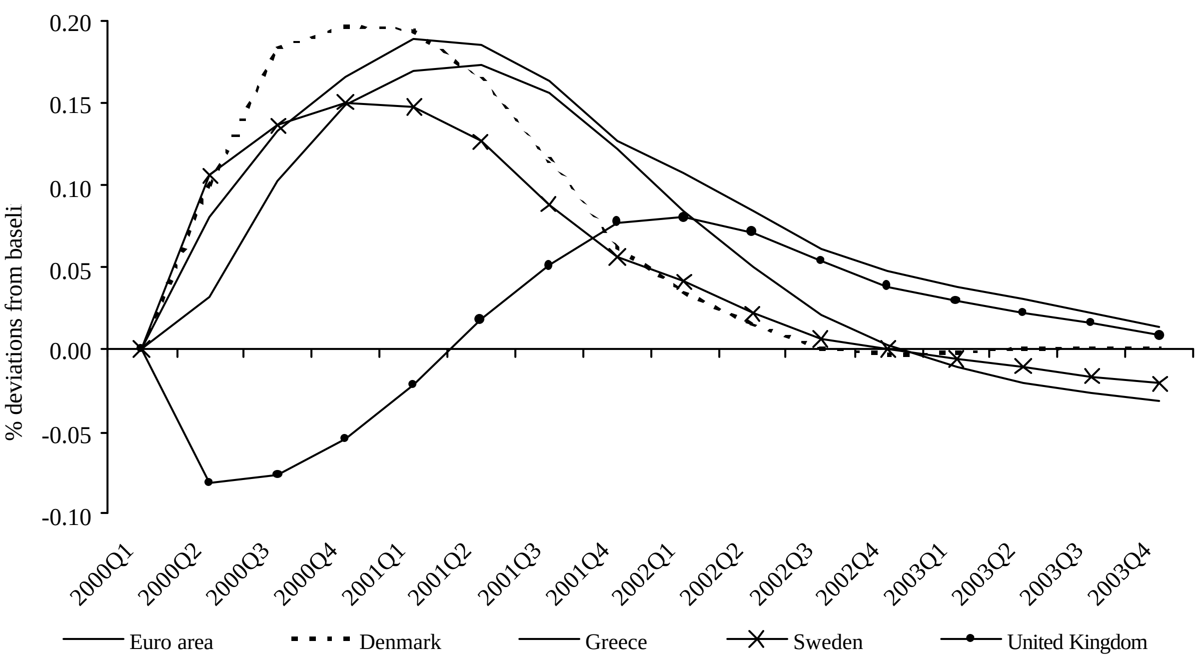
Source: Own calculations with the NiGEM world macro model.

Figure 13: Euro area: GDP effects of an interest rate cut
(1% decrease of short-term interest rates in the euro area 2000Q2-2001Q3)



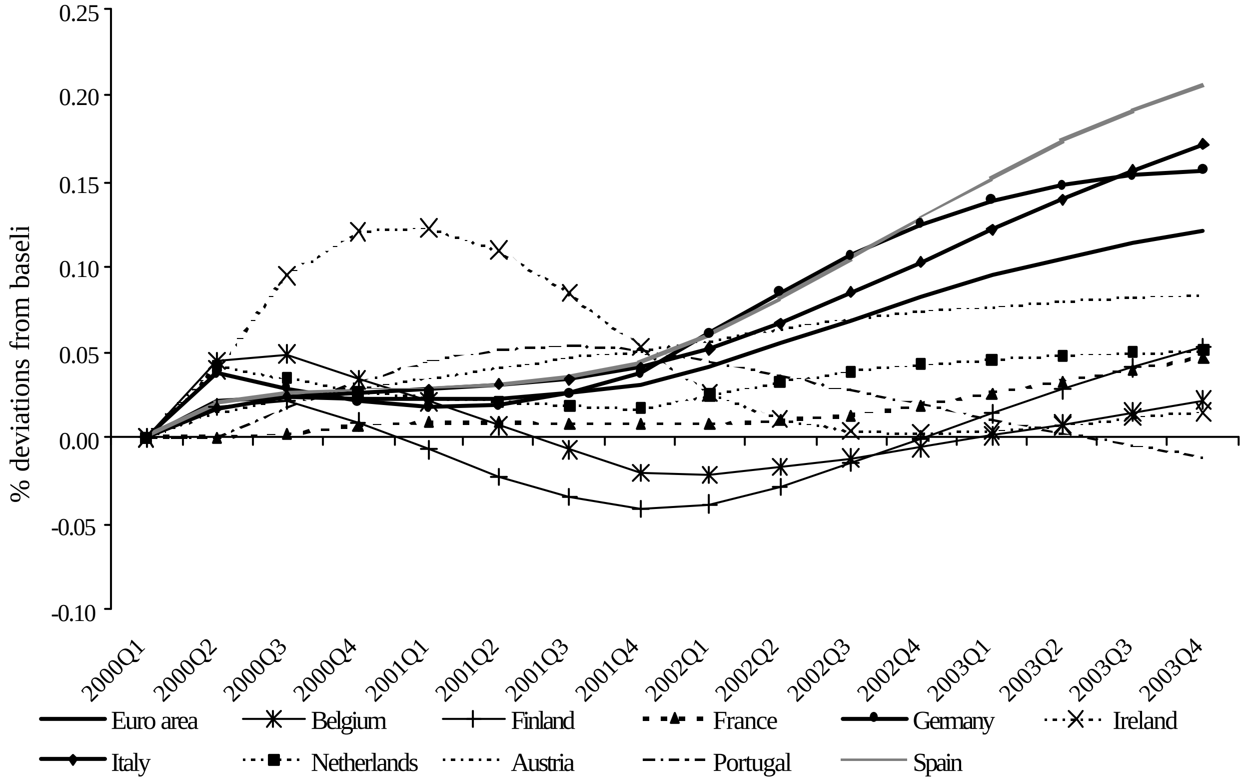
Source: Own calculations with the NiGEM world macro model.

