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Euroland: recovery will slowly gain momentum

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KIELER DISKUSSIONSBEITRÄGE

403 KIEL DISCUSSION PAPERS

Euroland: Recovery Will Slowly Gain Momentum

by Klaus-Jürgen Gern, Christophe Kamps, Carsten-Patrick Meier, Frank Oskamp, and Joachim Scheide

CONTENTS

- Economic activity in the euro area has weakened since last summer. In the second half of 2002, real GDP increased at an annualized rate of around 1 percent only. Economy-wide capacity utilization has further declined and the situation on labor markets has worsened. The increase in consumer prices has calmed down somewhat after an acceleration at the beginning of last year. Still, the inflation rate remains surprisingly high against the background of weak economic activity that has already lasted for two years.
- Monetary policy in the euro area is clearly expansionary. With only about 0.5 percent, the real interest rate is currently quite low by historical standards. Moreover, the nominal interest rate is well below the rate implied by the standard Taylor rule, even when low estimates of the current size of the output gap and the equilibrium real interest rate are employed in the calculation of the rule. Still, monetary policy is probably not too expansionary. According to theory, the equilibrium real interest rate may be substantially below the long-run average real interest rate in situations such as the current one with depressed income and profit expectations. However, these considerations also imply that the ECB should bring the real interest rate back towards the long-run average once the depressing factors will have vanished.
- The situation of public finances in the euro area deteriorated further in the course of last year, with the aggregated budget in the countries of the euro area approaching a deficit of 2.3 percent of GDP in 2002. The cyclically adjusted budget deficit in the euro area was as high as in 1998, the year immediately before the beginning of the third stage of the Economic and Monetary Union. Whereas most countries have in the meantime complied with the goal of the Stability and Growth Pact to at least balance the budget over the medium term, the budget deficit in Germany, France, Italy and Portugal remained high both in actual and in structural terms. The governments of the three largest countries of the euro area are not likely to switch towards a policy of fiscal consolidation based on cuts in primary spending in 2003 and 2004.
- Moderate wage settlements would be appropriate in the current cyclical situation. However, wage increases have not slowed down over the past year, and are not expected to do so to any meaningful extent this year and next, reflecting the judgment that labor market rigidities will remain significant over the forecast horizon. Nevertheless, as employment is likely to be slow in responding to a recovery in production, the rise in unit labor costs will decelerate considerably, improving the chances that inflation will fall persistently below 2 percent.
- The leading indicators suggest that economic activity in the euro area will remain weak in the first half of this year. Under the assumption that the war in the Gulf region is of short duration and that the global political situation calms down afterwards, dampening factors from the Iraq conflict are expected to wane. Impulses from expansionary monetary policy will then increasingly take effect and domestic driving forces will gain the upper hand. We expect real GDP to increase by 1.0 percent and by 2.6 percent in 2003 and 2004, respectively. The situation on the labor market will start to improve towards the end of this year only. Inflation will be moderate over the forecast horizon. In 2004, consumer prices will probably rise by 1.9 percent on average, after 2.2 percent this year.

Contents

This report was completed on March 6, 2003, and prepared for the 67th Kieler Konjunkturgespräch (March 17/18, 2003).

Euroland: Recovery Will Slowly Gain Momentum

The economic expansion in Euroland has remained moderate. In the course of 2002, real GDP increased on average at an annual rate of just 1 percent. Investment of firms continued to decline, and private consumption also weakened at the end of the year. For more than two years, capacity utilization has declined according to most estimates. While unemployment went up only moderately during the downturn, the number of employed persons decreased in the second half of last year for the first time since the recession of 1992/93. Inflation has remained stubbornly high; consumer prices increased by more than 2 percent also in 2002.

Leading indicators do not suggest that economic activity has picked up during the first months of 2003; however, there are also no indications of another setback. Although the current situation appears to be quite unstable because of the uncertainty related to the conflict with Iraq, we expect that the recovery will slowly gain momentum in the second half of this year. The stance of monetary policy continues to be expansionary. In real terms, both short-term and long-term interest rates are lower than ever before since the beginning of the monetary union. However, monetary conditions have been affected by the considerable appreciation of the euro.

Recently there have been signs that the consensus among governments regarding the targets and strategies of economic policy in the European Union is crumbling, probably due to the cyclical weakness which has prevailed longer than expected. First, it is claimed that the Stability and Growth Pact (SGP) is too strict in that it does not allow fiscal policy to cope with the state of the business cycle. Nevertheless, those countries which have successfully consolidated government budgets are not at all in a worse cyclical situation than those which have so far not met the targets of the SGP. Second, the European Central Bank (ECB) is urged to react more strongly to the cyclical downturn, i.e., to lower interest rates more radically. It has to be kept in mind, however, that the prime objective of the ECB is to maintain price level stability; therefore, the central bank must also be concerned about the fact that inflation has been higher than the upper limit of the target range and that it is also not likely that inflation will drop well below the 2 percent threshold this year. Thus, the credibility of the ECB is at risk. Third, it is claimed that the inflation target of the ECB is too ambitious. This reasoning neglects, however, the ample evidence which shows that problems of the real economy are not reduced when the average inflation rate is higher, in other words: There is no long-run tradeoff as suggested by the old Phillips curve.

It is, of course, a central objective of monetary policy to assess what level of interest rates is appropriate if economic activity is to be supported without the risk of violating the target of price level stability. At the center of research is thus the estimation of the equilibrium real interest rate and – related to that – the level of equilibrium output or the growth rate of potential output, respectively. However, there is no precise knowledge of these crucial variables, and every assessment depends on the underlying theoretical model. Nevertheless, it can be argued that the equilibrium real interest rate is not constant over time but fluctuates in the short run if an economy is hit by real shocks. Accordingly, it can be argued for the present situation in Euroland that the real equilibrium interest rate is relatively low because the oil price has increased and the expectations of firms and private households about the future course of the economy have become pessimistic. An “optimal” monetary policy should take account of that if the economy is to be stabilized. Although theoretical considerations commonly do not lead to precise prescriptions for actual policy, we think it is appropriate that real interest rates in the euro area are currently lower than they are on average.

1 Weak Economic Activity

Economic activity in the euro area has perceptibly weakened since last summer. In the second half of 2002, real GDP increased at an annualized rate of only around 1 percent, in the fourth quarter of last year it even almost stagnated (Figure 1). In 2002, real GDP increased by 0.8 percent on average (1.4 percent the preceding year). For two years economic activity has expanded at a slower pace than potential output whose current growth rate is estimated to be around 2 percent.[1] Since its cyclical peak in the year 2000 the output gap has fallen by roughly 2 percentage points. While the strength of the downturn is moderate compared to the recessions in 1974/75, 1980/82 or 1992/93, the current weakness of economic activity is considerably longer than in those years. The length of the downturn is very probably related to the uncertainty with respect to the Iraq conflict. This uncertainty has contributed to the loss in consumer and industrial confidence, to the continued decline in stock market values, and to the renewed increase in the oil price despite weak demand.

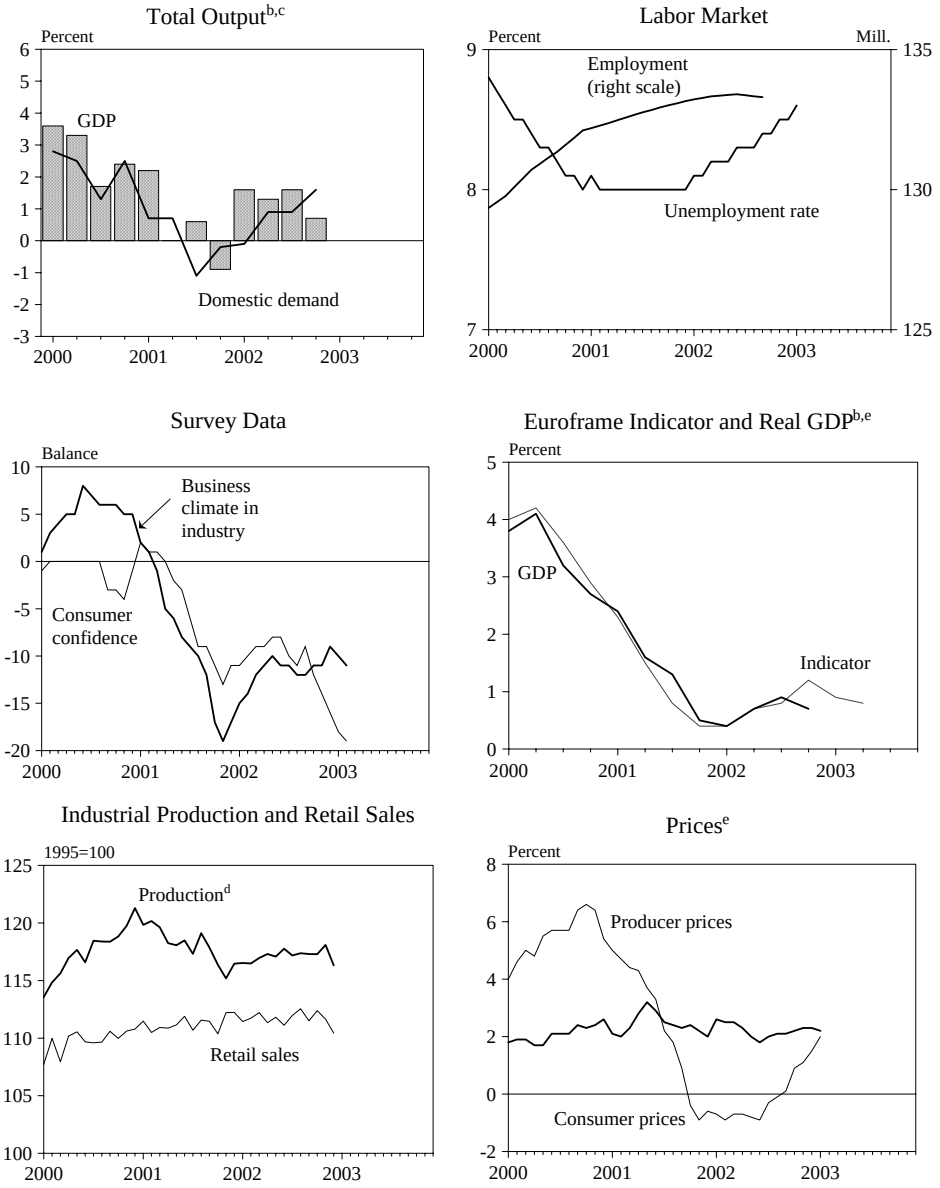
The increase in real GDP last year was almost exclusively due to external demand. In the course of 2002 exports increased by more than 4 percent. It has to be kept in mind, though, that the trade data published by Eurostat in the national accounts include trade flows between member countries of the euro area. Calculations of the European Central Bank (ECB 2003: 34) on the basis of trade data that are only partly comparable to those in the national accounts suggest that the increase in exports was mainly due to higher trade flows inside the euro area. According to these estimates deliveries to the United States and to the United Kingdom have declined since spring 2002. This is probably partly due to the strong appreciation of the euro. Against the US dollar the euro appreciated by around 14 percent in the course of last year, against the pound sterling it appreciated by roughly 4 percent. In the meantime, exports to Asia have expanded at a fast pace. The contribution of external trade to real GDP increased strongly last year also because imports rose only slightly in view of weak domestic demand.

Domestic demand remained weak in 2002, even though there was a slight recovery towards the end of the year. Corporate investment was downwards oriented just as in 2001. Apparently, the continued decline in capacity utilization, the renewed fall in stock market prices and the increase in oil prices were more important than the impulses from monetary policy. This impression is confirmed by the index of industrial confidence published by the European Commission and by the purchasing managers' index which both deteriorated after a recovery in the first half of last year. Private households expanded their consumption expenditures at a considerably lower pace than in the previous years. While wages and salaries rose somewhat faster than before, the increasingly worsening situation on the labor market and the Iraq conflict negatively affected consumer sentiment. The index of consumer confidence, which has declined since last summer, was even considerably lower at the beginning of this year than in the months immediately following the terrorist attacks on September 11, 2001.

The increase in consumer prices has calmed down somewhat after an acceleration at the beginning of last year. However, the inflation rate is still surprisingly high against the background of the weakness of economic activity that has already lasted for two years. In the course of the second half of 2002 the Harmonized Index of Consumer Prices (HICP) increased at an annual rate of 1.8 percent in seasonally adjusted terms. Measured as the change over the previous year the inflation rate has again even exceeded the target corridor of 0 to 2 percent that the European Central Bank views to be consistent with price level stability; on average the HICP exceeded its level in the previous year by 2.2 percent last year. The core inflation rate (HICP ex-

[1] The chapter on monetary policy presents estimates of the growth rate of potential output according to alternative methods. The average growth rate for 2002 amounts to 2.0 percent (see Table 3).

Figure 1:
Business Cycle Indicators[a] for Euroland



[a]Seasonally adjusted. – [b]At constant prices. – [c]Percentage change over previous quarter (annual rate). – [d]Industry excluding construction. – [e]Percentage change over previous year.

Source: EUROFRAME (2003); Eurostat (2003); ECB (2003).

cluding energy, food, alcohol and tobacco) also remained above the 2 percent threshold. This was mainly due to the fact that service prices – which had been raised considerably at the beginning of 2002 when euro banknotes and coins were introduced –continued to increase at a fast pace in the further course of last year. In the first half of 2003, core inflation will probably decline as firms' scope for raising prices will remain limited due to continued economic weakness. Headline inflation will accelerate somewhat, though, because of higher oil prices.

2 Fiscal Policy Has Given Up Consolidation Efforts

The situation of public finances in the euro area further deteriorated in the course of last year. The aggregated budget in the countries of the euro area exhibited a deficit of approximately 2.3 percent in relation to GDP (1.5 percent in 2001) (Table 1). The increase in the budget deficit was due to the further slowdown in economic activity. Real GDP in the euro area increased considerably slower than potential output last year, the output gap widened by 1 ½ percentage points in absolute terms. Assuming an elasticity of the budget balance with respect to the output gap of 0.5 (OECD 1999: 147), the cyclical component of the change in the deficit amounted to around ¾ percent in relation to GDP. Thus, the deterioration of public finances can be traced back to the free operation of automatic stabilizers. As in the preceding years fiscal policy in the euro area as a whole was on a neutral course.

According to estimates of international organizations the cyclically adjusted budget deficit in the euro area was as high last year as in 1998, the year immediately before the beginning of the third stage of Economic and Monetary Union. Yet, there are pronounced differences between individual euro area countries: In the meantime most countries have fulfilled the goal of the Stability and Growth Pact, i.e., they have reached a nearly balanced structural budget or even a budget surplus. However, Germany, France, Italy and Portugal exhibit a considerable structural budget deficit. In the case of Germany and Portugal the European Commission started the excessive deficit procedure last year, in the case of France the ECOFIN Council lately issued an early warning because the budget deficit there threatens to exceed the critical value of 3 percent in relation to GDP. Figure 2 shows that the mentioned four countries could have avoided coming closer or exceeding the 3 percent threshold if they had not deviated from the consolidation course after the beginning of the third stage of monetary union. Between 1992, when the Maastricht Treaty was signed, and 1998 the structural budget balance as well as the primary balance improved considerably in Germany as well as in the rest of the euro area. Whereas the situation of public finances in Germany mainly improved because of a rise in taxes and social security contributions, the deficit reduction in the rest of the euro area was mainly due to a decrease in primary spending (government spending excluding interest payments). Since 1998, however, the primary budget balance has deteriorated both in Germany and in the rest of the euro area. In many countries taxes were cut. While these tax cuts are welcome under efficiency considerations, these countries in general refrained from corresponding cuts in primary spending. In Germany the structural budget deficit increased strongly as a result of this. In the other countries such an increase was not recorded only because interest payments considerably fell due to the strong decrease in long-term interest rates. The reduction in the government spending to GDP ratio repeatedly announced by the German, French and Italian government in their stability programs has proved to be a hollow promise.

For this year and next year it is foreseeable that the governments of the three largest countries of the euro area will not move to a consolidation course based on cuts in primary spending. While Germany and Italy count on higher tax revenues in order to reach their deficit goals, the French government will not undertake any consolidation measures even if the budget deficit exceeds the 3 percent threshold. The favorable situation of public finances in the other countries of the euro area (except Portugal) makes it possible for their respective governments to let automatic stabilizers operate freely. All in all, fiscal policy in the euro area will be slightly restrictive this year. In view of weak economic activity the budget deficit will increase to 2.6 percent in relation to GDP. Next year the fiscal policy stance will be neutral again. With the foreseeable recovery of economic activity in 2004, the aggregate budget deficit in the euro area will decline to 2.2 percent in relation to GDP.

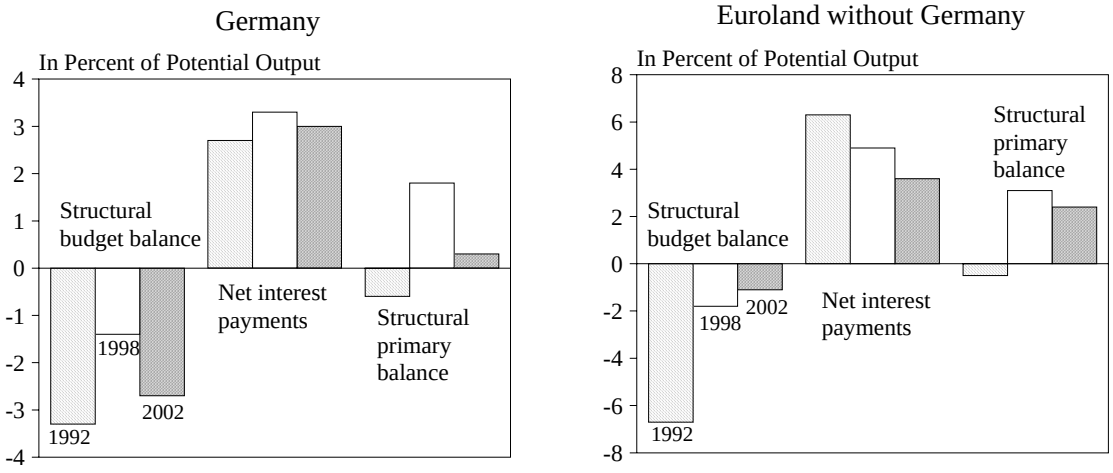
Table 1:
Indicators of Fiscal Positions in Euroland, 2001–2004

	Gross public sector debt[a]				General government balance[a]			
	2001	2002[b]	2003[c]	2004[c]	2001	2002[b]	2003[c]	2004[c]
Germany	59.5	61.3	63.5	64.0	–2.8	–3.6	–3.4	–2.7
France	57.3	58.6	60.0	60.5	–1.4	–3.0	–3.4	–2.9
Italy	109.8	109.0	108.0	106.5	–2.2	–2.4	–2.9	–2.6
Spain	57.1	55.5	54.5	53.0	–0.1	–0.5	–1.0	–0.6
Netherlands	52.8	52.0	52.5	53.0	0.1	–1.1	–2.0	–2.0
Belgium	107.6	105.0	103.5	102.0	0.4	–0.2	–0.7	–0.3
Austria	63.2	63.0	63.0	62.5	0.2	–1.0	–1.8	–1.5
Finland	43.4	42.0	41.0	41.0	4.9	3.5	3.0	2.5
Greece	107.0	104.0	101.0	99.5	–1.2	–1.0	–0.8	–0.5
Portugal	55.5	56.5	57.5	58.0	–4.1	–2.8	–3.5	–2.9
Ireland	36.4	35.0	34.5	34.0	1.5	0.0	–1.0	–1.5
Luxembourg	5.6	5.1	5.0	5.0	6.1	–0.3	–1.0	–0.5
Euroland	69.1	69.5	70.1	69.9	–1.5	–2.3	–2.6	–2.2

[a]In percent of nominal GDP. – [b]Partly estimated. – [c]Forecast.

Source: ECB (2003); own calculations, estimates and forecasts.

Figure 2:
Indicators of Fiscal Policy in Euroland



Source: OECD (2002); own calculations.

3 Is the Stability and Growth Pact "Stupid and Too Rigid"?

The European Stability and Growth Pact has continuously been under discussion. Already last fall it was questioned by a number of governments, and even the president of the European Commission made a harsh statement about the pact. Currently it is discussed whether the rules of the SGP should be suspended if there is a war with Iraq. Apart from that, there are many proposals to soften the pact or get rid of it altogether. Usually, such proposals come from those countries which have so far failed to balance their budgets.

Most countries of the European Union have succeeded in balancing their budgets by the year

Table 2:
Structural Budget Balances in EMU Countries, 1998–2002[a]

	1998	1999	2000	2001	2002
Belgium	–0.6	–0.9	–1.1	–0.3	0.2
Germany	–1.9	–1.4	–1.9	–2.8	–3.3
Finland	–0.4	0.3	3.8	3.8	3.7
France	–2.6	–2.0	–2.1	–2.0	–2.7
Greece	–1.9	–1.6	–1.8	–2.1	–1.7
Ireland	1.9	0.8	2.5	0.2	–1.4
Italy	–3.0	–1.9	–2.1	–2.4	–1.8
Netherlands	–1.9	–1.2	–0.6	–1.2	–0.6
Austria	–2.4	–2.5	–2.5	0.0	–1.6
Portugal	–3.0	–3.0	–4.0	–4.3	–3.0
Spain	–2.6	–1.5	–1.4	–0.7	–0.1
EMU average	–2.2	–1.6	–1.7	–1.9	–2.0
Addendum:					
Denmark	0.5	2.5	1.3	2.6	2.1
Sweden	2.3	0.6	2.1	4.2	1.3
United Kingdom	–0.3	0.8	1.2	0.7	–0.6
EU average	–1.7	–1.0	–1.0	–1.2	–1.6

[a]In percent of nominal GDP.

Source: European Commission (2002a).

2002 as it was originally intended by the pact when it was ratified in 1997. Only the three large countries Germany, France and Italy and also Portugal continue to have high structural budget deficits which have, in part, even increased recently (Table 2).[2] In Germany, not only the actual but also the structural deficit amounted to more than 3 percent of GDP; in some years, this was also the case in Portugal. Therefore, one cannot blame the cyclical weakness for the budget problems in those countries since their deficits increased not only because of the automatic stabilizers but also because of discretionary measures. If, as it is commonly done, the stance of fiscal policy is measured in terms of the change of the structural deficit, fiscal policy in both France and Germany was clearly expansionary, contrary to the average of all other countries.[3] Accordingly, it cannot be argued that fiscal policy in, for example, Germany was – by following the rules of the pact – too tight and therefore has contributed to the cyclical slowdown. Apart from that, the current economic situation in those countries which have more or less balanced their budgets is definitely not worse than in the problem countries; they also did not have more favorable macroeconomic conditions but have been hit by more or less the same shocks (e.g., oil price increase and weak external demand) and have had the same monetary policy (with the notable exception of the United Kingdom, of course). All in all, the statement that the pact is "stupid and too rigid" because it supposedly does not allow fiscal policy to respond to the cyclical situation does not make sense.[4]

[2]The estimates of structural deficits by various international organizations are quite similar as far as the tendencies over time are concerned; however, in terms of the levels there is sometimes a bigger difference. For example, the Commission's estimate for Germany's deficit in 2002 appears to be quite high.