Figure 14: Pre-ins area: GDP effects of an interest rate cut
(1% decrease of short-term interest rates in the euro area 2000Q2-2001Q3)



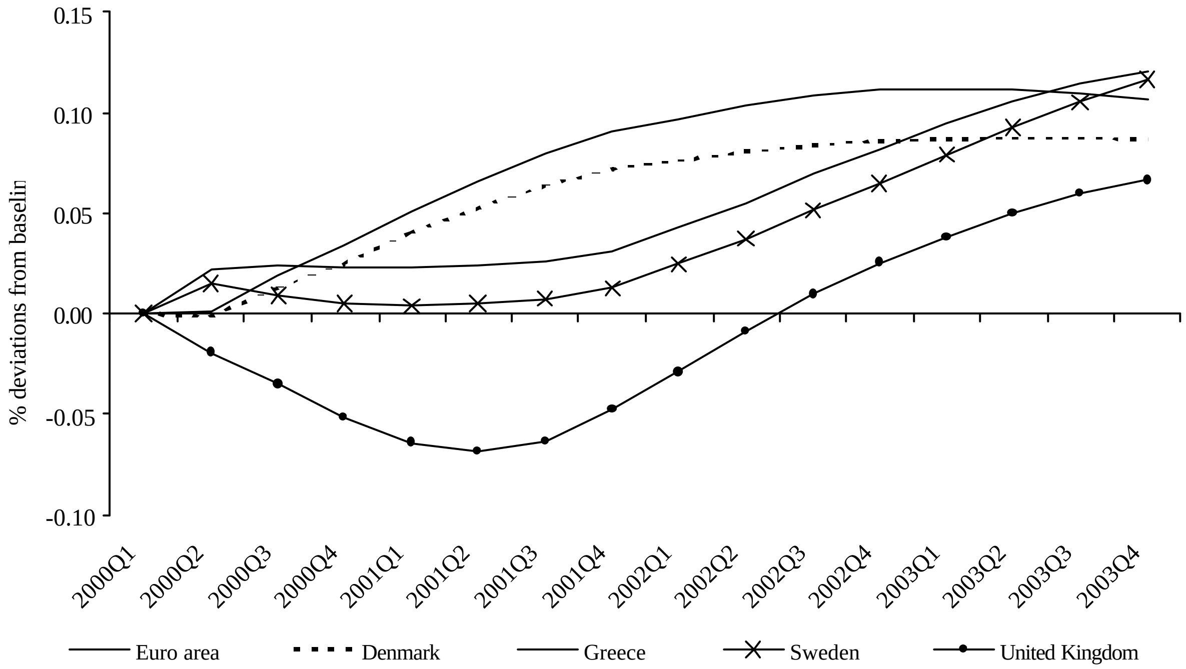
Source: Own calculations with the NiGEM world macro model.

Figure 15: Euro area: HICP inflation effects of an interest rate cut
(1% decrease of short-term interest rates in the euro area 2000Q2-2001Q3)



Source: Own calculations with the NiGEM world macro model.

Figure 16: Pre-ins area: HICP inflation effects of an interest rate cut
(1% decrease of short-term interest rates in the euro area 2000Q2-2001Q3)



Source: Own calculations with the NiGEM world macro model.

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