[3]Although the increase in Germany is also due to a special factor (the corporate tax reform which led to a strong shortfall of revenues), this effect alone cannot explain the increase in 2002.

[4]For example, the SGP allows a deficit above the 3 percent limit if there is a severe economic downturn. Furthermore, it is explicitly stated that automatic stabilizers should be allowed to work so that the deficit can increase in bad times. There is, however, an exception insofar as the 3 percent limit should not be exceeded. This was one reason why the target of a balanced budget was supposed to be met as soon as possible in order to get the necessary "safety margin."

The reasons for the problems with public finances are to be found in the respective countries themselves. Contrary to the goals of most national stability programs or the "Broad Economic Policy Guidelines" (BEPG) (European Commission 2002b), government expenditures have not been limited sufficiently. For example, in 2002 the share of government in the three large countries was as high as four years before, in Portugal it was even higher. This is not compatible with the intention which is described in the BEPG and which has been accepted by all European governments; the reduction of the share of government should be used to lower the tax burden which is considered to be much too high in most countries. Limiting expenditures does not mean that public investment cannot rise – quite the opposite: In the BEPG it is explicitly stated that expenditures should be shifted away from consumption to investment in human and in physical capital. This exactly describes the positive effects on economic growth which can be expected of the SGP.

Several times, the year by which the budgets should be balanced or in surplus was postponed further into the future, thereby taking into consideration the apparent difficulties of the problem countries. Originally it was intended to achieve the goal by 2002, in June 2002 it was by 2004 at the latest, and more recently, it is the year 2006. We think that it is essential that the new timeframe is strictly adhered to if economic policy in Europe should not lose more credibility. However, enforcing such commitments is difficult because the power of the European Commission is very limited in this respect. For a successful consolidation of the public budget it is necessary therefore that the governments really want it and just do it. Not only would this be in line with the announcements in the BEPG, but also there are many examples in Europe and elsewhere that budget consolidation has positive effects.

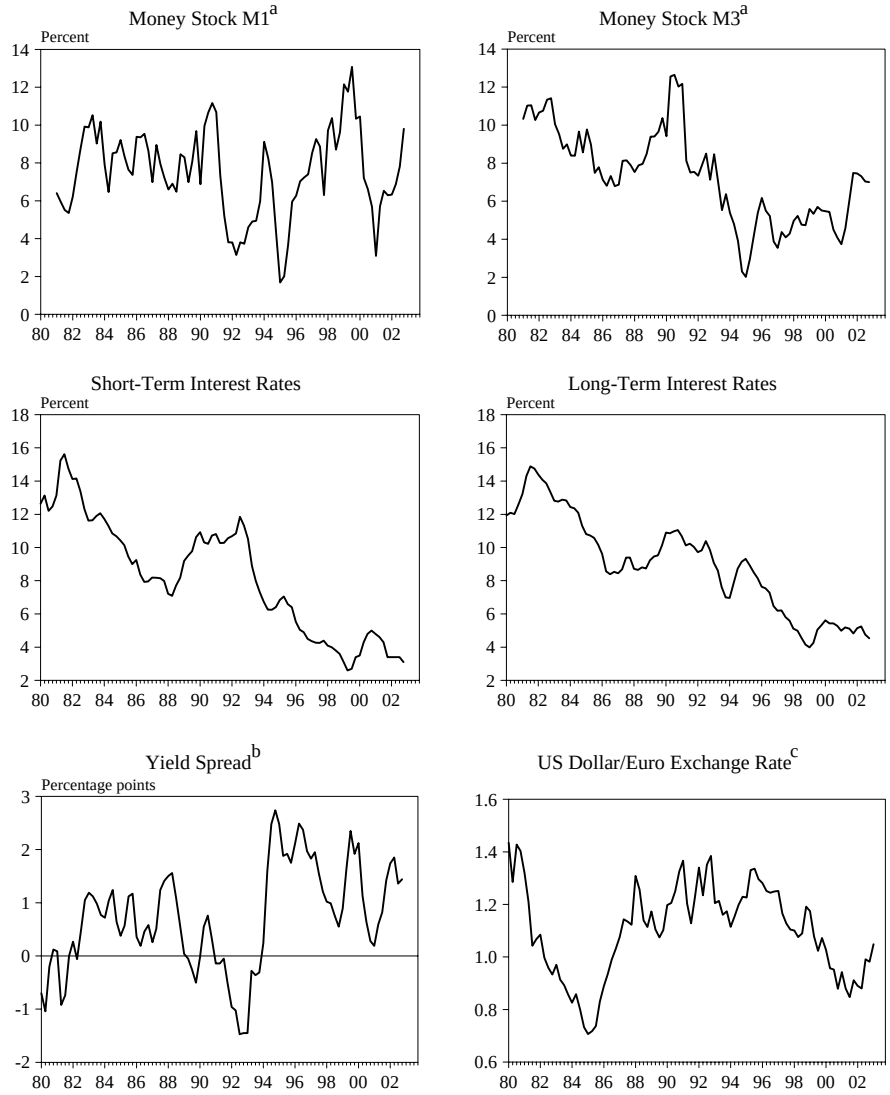
In order to achieve the balanced budgets by the year 2006, the problem countries have to make a turnaround quickly. This does not change in case there is a more "generous" interpretation of the 3 percent margin because of a war with Iraq. In any case, in order to get on a higher growth path it can be recommended to reduce the share of government in most countries because only then the tax burden and social contributions can be reduced. The countries should simply not be "afraid to save" (Gern et al. 2002). If there is no turnaround in expenditure policy, the budgets can only be balanced by raising taxes and social contributions. If this expectation prevails, both income expectations of private households and profit expectations of firms could be dampened, thus lowering the perspectives for economic growth already in the short run. To be credible, the course of fiscal consolidation has to be based on realistic assumptions about the future development of income. It has often be the case that in the stability programs the governments overestimate the trend growth of output; this is probably also the case in some of the current programs.[5] This leads to an underestimation of the need to consolidate: If potential output grows slower than assumed, expenditures must rise by less than assumed if the share of government is to decline.

[5]According to the Stability Program of the German government, potential output will increase by 1 ¾ percent per year between 2003 and 2006. However, in the second half of the 1990s, the trend growth rate was only 1 ½ percent, recently it has been even lower than that.

4 Is the Stance of Monetary Policy Adequate?

Against the background of the weak economic activity, the ECB lowered key interest rates once again on March 6, 2003 by 25 basis points. The minimum bid rate in the main refinancing operations now stands at 2.50 percent (Figure 3). The 3-month money market rate (EURIBOR) dropped to about the same level. In real terms, the short-term interest rate amounts to some 0.5 percent given the current core rate of inflation; this is a very low level historically. Long-term rates have declined also since the fall of last year; the yield of 10-year bonds was a little lower than 4.0 percent at the beginning of March; so the long-term interest rates, too, are very low in real terms. There continues to be ample liquidity in the euro area. In the second

Figure 3:
Indicators of Monetary Policy in Euroland, 1980–2003



[a]Percentage change over previous year. – [b]Long-term interest rate minus short-term interest rate. – [c]Before 1999: exchange rate US dollar/ecu.

Source: ECB (2003); own calculations.

half of 2002, the money stock M3 even rose by double-digit rates in a few months, and in January 2003 it was 7.4 percent higher than a year ago. For the year 2002 as a whole, the growth rate exceeded the reference value by about 2 ½ percentage points. One important factor which has led to a deterioration of monetary conditions was the strong appreciation of the euro. Its value increased especially strongly against the US dollar but gained ground also against the yen and the British pound. In January 2003, the real effective rate of the European currency[6] was 11.4 percent higher than one year ago.

There are various measures by which the course of interest rate policy can be judged. Frequently, a Taylor rule is used in order to estimate whether the actual rate of interest is adequate. In this rule, the inflation gap, the output gap and the equilibrium real interest rate are the main inputs. In the literature, there are many different specifications of the Taylor rule. In a simulation analysis of several different rules it is found that the original, very simple variant propagated by John Taylor leads to good results in that it contributes quite satisfactorily to the stabilization of inflation and output (Taylor 1999). More complex rules are not necessarily better in terms of achieving the targets; in addition, they seem to be less robust if they are used in simulations with different models.

This was the major reason why we have used the original version of the Taylor rule in our publications.[7] The estimates show that the short-term interest rate is currently well below the rate implied by the Taylor rule (Figure 4). This rate is relatively high because the current rate of inflation is still above the inflation target which we assume to be 1.5 percent; this fact implies that the actual real rate is higher than the assumed equilibrium rate (the so-called Taylor principle). The Taylor rate is lowered by the fact that there is a negative output gap in the euro area.

So the Taylor rule implies that interest rates in the euro area should actually be substantially higher.[8] According to the rule, the stance of monetary policy is much too expansionary so that the economy is stimulated too much and that there is a risk that inflation will accelerate. However, this conclusion may be incorrect for two reasons:[9]

1. It is possible that the output gap is substantially lower so that the level of potential output is higher than assumed. This would imply a lower Taylor rate.
2. It is possible that the equilibrium real interest rate is lower on average than assumed and/or that this rate fluctuates and is currently relatively low. This, too, would imply a lower Taylor rate.

However, the bias may also be in the opposite direction: It is possible that potential output growth is lower and the output gap is higher than assumed; in that case, the stance of monetary policy would even appear to be more expansionary. This possibility cannot be dismissed right away. The underutilization of capacity may be relatively low (i.e., the output gap may be relatively high) because the core rate of inflation has not come down in the past two years but rather has increased. This seems to contradict theories which rely on a mechanism by which inflation should fall if the output gap falls. In this regard it is worth noting that in the past two years the forecasts for real GDP growth in the euro area had to be revised downwards whereas the forecasts for inflation were revised upwards.

For the calculation of the Taylor rule several variables are needed which cannot be observed but must be estimated. In the following sections we analyze the relevance of the above-mentioned objections in order to judge whether the "correct" interest rate for the euro area is lower than the rate calculated on the basis of the

---

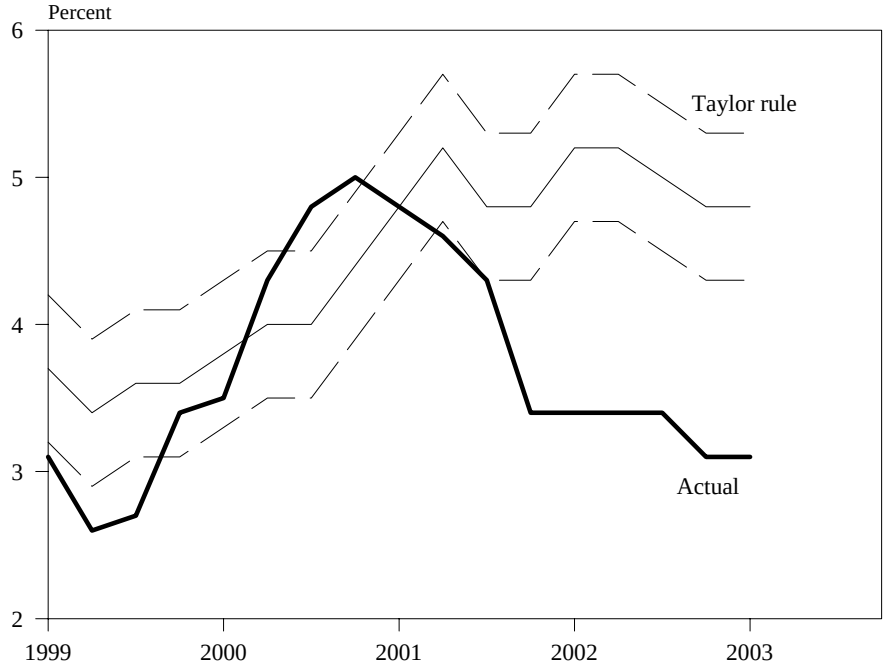
[6] Real effective exchange rate of the euro (broad group, CPI).

[7] As far as the inflation target is concerned, we have used the core rate of inflation (Gern et al. 2002: 10).

[8] The same observation applies to the United States where the actual real rate is even negative although output is very close to its potential.

[9] It is assumed here that the version of the Taylor rule we use is the "correct" one. However, the arguments would not change very much if any of the alternative versions are chosen.

Figure 4:
Short-term Interest Rates in Euroland[a]: Actual Values and Values According to the Taylor Rule



[a]The Taylor rule is calculated for the core HICP (HICP excluding ernergy, food, alcohol and tobacco) under three different assumptions about the equilibrium real interest rate (2 percent, 2.5 percent and 3 percent).

Source: Eurostat (2003); ECB (2003); own calculations and estimates.

Taylor rule. We start with looking at various estimates of potential output growth and the implied output gaps. Then we discuss what the level of the equilibrium real interest rate may be. In a first step we use several methods to estimate the rate by using a long-term average (e.g., one complete cycle). In a second step it is shown that there are theoretically sound arguments for the hypothesis that the equilibrium real interest rate can fluctuate in the short run if the economy is hit by real shocks. We will then draw conclusions for the policy of the ECB.

4.1 What Is the Size of the Output Gap?

A central bank which follows a policy like the Taylor rule needs an estimate of the current level of potential output.[10] There is a substantial uncertainty involved which is indicated by the fact that there can be substantial revisions (Orphanides 2001). Also, the currently available estimates for the euro area show substantial differences (Table 3), and it is difficult to say which of the estimates is "correct" as all methods have advantages and disadvantages (Box 1).

For the year 2002 the estimated growth rates of potential output vary between 1.5 and 2.2 percent. Consequently, there are differences in the levels and therefore also different estimates of the output gap; the respective range for 2002 is from –0.1 to –1.7 percent. For the fourth quarter alone the difference goes up to about 2 percentage points. For the calculation in the Taylor rule this implies – given a coefficient of 0.5 for the output gap – a difference of 1 percent for the short-term interest rate. However, the Taylor rate is still substantially higher than the actual interest rate if the estimate with the highest potential output growth is used.

[10]Other policy strategies including the ECB's two-pillar strategy rely on such estimates as well. In general, one has to remember that real GDP data which are needed for such estimations are available only with a lag and, in addition, are subject to revisions especially for very recent data.

Table 3:
Potential Output Growth and Output Gap in Euroland According to Various Estimates

	Potential Output Growth[a]			Output Gap[b]			
	2000	2001	2002	2000	2001	2002	2002 4th quarter
OECD	2.1	2.2	2.1	0.7	0.0	–1.3	–1.8
IMF	2.3	2.4	2.2	0.5	–0.4	–1.7	–2.3
EU Commission (HP filter)	2.2	2.1	2.1	1.6	0.9	–0.4	–0.9
EU Commission (Production function)	2.5	2.4	2.2	1.6	0.6	–0.7	–1.2
HP filter	2.2	2.0	1.8	1.4	0.8	–0.1	–0.5
Band-pass filter	2.4	1.7	1.5	0.8	0.4	–0.2	–0.4

[a]Percentage change over previous year. – [b]Difference between real GDP and potential output in percent of potential output.

Source: European Commission (2002a); OECD (2002); IMF (2002); own estimates.

Box 1:
Methods to Estimate Potential Output

Potential output can be defined as "the sustainable aggregate supply capabilities of an economy, as determined by the structure of production, the state of technology and the available inputs" (ECB 2000:37). As the potential output is not observable, an estimation is necessary. The result depends on the method that is chosen and can show large differences. Basically, one can distinguish between univariate and multivariate approaches to estimate potential output.

The most popular univariate method is the Hodrick–Prescott filter (HP filter). It is trying to extract the cycles from output series by trying to balance two goals, which are conflicting: A good fit of the trend to the actual series and a certain degree of smoothness. Consequently, the choice of the key parameter which determines the respective weight given to each of the two characteristics is of essential importance for the result. A shortcoming is the end-point problem. As the HP filter is a floating one, i.e., it is calculated by a moving average, forecasts of the actual real GDP are necessary in order to be able to estimate the potential output for the most recent time. Consequently, the uncertainty associated with the forecast is transformed to the estimation of potential output. Moreover, the HP filter is based on a certain theoretical notion of the characteristics of business cycles; so the calculation of trend output using a HP filter imposes the property that the business cycles are symmetric over the full estimation period, i.e., the output gap is on average zero. A further possible weakness of the HP filter is its treatment of structural breaks. They are typically smoothed even if they would lead to a shift in the level of output.

The band-pass filter is also a floating, symmetric filter. In contrast to the HP filter, it requires a presumption concerning the frequency of the business cycle. Given the judgment on this frequency by the user, a band-pass filter can be determined which is able to extract all business cycles from output series by using the spectral analysis. The essential advantage of both methods is that the data requirements are low.

One of the multivariate methods is the production function approach which is widely used, for example, by international organizations.[a] In this context a Cobb–Douglas production function is very popular. The production function approach provides a framework to derive estimates of potential output via its long-term fundamental determinants. The potential output depends on (1) the capital stock, (2) the potential employment which itself depends on the estimation of the non-accelerating inflation rate of unemployment (NAIRU), the working age population and the trend participation rate, and (3) the trend of the total factor productivity (TFP). An essential shortcoming of this approach is that the capital stock and the production elasticities as well as the trend components of labor and TFP have to be estimated. Consequently, the problem of determining the potential is shifted from the output to the input level.

Further multivariate methods are the structural vector autoregression (SVAR) models. In contrast to the production function approach, trend and cycle are not explained by a change of the input factors. In SVAR models output is divided into a permanent and a transitory component. The permanent part is considered as the potential output, the transitory part as the output gap. In order to distinguish between the permanent and transitory part, the development of total output is analyzed as a function of shocks. In SVAR models, the shocks are modeled by the corresponding residuals. Based on orthogonalized residuals and impulse response functions, the dynamic, quantitative reaction of output to exogenous shocks can be analyzed. Consequently one can distinguish between shocks having a permanent effect (potential output) and shocks having a transitory effect (output gap).

[a]Concerning the method of the IMF see DeMasi (1997), concerning the method of the OECD see Giorno et al. (1995). See McMorrow and Röger (2001) for the method of the European Commission and for example Proietti et al. (2002) for a method of the ECB.

4.2 Estimating the Average Equilibrium Real Interest Rate

The equilibrium value for the real interest rate used in the Taylor rule cannot be observed. A simple estimator is given by the average of the real interest rate over a longer period of time.[11] It is assumed that the real interest rate is constant over one or more complete business cycles. For the period 1965–2002, the average for the real German 3-month rate is 3.0 percent.[12] However, on theoretical grounds, there is no presumption that the real interest rate should be constant. When using a very long sample period for the calculation of the average one risks that changes in the real interest rate are not noticed.

A number of facts indicate that the equilibrium real interest rate is currently lower than the average real interest rate calculated over the past three decades. As shown in Figure 5, the time series of the German real interest rate obviously has a structural break in the early 1990s. After 1992 the real interest rate is significantly lower than before. For the period 1993–2002, the average real interest rate calculated on the basis of the consumer price index is 2.3 percent, calculated on the basis of the core rate of inflation it is 2.4 percent.

In addition, the growth rate of potential output which is closely related to the equilibrium real interest rate has declined in Germany. If one takes the time since the recession of 1993 as a basis, potential output has only grown by 1.5 percent per year, on average. In the 1980s, the average growth rate was more than 2 percent.[13]

Finally, a lower equilibrium real interest rate also follows from an empirical Taylor rule for Germany. Calculating a reaction function for the Deutsche Bundesbank for the period 1992–1998 on the basis of the Taylor rule with the usual weights of 0.5 for the inflation gap and 0.5 for the output gap, one finds that the best fit is given by a formula in which the equilibrium real interest rate is assumed to be 2.0.[14] With an equilibrium real interest rate of 3.0 percent, in contrast, the Taylor rate is significantly above the actual money market rate, with 1.5 percent it is below (Figure 6). Since inflation was by and large close to the target figure of the Bundesbank, the parameterization of the reaction function may be interpreted as mirroring the Bundesbank's stability-oriented behavior which was implicitly based on an estimate for the equilibrium real interest rate of 2.0 percent.

All in all, there is evidence that the average equilibrium real interest rate in Germany is close to 2.0 percent. The different methods we used point to a margin of uncertainty of some 0.5 percentage points for this estimate.[15] The calculations for Germany also point to a likely value for the equilibrium real interest rate in the euro area which is important for assessing the ECB's monetary policy. Estimates indicate that potential output growth is about half a percentage point higher in Euroland than in Germany. An average equilibrium real interest rate of 2.5 percent for Euroland therefore seems appropriate and is in line with our practice of using a range of 2 to 3 percent when calculating Taylor rules for Euroland. This implies that the Taylor rate we calculate is not too high.

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[11] For the 3-month interest rate on which we focus here, it seems justifiable to approximate the expected rate of change of the consumer price index over the next 3 months by the current rate of inflation (change of the consumer price index over the previous year), that is, by the average rate of change over the past four 3-month periods.

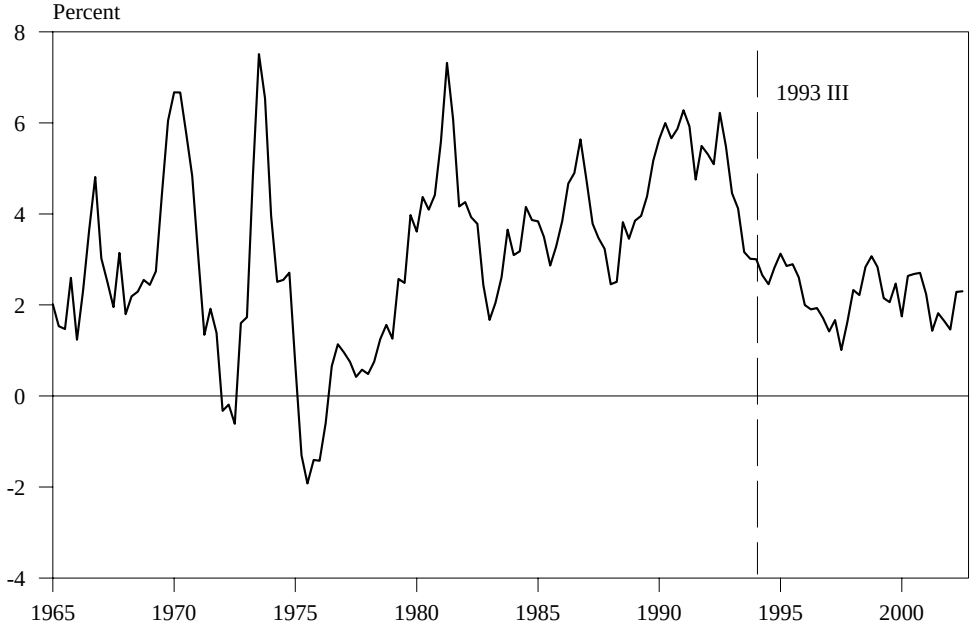
[12] We look at German instead of euro area data, since euro area interest rates were higher before the start of monetary union due to the expectation of an appreciation of some currencies vis-à-vis the D-mark.

[13] On the basis of the Hodrick–Prescott filter, potential output growth was only 1.1 percent in 2002.

[14] The output gap is calculated on the basis of a Hodrick–Prescott filter. For the target inflation rate we used 2.0 until 1996 and 1.75 thereafter, following the official announcements of the Deutsche Bundesbank.

[15] We have not accounted for the fact that the equilibrium real interest rate may fluctuate even in the short run (see final Chapter).

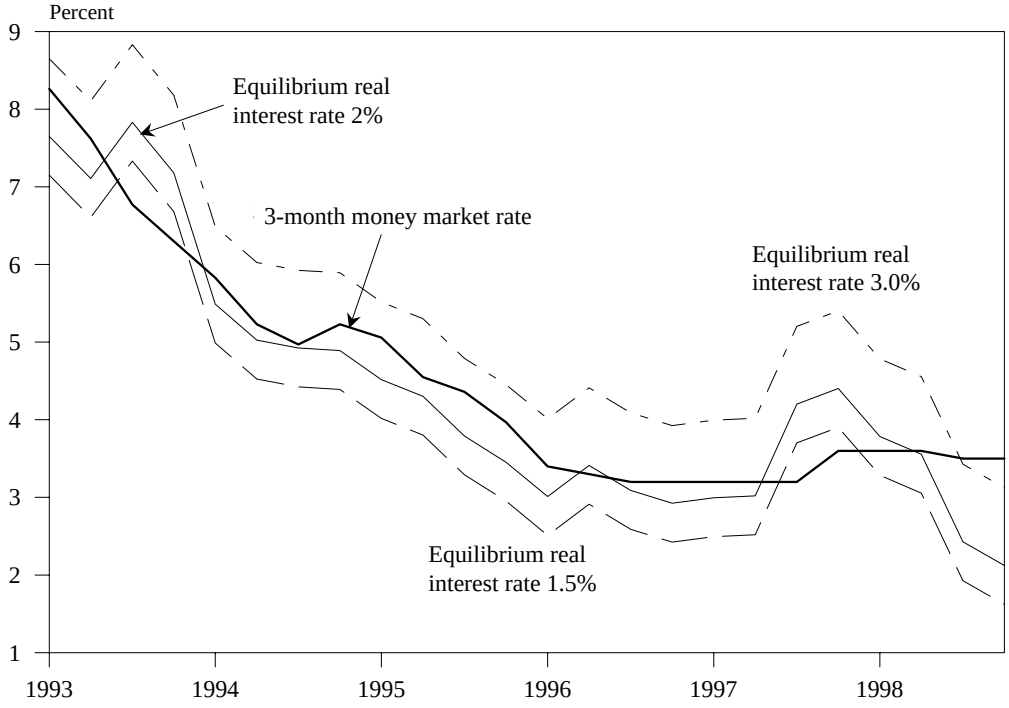
Figure 5:
Real 3-Month Interest Rate[a] in Germany



[a]Nominal 3-month money market rate (Fibor) minus change of the consumer price index over the previous year, in percent. Quarterly averages.

Source: Deutsche Bundesbank (various issues); own calculations.

Figure 6:
3-Month Interest Rate and Alternative Taylor Rates[a] for Germany



[a]Taylor rate calculated for alternative values of the equilibrium real interest rate.

Source: Deutsche Bundesbank (various issues); own calculations.

4.3 The Equilibrium Real Interest Rate May Vary in the Short Run

The assumption that the equilibrium real rate is constant over several years may not be correct; the same applies to potential output growth. In particular, it is possible that real shocks occur which affect both variables. This possibility is at the core of several macroeconomic models (see final Chapter).

As in most standard models it is assumed that the central bank tries to stabilize the inflation gap and the output gap (or keep them as low as possible). The difference in the more recent models lies in the fact that the optimal monetary policy takes account of possible changes of the real equilibrium rate. So while the policy of the central bank can still be described as a Taylor rule, the assumption of a constant equilibrium real interest rate is given up, in other words: The central bank follows a Taylor rule with a variable real rate.

4.4 Implications for the Monetary Policy of the ECB

In general, it is unrealistic to expect that a central bank relies on a specific theoretical model or a specific class of models when pursuing monetary policy. This is certainly also a correct approach because it is generally accepted that there is a great uncertainty about the "true" model. Apart from that, it is close to impossible to come up with a precise estimate of the equilibrium real interest rate. Nevertheless, the theoretical considerations can be used when assessing the present situation.

There are several reasons to believe that the current equilibrium rate is lower than the longer-term average. Oil prices have jumped, and the uncertainty of investors as well as consumers about the outlook is high especially because of the conflict with the Iraq; therefore, income and profit expectations are depressed. For these reasons it seems adequate that in the present situation real interest rates are lower than they "should" be according to the conventional Taylor rule. As this uncertainty seems to persist, the recent reduction of key interest rates by the ECB can be justified.

However, the theoretical consideration also implies that the equilibrium real interest rate will not be so low for an extended period of time because it is affected mainly by transitory shocks. Once these disturbances lose their impact, the real rate will move back to its longer-term average. In addition, the ECB still has to try to reduce the inflation rate in the euro area and keep it low. Therefore, we recommend that interest rates should be increased when the recovery is well under way. We expect that the ECB will start raising rates again at the beginning of next year.

5 Little Change in Wage Increases

Despite the significant labor market deterioration, wage increases in Euroland have not slowed. In the third quarter 2002 – the period for which the most recent figures are available – compensation per worker even accelerated slightly. Compensations have risen by around 2.5 percent annually for three years in a row. At the same time, the increase in contractual wages has accelerated from 2 percent to 3 percent.[16] Wage cost per hour in the nonfarm sector also was on an upward trend, partly due to rising social contributions of employers.

In the current cyclical situation wage policy should contribute to a deceleration of labor costs. This would benefit the cost situation of businesses, promote employment and improve

[16] A major part of the acceleration of contractual wages can be explained by developments in Germany, where wage negotiations in 2002 resulted in significantly higher wage increases than in the years before. Compensation per employee, however, was much less affected as companies cut back noncontractual parts of the wages and average hours worked declined.

the outlook for inflation. A significant slowdown in wage increases, however, seems not to be likely this year and next. Wages are set to rise at a noticeably slower pace only in a few countries, such as Spain, Ireland and the Netherlands, in which reduced competitiveness as a result of relatively high inflation in recent years has begun to cloud the medium-term outlook (Table 4). By contrast, there is no indication of a policy of more pronounced wage moderation in the large countries. This forecast rests on the judgment that labor market rigidities in Euroland are still significant and will remain so over the forecast horizon despite the fact that the issue of labor market flexibilization has moved into the center of the political debate in a number of countries.

Labor productivity in Euroland stagnated more or less in 2001 and 2002 (Table 5). This was due to lower economic growth on the one hand and a slow response of employment on the other hand. In the course of 2002, however, the number of employees started to fall. Consequently, productivity began to recover in the second half of the year. We expect that employment will also be slow to react to a cyclical recovery. Thus, labor productivity will accelerate markedly this year and next, leading to a slowdown in the rise of unit labor costs. An increase of unit labor costs of 1.8 percent and 0.6 percent in 2003 and 2004, respectively, improves the chances that inflation will fall persistently below 2 percent over the forecasting horizon.

Table 4:
Wage Increases in Euroland[a], 2001–2004 (percent)

	2001	2002	2003[b]	2004[b]
Germany	1.7	1.6	2.2	2.0
France	2.6	2.7	2.5	2.5
Italy	2.8	2.9	2.8	2.7
Spain	4.1	4.2	3.6	3.4
Netherlands	5.0	5.1	4.2	3.8
Portugal	5.0	4.7	3.8	3.0
Austria	1.8	2.2	2.1	2.3
Belgium	3.6	3.5	3.0	3.0
Greece	5.4	6.5	5.7	5.0
Finland	4.5	3.2	3.8	3.7
Ireland	9.2	7.5	6.8	6.0
Luxembourg	4.4	3.5	3.0	2.5

[a]Compensation of employees per worker. – [b]Forecast.

Source: European Commission (2002a); own calculations and forecasts.

Table 5:
Compensation of Employees and Productivity in Euroland, 2000–2004 (change over previous year in percent)

	2000	2001	2002	2003[a]	2004[a]
Compensation of employees per worker	2.5	2.7	2.7	2.7	2.5
Productivity[b]	1.3	0.1	0.2	0.9	1.9
Unit labor costs	1.2	2.6	2.5	1.8	0.6

[a]Forecast. – [b]Real GDP per worker.

Source: ECB (2003); own calculations and forecasts.

6 Outlook: Recovery Will Slowly Gain Momentum

The leading indicators suggest that economic activity in the euro area will remain weak in the first half of this year. The confidence indicators compiled by the European Commission taken together have deteriorated since last spring. Confidence in the service sector and consumer confidence have considerably decreased in the past months. Only industrial confidence has not further worsened but also here the assessment of the current situation and the business outlook remain rather pessimistic. Moreover, the purchasing managers' index has stayed below the threshold value of 50 since last summer and thus signals a shrinking industrial production. Finally, the growth indicator calculated by EUROFRAME suggests that economic activity will expand at a pace much slower than that of potential output until this summer. The continued weakness is probably also due to the uncertainty related to the Iraq conflict. This uncertainty has contributed to the fall in stock market prices and to the renewed increase in oil prices during the past winter. For the forecast we assume that there will be a war in Iraq in the coming weeks. Under the assumption that the war is of short duration and that the situation of world politics calms down afterwards, industrial confidence and consumer sentiment should improve considerably this summer.

However, the first half of 2003 will still be characterized by the feeling of insecurity of economic agents in the euro area. Real GDP will probably increase at an annual rate of around 1 percent in this period and thus considerably slower than potential output (Table 6). Private households will expand their consumption expenditures only moderately in view of a further deterioration in the labor market situation. Against the background of low capacity utilization and of unfavorable sale and profit expectations for the time being, firms will decide to wait so that a recovery of investment is unlikely to occur in the first half of this year. Furthermore, export expansion will probably slow down compared to last year. On the one hand, this is due to the euro appreciation that will increasingly unfold its dampening effects. On the other hand, economic activity in the rest of the world is also expected to be less dynamic in the first half of this

Table 6:
Quarterly Data on the Economic Development in Euroland, 2002–2004

	2002				2003				2004			
	I	II	III	IV	I[a]	II[a]	III[a]	IV[a]	I[a]	II[a]	III[a]	IV[a]
Gross domestic product[b]	1.6	1.3	1.6	0.7	0.6	1.0	1.5	2.0	2.5	2.9	3.2	3.2
Domestic demand[b]	–0.1	0.9	0.9	1.6	0.8	1.3	1.7	2.1	2.5	2.9	3.0	3.0
Private consumption[b]	–0.7	1.4	1.7	1.4	0.6	0.8	1.4	1.8	2.2	2.4	2.4	2.4
Public consumption[b]	3.0	3.8	1.4	2.2	1.4	1.7	1.7	1.5	1.4	1.6	1.4	1.4
Fixed investment[b]	–0.9	–5.2	–0.8	–0.3	0.6	1.6	3.0	3.5	4.6	5.2	5.1	4.8
Change in stocks[c]	–0.1	0.4	–0.2	0.3	0.0	0.2	–0.1	0.0	0.0	0.1	0.2	0.3
Net exports[d]	1.7	0.4	0.7	–0.8	–0.2	–0.4	–0.1	–0.1	0.0	0.0	0.2	0.3
Exports[b,d]	0.8	7.0	8.6	0.1	0.2	1.5	2.8	3.8	4.9	5.6	5.6	5.4
Imports[b,d]	–3.8	6.3	7.4	2.5	0.8	2.6	3.3	4.4	5.2	5.9	5.4	5.0
Unemployment rate[e]	8.1	8.2	8.3	8.5	8.8	8.9	8.9	8.9	8.8	8.7	8.5	8.3
Consumer prices (HICP)[f]	2.5	2.0	2.1	2.3	2.3	2.2	2.3	2.0	1.8	1.8	1.9	1.9
Money stock M3[b]	5.0	6.2	7.8	8.7	7.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
3-month money market rate	3.4	3.5	3.4	3.1	2.9	2.5	2.5	2.6	2.8	3.0	3.0	3.0
Long-term interest rate	5.1	5.3	4.8	4.5	4.1	4.2	4.4	4.6	4.7	4.8	4.9	4.9
US dollar/euro exchange rate[g]	0.88	0.92	0.99	1.00	1.06	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Real effective exchange rate[h]	88.1	90.5	94.1	95.2	98.5	98.9	98.9	98.9	98.9	98.9	98.9	98.9

[a]Forecast. – [b]Annualized quarterly rate of change in percent. – [c]Contribution to change in GDP. – [d]Including intra-Euroland trade. – [e]In percent of the labor force, harmonized according to the ILO concept. – [f]Change over previous year in percent. – [g]US dollar/euro. – [h]Broad group. Based on the consumer price index. Index 1999 I = 100.

Source: Eurostat (2003); ECB (2003); OECD (2003); own calculations and forecasts.

Table 7:
Real GDP, Consumer Prices and Unemployment Rate in Euroland, 2001–2004

	Weights in total[a]	Real GDP[b]				Consumer prices[b,c]				Unemployment rate[d]			
		2001	2002[e]	2003[f]	2004[f]	2001	2002	2003[f]	2004[f]	2001	2002	2003[f]	2004[f]
Germany	30.4	0.6	0.2	0.4	2.3	2.1	1.2	1.5	1.4	7.8	8.2	8.9	8.9
France	21.4	1.8	1.2	1.3	2.9	1.8	1.9	1.7	1.5	8.5	8.7	9.2	8.6
Italy	17.8	1.8	0.4	1.3	2.5	2.3	2.6	2.6	2.0	9.5	9.0	9.1	8.7
Spain	9.5	2.7	2.0	2.0	3.5	2.8	3.5	3.3	2.7	10.6	11.4	12.3	11.6
Netherlands	6.3	1.3	0.3	0.7	2.5	5.2	3.9	2.7	2.2	2.5	2.7	3.6	3.7
Belgium	3.7	0.8	0.7	1.3	2.7	2.4	1.5	1.7	1.5	6.7	7.3	8.0	7.6
Austria	3.1	0.6	1.0	1.1	2.6	2.3	1.7	1.6	1.8	3.6	4.1	4.4	4.2
Finland	2.0	0.6	1.6	2.9	4.5	2.6	2.0	2.0	2.4	9.1	9.2	8.8	8.0
Greece	1.9	4.1	4.0	4.0	5.0	3.6	3.9	3.1	3.0	10.5	10.0	9.7	9.2
Portugal	1.8	1.6	0.2	0.0	2.0	4.4	3.7	4.0	4.0	4.1	5.0	6.6	6.5
Ireland	1.7	5.7	5.5	3.5	4.5	4.0	4.7	4.3	3.0	3.9	4.4	4.7	4.5
Luxembourg	0.3	1.0	0.5	2.0	3.5	2.4	2.0	2.7	1.9	2.0	2.4	3.1	2.9
Euroland	100.0	1.4	0.8	1.0	2.6	2.4	2.2	2.2	1.9	8.0[g]	8.3[g]	8.9[g]	8.6[g]

[a]Based on GDP in current prices of 2001. – [b]Percentage change over previous year. – [c]Harmonized Index of Consumer Prices (HICP). – [d]Standardized unemployment rates according to the ILO concept. – [e]Partly estimated. – [f]Forecast. – [g]Based on the number of employees in 2001.

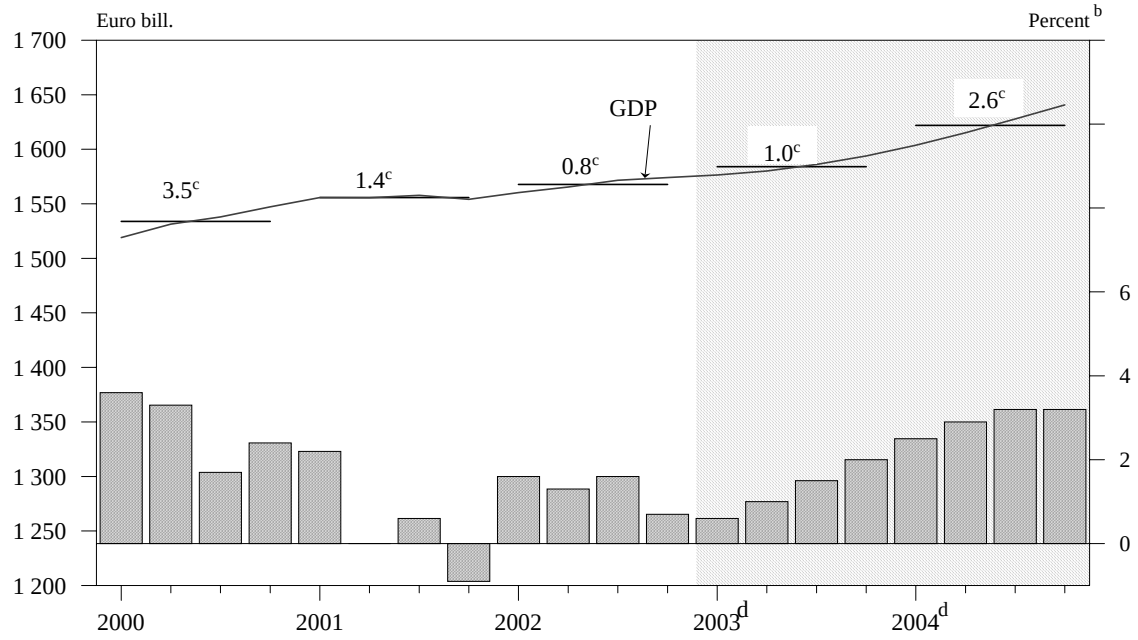
Source: ECB (2003); OECD (2003); own calculations and forecasts.

year. Starting this summer the cyclical situation should perceptibly improve in both the euro area and the rest of the world. The end of the Iraq conflict should contribute to lift the uncertainty that affects consumers and investors. With that the impulses from expansionary monetary policy will be strongly felt and domestic dynamic forces will gain the upper hand. Moreover, the expansion of economic activity abroad will gather speed so that exports will expand more rapidly in spite of the appreciation of the euro. All in all, we expect real GDP to increase by 1.0 percent this year on average (Table 7).

In the course of next year, real GDP will probably increase faster than potential output for the first time since the year 2000 (Figure 7). The dynamics of economic activity are due to fading dampening impulses as well as to a continued stimulation from monetary policy. We expect that the European Central Bank will hold its expansionary course next year in view of a still low economy-wide capacity utilization. With the calming down of the situation of world politics firms' confidence should markedly improve so that the favorable financing conditions will probably materialize in increased investment. Strong impulses will also come from external demand (Figure 8). We expect that the euro exchange rate will remain constant from this spring on, after having appreciated by around 11 percent in real effective terms over the past twelve months. The dampening effects of the past euro appreciation will gradually fade so that the deliveries to countries outside the euro area should perceptibly gather speed over the forecast horizon. The situation on the labor market will improve, the unemployment rate will decline to 8.6 percent next year on average, after a rise to 8.9 percent this year. Then consumer confidence will improve and private households will expand their consumption expenditures noticeably faster than before. All in all, we expect real GDP to increase by 2.6 percent next year on average. Note that the annual growth rate for next year is influenced by a considerable positive working-days effect (see Benner et al. 2003).

The increase in consumer prices will weaken in the course of this year. After an acceleration at the beginning of this year due to higher oil prices inflation will fall with the end of the Iraq conflict. In the second half of this year, inflation will be stable in view of low capacity utilization and of moderate wage increases. Due to the high price level at the beginning of this year, the inflation rate – measured as the increase in the HICP – will be 2.2 percent this year on average and will again remain above the target corridor

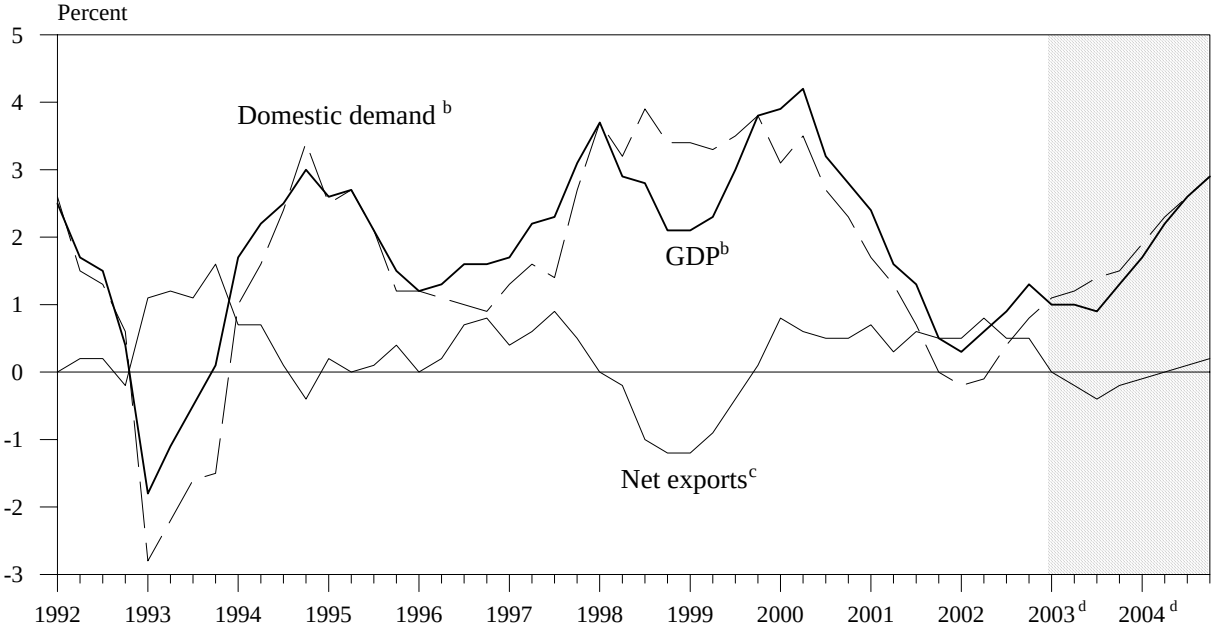
Figure 7:
Real GDP[a] in Euroland



[a]Seasonally adjusted. – [b]Annualized quarterly rate of change in percent. – [c]Percentage change over previous year. – [d]Forecast starting in 2003 I.

Source: Eurostat (2003); own forecast.

Figure 8:
GDP, Domestic Demand and Net Exports in Euroland[a]



[a]At constant prices. – [b]Percentage change over previous year. – [c]Change of net exports over previous year in percent of GDP in the same quarter of previous year. – [d]Forecast starting in 2003 I.

Source: Eurostat (2003); own forecast.

of the European Central Bank. Next year, firms' scope for raising prices will gradually increase against the background of stronger economic activity. In 2004, consumer prices will probably exceed their level in the previous year by 1.9 percent on average.

7 The Equilibrium Real Interest Rate and Optimal Monetary Policy

In the recent past a consensus has emerged in macroeconomic research on the framework for the analysis of questions relating to monetary policy (McCallum 2001). In the literature, models of this class are called alternatively *New IS-LM models* (McCallum and Nelson 1998), *New Keynesian models* (Clarida et al. 1999), *Neo-Wicksellian models* (Woodford 2002) or *New Neoclassical Synthesis models* (Goodfriend and King 1997). These models have in common that they incorporate key elements of real business cycles theory such as intertemporal optimization and rational expectations as well as Keynesian concepts such as monopolistic competition and sticky prices.

The latter two model elements are indispensable if one is interested in analyzing the real effects of monetary policy.[17] The assumption of monopolistic competition guarantees that goods prices are higher than marginal costs. Accordingly, firms are willing to satisfy an increase in demand at the prevailing price. Yet, a profit-maximizing firm would increase its price instead if it was able to do so. With the assumption of immediate price adjustment, an expansionary monetary policy has no real effects but only leads to an increase in prices. However, the assumption of sticky prices alone is not sufficient either for monetary policy to affect real variables. If goods markets were characterized by perfect competition (price = marginal cost), firms would not be willing to increase their goods supply in response to an increase in demand at the prevailing price.

In the following, the reaction of the natural interest rate and of potential output to typical shocks will be presented in this model framework. The analysis relies on Woodford's (2002)[18] model that is especially suitable for the question. In his analysis of monetary policy, Woodford accentuates the concept of the natural interest rate that was first advanced by Wicksell. The natural interest rate is defined as the equilibrium real interest rate that would prevail under flexible prices (Woodford 2002: 13). It is the real interest rate at which aggregate demand is always equal to potential output, i.e., the output gap is always zero. Just like potential output the natural interest rate fluctuates over time in response to real shocks. Yet, both variables are independent of monetary policy shocks.

The basic model presented in Woodford (2002: 11) consists of an aggregate demand equation, an aggregate supply relation and a monetary policy reaction function.[19] The endogenous variables of this model are the output gap x_t, the inflation rate π_t and the nominal interest rate i_t. The output gap is defined as the deviation of actual output from potential output ($x_t \equiv y_t - y_t^n$). Potential output y_t^n and the natural real interest rate r_t^n are exogenous variables.[20] Both variables depend on a variety of shocks that are discussed in detail below.

$$(1) \quad x_t = E_t x_{t+1} - \sigma (i_t - E_t \pi_{t+1} - r_t^n)$$

$$(2) \quad \pi_t = \beta E_t \pi_{t+1} + \kappa x_t$$

$$(3) \quad i_t = \bar{i}_t + \phi_\pi (\pi_t - \bar{\pi}) + \frac{\phi_x}{4}(x_t - \bar{x})$$

[17] It has to be kept in mind, though, that the real effects of monetary policy are transitory. These effects vanish as soon as all firms have adjusted their prices. In the long run, monetary policy is neutral in these models.

[18] This paper is a draft version of chapter 4 of his forthcoming book (Woodford 2003).

[19] All variables are measured in deviations from their steady-state values.

[20] In this model the average natural interest rate equals the time preference rate of the representative household, ρ.

Equation (1) represents the so-called intertemporal IS equation that can be derived from the intertemporal optimization problem of the representative household. According to the IS relation the output gap in the current period depends on the expected output gap and on the difference between the ex ante real interest rate $(r_t \equiv i_t - E_t\pi_{t+1})$ and the natural interest rate. The coefficient σ corresponds to the intertemporal elasticity of substitution of private spending. Equation (2) is the so-called New Keynesian Phillips Curve that can be derived from Calvo's (1983) price-setting model. According to this aggregate supply relation the inflation rate in the current period π_t depends on expected inflation and on the output gap. The parameter β is the subjective discount factor[21], the parameter κ is a decreasing function of the degree of price stickiness.[22] Equation (3) is the reaction function of the central bank taking the form of a Taylor rule. According to this equation the nominal interest rate is a function of deviations of the inflation rate and the output gap from their respective target values, where $\bar{\pi}$ represents the central bank's inflation target and $\bar{x}$ its preferred level for the output gap.[23]

Two aspects of this interest rate rule merit special attention. First, the reaction coefficients ϕ_π and ϕ_x must satisfy the following condition in order to guarantee determinacy of the rational expectations equilibrium (see Woodford 2001: 232 ff.):

$$(4) \quad \phi_\pi + \frac{1-\beta}{4\kappa}\phi_x > 1.$$

If the interest rate rule satisfies this condition, a permanent increase in the inflation rate by one percentage point results in a rise in the nominal interest rate by more than one percentage point, i.e., the real interest rate goes up; otherwise the equilibrium would be indeterminate. The coefficient values $\phi_\pi = 1.5$ and $\phi_x = 0.5$ proposed in Taylor's (1993: 202) seminal paper satisfy this condition.[24]

Second, the exogenous variable $\bar{i}_t$ has to be determined. In his empirical investigation for the United States, Taylor (1993) replaces this variable by a constant that in his view represents the "equilibrium" real interest rate (plus the target for the inflation rate). He approximates the "equilibrium" real interest rate by the growth rate of potential output (2.2 percent in the period 1984–1992). Woodford (2002) agrees that the variable $\bar{i}_t$ should equal the equilibrium real interest rate (plus inflation target). However, he emphasizes the classical idea that the equilibrium real interest rate is not constant over time but fluctuates in response to a variety of real shocks.[25] Furthermore, his analysis shows that the inflation rate always equals the target rate of the central bank only if the relation $\bar{i}_t = r_t^n + \bar{\pi}$ is always satisfied. The interest rate rule proposed by Taylor (1993) is suboptimal because the nominal interest rate does not react to fluctuations in the equilibrium real interest rate. In fact, the deviation between the equilibrium nominal interest rate $r_t^n + \bar{\pi}$ and the intercept term $\bar{i}_t$ can be viewed as an indicator for the monetary policy stance (Woodford 2002: 33).

In the following, the implications of the above-mentioned considerations will be demonstrated in two ways. First, it will be shown that the fluctuations of the natural interest rate and of potential output in response to real shocks do not have the same sign in any case. Second, it will be shown that undesirable fluctuations of the inflation rate and of the output gap result if the central bank views the equilibrium real interest rate as constant over time.

In Woodford's (2002) model potential output and the natural real interest rate are functions of four exogenous stochastic processes: a technology shock, a_t, a government spending shock, g_t, a preference shock relating to the marginal propensity to consume of the representative

[21] The subjective discount factor is defined as $\beta \equiv 1/(1+\rho)$.

[22] In Calvo's model, in every period a fraction of firms cannot adjust their price. The larger this fraction the less an increase in the output gap (an increase in marginal costs) affects the inflation rate.

[23] In the following we assume $\bar{x} = 0$.

[24] The structural parameters are subject to the following restrictions: $0 < \beta < 1$ and $\kappa > 0$.

[25] Woodford (2002) calls the equilibrium interest rate "natural interest rate" following Wicksell.

household, $\bar{c}_t$, and a preference shock concerning the household's labor supply, $\bar{h}_t$. These shocks affect potential output y_t^n and the natural real interest rate r_t^n in the following way (Woodford 2002: 15–16):

$$(5) \quad y_t^n = \frac{\sigma^{-1}}{\sigma^{-1}+\varpi}(g_t + s_c\bar{c}_t) + \frac{1}{\sigma^{-1}+\varpi}\left((1+\varpi)a_t + \upsilon\bar{h}_t\right)$$

$$(6) \quad r_t^n = \frac{1}{\sigma+\varpi^{-1}}[(1-\rho_g)g_t + s_c(1-\rho_c)\bar{c}_t - (1+\varpi^{-1})(1-\rho_a)a_t - \varpi^{-1}\upsilon(1-\rho_a)\bar{h}_t].$$

Equations (5) and (6) show how potential output and the natural real interest rate depend on the various shocks.[26] Figure 9 displays the dynamic adjustment of these two variables in response to the considered shocks assuming that the shocks are transitory ($0 \le \rho_a, \rho_g, \rho_c, \rho_h < 1$).[27] In the case of preference shocks that increase the marginal propensity to consume of the household and in the case of government spending shocks both potential output and the natural real interest rate increase. Yet, both variables move in opposite directions in response to preference shocks that increase the household's labor supply and in response to technology shocks. It follows from (6) that the natural real interest rate does not react at all if the shocks are permanent ($\rho_a = \rho_g = \rho_c = \rho_h = 1$).

The economic intuition behind these results shall be expounded for the example of a technology shock (see also Goodfriend 2002). In the case of a *transitory technology shock* aggregate supply rises by more than aggregate demand at a *constant real interest rate*[28], because the representative household does not want to consume the whole increase in income at once but it wants to use a fraction of the temporarily higher income to finance consumption in the future (consumption smoothing). It will only use the additional income for higher consumption in the current period if the relative price of current consumption (the real interest rate) falls. Therefore, the decline in the real interest rate ensures the goods market equilibrium. In the case of a *permanent technology shock*, instead, the natural interest rate remains unchanged. The household's income does not only increase in the current period but also in all future periods. Accordingly, consumption rises by the same amount in all periods so that there is no need for an adjustment of the real interest rate. Another interesting case occurs if there is a permanent technology shock that does not increase the level of potential output but its growth rate.[29] If the growth rate rises permanently, then consumption smoothing implies that the household will want to transfer a fraction of the increase in income expected for the future to the present and to use it to finance current consumption. This is impossible, though, because aggregate supply in the current period is lower than the goods quantity desired by the household. Equilibrium in the goods market is attained through an increase in the real interest rate. From that the following conclusions can be drawn: Potential output always increases in response to a positive technology shock. The response of the natural real interest rate depends on the nature of the shock. If the shock is transitory, the natural interest rate falls. If a permanent shock occurs that increases the *level* of potential output, the natural interest rate remains unchanged. If, instead, there is a permanent shock that increases the *growth rate* of potential output the natural interest rate also rises.

The responses of potential output and of the natural real interest rate to the other shocks can be explained as follows. In the case of an ex-

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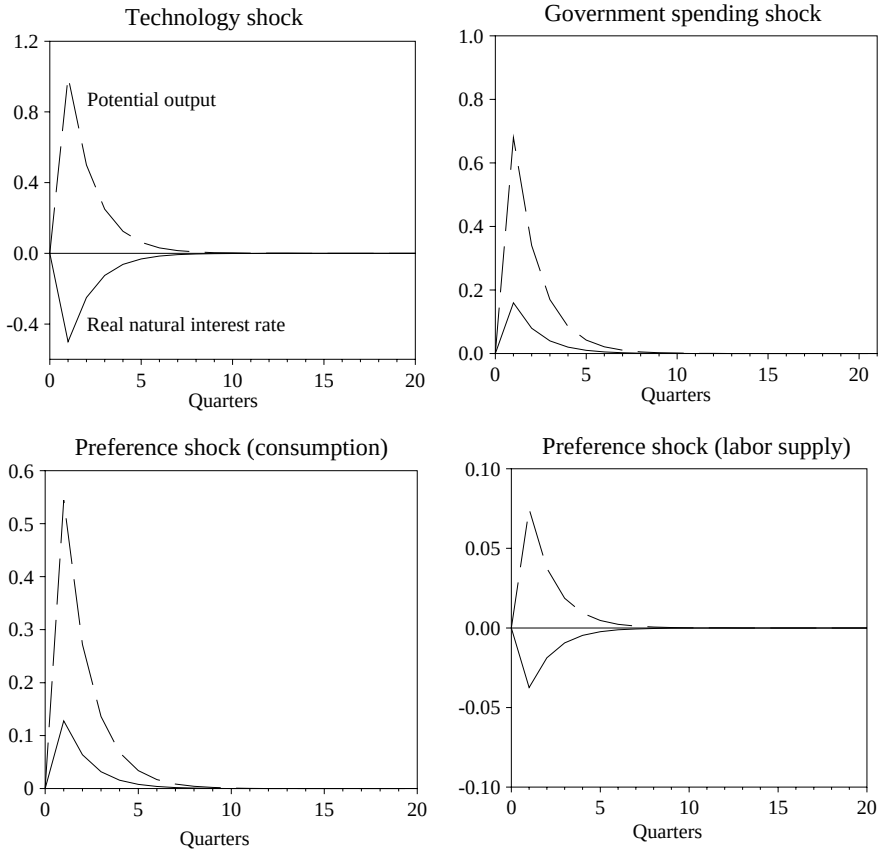
[26] σ, ϖ and υ are structural parameters, which by assumption take on positive values, and s_C is the share of private spending in total demand in the steady state. The shocks are modeled as AR(1) processes, where ρ_g, ρ_a, ρ_c and ρ_h measure the persistence of the shocks.

[27] The AR parameter is set to 0.5 and the intertemporal elasticity of substitution of private consumption σ is set to the empirically plausible value 1.0. For the values of the other parameters see Woodford (2002: 83).

[28] The assumption of a constant real interest rate is chosen for illustrative purposes only. In the model the real interest rate adjusts in response to shocks.

[29] For instance, many observers believe that especially in the United States innovations in the IT sector have led to a permanently higher rate of economic growth (New Economy).

Figure 9:
Response of the Real Natural Interest Rate and of Potential Output to Real Shocks



Note: The impulse responses show the percentage deviation of the real natural interest rate and of potential output from their steady-state levels in response to a one percent shock.

ogenous increase in *government spending* aggregate demand rises by more than potential output resulting in an increase in the natural real interest rate. The same holds in the case of an exogenous increase in the *marginal propensity to consume* of the representative household.[30] Instead, the natural real interest rate decreases in the case of an exogenous rise in *labor supply*. Such a shock leads to a temporary rise in potential output. Yet, the household who wishes to smooth consumption does not want to consume the entire increase in income in the current period. For an *unchanged real interest rate* the increase in aggregate demand would be lower than that in potential output. A higher demand for current consumption only materializes if the real interest rate falls.

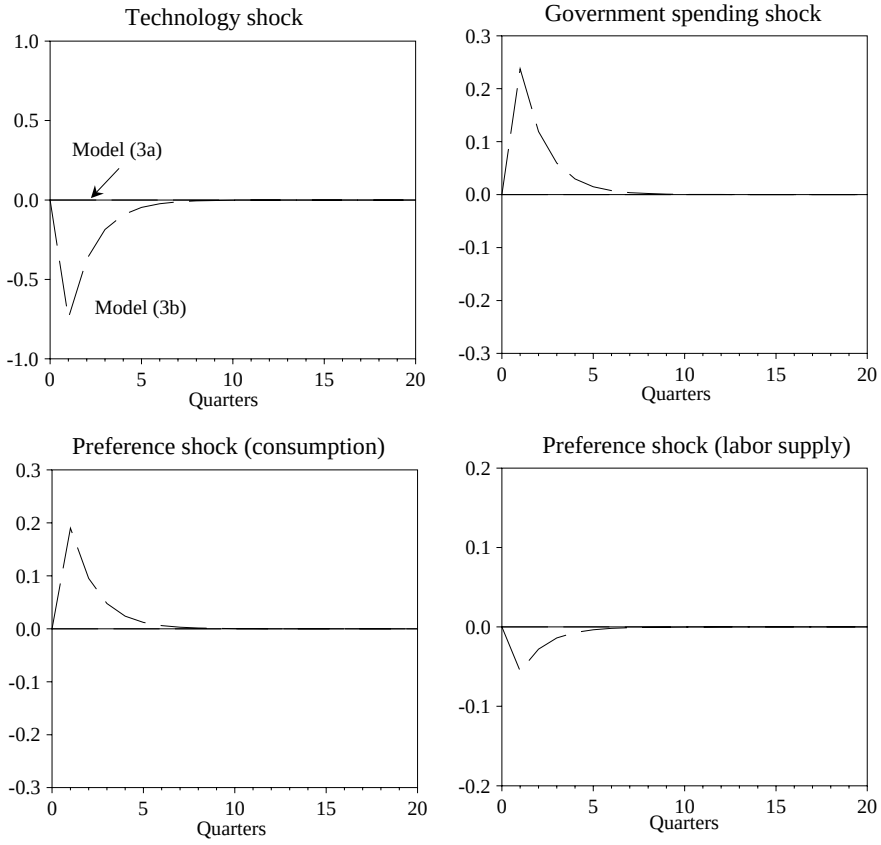
In conclusion, one can say that the natural real interest rate and potential output move in the same direction in response to transitory shocks in the case of "demand shocks" (governent spending, marginal propensity to consume). Instead, if "supply shocks" (technology, labor supply) occur, the responses of the natural interest rate and of potential output exhibit opposite signs.[31]

The following paragraphs present the implications of fluctuations in the natural real interest rate for monetary policy. It is shown how the central bank's target variables, the inflation rate and the output gap, behave in response to real shocks depending on whether the central bank takes the fluctuations of the natural interest rate

[30] A higher propensity to consume can result from, e.g., increased optimism with regard to future income prospects.

[31] Woodford (2002) avoids the terms "supply shock" and "demand shock" because the literature often assumes that only supply shocks affect potential output.

Figure 10:
Response of the Output Gap to Real Shocks



Note: The impulse responses show the response of the output gap to a one percent shock. The solid lines represent the impulse responses for the model with response function (3a), the dashed lines give the impulse responses for the model with reaction function (3b).

into account or not. Woodford (2002: 33) shows that the inflation rate and the output gap are not affected by real shocks if the nominal interest rate is always adjusted such that $\bar{i}_t = r_t^n + \bar{\pi}$ holds in every period. In this case (3a) replaces reaction function (3). An alternative is to use reaction function (3b) originally proposed by Taylor (1993) that has been widely used in monetary policy analysis in recent years. In this reaction function the term $\bar{i}_t$ is replaced by a constant ($\bar{i}$).

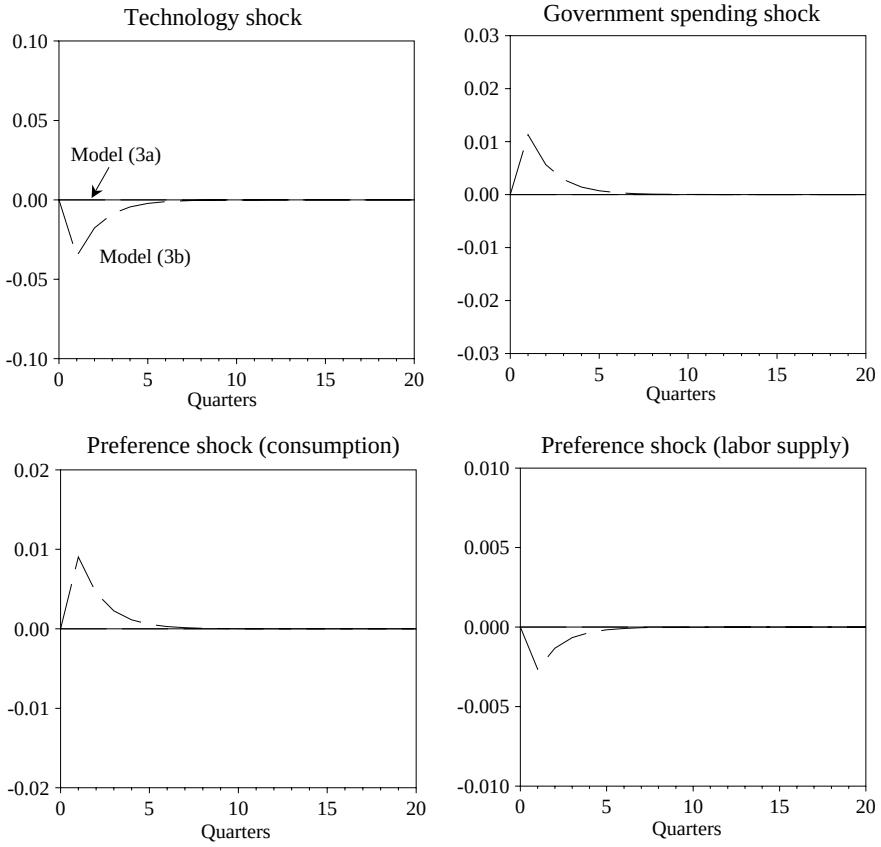
$$\text{(3a)} \quad i_t = r_t^n + \bar{\pi} + \phi_\pi(\pi_t - \bar{\pi}) + \frac{\phi_x}{4}(x_t - \bar{x})$$

$$\text{(3b)} \quad i_t = \bar{i} + \phi_\pi(\pi_t - \bar{\pi}) + \frac{\phi_x}{4}(x_t - \bar{x})$$

In the following, the dynamic adjustment of the output gap and of the inflation rate is considered for two alternative models. The first model consists of (1) and (2) as well as of reaction function (3a). The second model comprises (1) and (2) as well as the original Taylor rule (3b). In both cases we use the coefficient values suggested by Taylor (1993: 202): $\phi_\pi = 1.5$ and $\phi_x = 0.5$.

Figure 10 exhibits the responses of the output gap to the four considered shocks for the two models. In the case of the model with reaction function (3a), the output gap is always zero irrespective of the source of the shock. Consequently, the central bank can always reach its goal of a zero output gap by varying its policy instrument, the nominal interest rate, one for one with the natural interest rate. Instead, a monetary policy that is oriented towards the original Taylor (1993) rule and regards the equilibrium real interest rate as a constant leads to a sub-

Figure 11:
Response of the Inflation Rate to Real Shocks



Note: The impulse responses show the deviation of the inflation rate from the target rate of the central bank to a one percent shock. The solid lines represent the impulse responses for the model with response function (3a), the dashed lines give the impulse responses for the model with reaction function (3b).

optimal outcome. For all four considered (transitory) shocks the output gap temporarily differs from zero. In the case of transitory "supply shocks" (technology, labor supply), the nominal interest rate set by the central bank is too high so that the increase in aggregate demand falls short of the rise in potential output (negative output gap), whereas in the case of transitory "demand shocks" (government spending, marginal propensity to consume), the central bank sets too low an interest rate so that aggregate demand exceeds potential output (positive output gap).

The responses of the inflation rate to the four considered shocks depicted in Figure 11 directly follow from the responses of the output gap. This can easily be seen by solving the New Keynesian Phillips curve (equation (2)) forward:

$$(2') \quad \pi_t = \sum_{i=0}^{\infty} \beta^i \kappa E_t x_{t+i} \, .$$

Equation (2') shows that the inflation rate only depends on the output gap. However, it is not only a function of the current level of the output gap but it also depends on all expected future output gaps. With that it is also clear how the inflation rate behaves in the two considered models. In the model with reaction function (3a), in which the central bank reacts to fluctuations of the natural interest rate, the inflation rate, just as the output gap, never deviates from the target rate irrespective of the nature of the shock. If the central bank instead is oriented towards the original Taylor rule with a constant intercept term, the inflation rate deviates from

the central bank's inflation target in response to each considered shock. Note that the deviations of the inflation rate have the same sign as the output gap. In response to "supply shocks" aggregate demand is lower than potential output (negative output gap), implying a falling inflation rate. In response to "demand shocks" aggregate demand exceeds potential output (positive output gap), resulting in an increase in inflation.

These considerations suggest that the simple Taylor rule with a constant intercept term leads to suboptimal outcomes. In particular, the average equilibrium real interest rate does not seem to be a good gauge for the judgment of monetary policy. Rather, monetary policy is optimal if it reacts to fluctuations in the equilibrium real interest rate. However, the equilibrium real interest rate is an unobservable variable, and a central bank in practice is confronted with an almost unsolvable problem when it comes to identifying the source, the strength and the persistence of the multitude of shocks that occur in reality. For this reason a monetary policy rule in the form of (3a) is not operational. This does not mean at all, however, that the original Taylor rule that implicitly assumes a constant equilibrium real interest rate is the best alternative among operational monetary policy rules. Giannoni and Woodford (2003) rather show that a central bank can take the implications of the variable natural interest rate into account even if it does not react directly to the natural interest rate. Yet, in this case the concrete form of the reaction function depends on the chosen model of the economy. In general, however, it remains true that monetary policy is only optimal if it leads to a correspondence between the actual ex ante real interest rate and the natural real interest rate.

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