THE NATURAL REAL INTEREST RATE IN THE EURO AREA

In economic literature, the "natural" or "neutral" real interest rate is often defined as the real short-term interest rate which is consistent with output at its potential level and a stable rate of inflation. In the short run, however, interest rates will deviate from the neutral rate as the economy is typically hit by economic shocks that could represent a risk to price stability. A central bank pursuing a stability-oriented policy would then set its interest rate instrument so as to move real short-term interest rates to that level below or above their natural level that is necessary to counter the effects of these shocks to price developments.

From a conceptual point of view, the natural real interest rate is an important benchmark for monetary policy and potentially, in theory, an important indicator of the monetary policy stance. In practice, however, the natural real interest rate is unobservable and can only be estimated on the basis of specific assumptions and with a large degree of uncertainty. This makes it difficult to rely on this indicator in the day-to-day conduct of monetary policy.

From an empirical point of view, this article discusses a number of issues related to developments in the natural real interest rate in the euro area, as estimated on the basis of specific assumptions. The main conclusion is that the natural real interest rate in the euro area is generally found to have declined over the past decade. This reflects factors such as the slowdown of productivity and population growth in the euro area, the reduction of inflation risk premia, the disappearance of intra-euro area exchange rate risk premia since the introduction of the euro and the process of fiscal consolidation in the euro area countries before the start of Stage Three of Economic and Monetary Union (EMU).

1 INTRODUCTION

The real interest rate is the return, expressed in real terms, that a lender obtains on his investment, i.e. the return deflated by the change in the price index expected from the period in which he lends the funds to the period in which the funds are repaid. If the real interest rate is relatively low compared with its equilibrium level, borrowing is relatively cheap in real terms and, ceteris paribus, consumption and investment are more easily financed. If the real interest rate is relatively high, by contrast, borrowers face relatively high costs in real terms when financing their consumption and investment plans.

In the long term, real interest rates are determined mainly by real factors, inter alia by the rate of productivity growth and by households' preferences as to whether to spend on consumption sooner rather than later. In the short term, however, real interest rates can be influenced by monetary policy. By changing the nominal short-term interest rate, the central bank is able to control the real interest rate, as prices are sticky in the short run.

In this context, economists have developed the notion of a "natural" or "neutral" real interest rate. This is often defined as the real short-term interest rate which is consistent in the long run – i.e. when prices are expected to adjust flexibly to whatever shocks may hit the economy from time to time – with output at its potential (or sustainable) level and a stable rate of inflation. Therefore, the "natural" or "neutral" real interest rate is a concept that is potentially important for monetary policy-makers. However, like the level of potential output, the natural real interest rate is not directly observable. It can only be estimated on the basis of specific assumptions, and the resulting estimates depend crucially on these assumptions.

This article discusses a number of issues related to the natural real interest rate in the euro area. Section 2 reviews the main determinants of the natural real interest rate from a conceptual point

of view. Section 3 explores the evolution of those determinants in the euro area over the past decades and presents the results of some empirical exercises that aim at estimating how the natural real interest rate may recently have evolved in the euro area. Section 4 explains the monetary policy implications embedded in the concept of the natural real interest rate. Finally, Section 5 sets out the conclusions.

2 THE DETERMINANTS OF THE NATURAL REAL INTEREST RATE

Economic literature identifies several determinants of the natural real interest rate. The most relevant of these are explicitly discussed in this article: the time preference of consumers; productivity and population growth; fiscal policy and risk premia; and the institutional structure of financial markets. Broadly speaking, the first factor relates to preferences, the second to technology and demography, and the others mainly to the institutional and macroeconomic policy setting.

The most intuitive and straightforward determinants of the natural real interest rate are those anchored in households' decisions on their pattern of consumption and saving over time.

For example, a decrease in the value households attach to future consumption relative to current consumption – typically referred to as a decline in the households' "discount factor" – will, other things being equal, encourage households to bring forward consumption and reduce saving. In this situation the equilibrium real interest rate must rise in order to ensure, in the aggregate, that savings remain equal to investment. Therefore, a greater tendency of households to discount the future raises the equilibrium real interest rate or, more generally, changes in household time preferences will produce fluctuations in the natural real interest rate.

While the link between the discount factor and the equilibrium real interest rate is intuitive, it should be noted that the discount factor of households is a very theoretical concept. In practice, intertemporal preferences of households are not observable, so that it is difficult to assess their influence on discount factors and real interest rates.

For firms, *faster productivity growth* implies higher returns on physical investment. This stimulates investment demand. To generate sufficient savings to meet this investment demand, the natural real interest rate must rise. In addition, productivity growth may also affect consumers' borrowing and lending demand, to the extent that productivity growth has repercussions on the expected rate of growth of households' income. A situation in which households anticipate higher real incomes in future may induce them to consume more relative to their income at present than in the future. This, again, exerts an upward pressure on the natural real interest rate in equilibrium.

A *higher rate of increase in the working-age population* normally leads to an expansion of the workforce. Because the additional workers have to be equipped with capital, greater investment by firms may be required. To the extent that the higher investment needed to equip an expanding working-age population is not matched by increased savings, the natural real interest rate may have to increase to maintain the equilibrium.

In addition to these fundamental determinants, there are also a number of other factors, such as fiscal policy, risk premia and the institutional setting of financial markets, which may also have a significant influence on the natural real interest rate.

Starting with *fiscal policy*, governments are typically very large net borrowers or lenders, and their actions can have a significant impact on the real interest rate as the equalising force between borrowing and lending demand. A large and sustained budget deficit that has to be

financed by debt issuance will need to create a corresponding demand for saving on the side of the private sector. If private agents decide to save more in order to offset a likely increase in taxes in the future, this would have no impact on the natural real interest rate, as saving would then increase one-to-one with the government's borrowing requirements, with no implications for the real rate that clears the market for funds. However, if agents do not fully adjust their saving in response to a rise in the budget deficit, an increase in the natural real interest rate is necessary in order to maintain the equilibrium. A prominent example of this non-neutrality of budget decisions can be found in the field of social security. Typically, increases in social security transfers have been found to reduce private savings, as households are encouraged to cut back on saving in anticipation of their old age. As a consequence, a higher real interest rate is required to finance the larger social security deficits.

In addition to the above-mentioned factors, risk premia may also matter. For example, *exchange rate risk premia* as well as *inflation risk premia* affect the level of the natural real interest rate. These premia are often interrelated since the credibility of a currency is typically closely related to the monetary policy regime and the level of inflation, e.g. exchange rate risk premia may be more significant in countries where the inflation rate is high and volatile and where the credibility of monetary policy is low.

Uncertainties related to inflation and the credibility of a currency, which are reflected in exchange rate and inflation risk premia, can raise the cost of borrowing. This introduces some distortions to an efficient functioning of capital markets. Maintaining price stability and the credibility of a currency therefore make a crucial contribution to the ability of financial markets to allocate resources efficiently across time, thereby enhancing the growth potential of the economy.

Finally, in all modern economies saving and investment are channelled through the financial markets. Hence, the *institutional structure of financial markets* may represent another relevant factor in the determination of the natural real interest rate. The efficiency of financial markets makes an important contribution to an optimal allocation of savings across time and across investment projects. For example, improvements in the structure of financial markets can enlarge the range of assets available to savers in terms of returns, risk and liquidity. This may have the overall effect of encouraging households to save more, thereby leading to a lower level of the equilibrium real interest rate.

These considerations suggest that a high or low level of the natural real interest rate cannot necessarily be interpreted as a positive or a negative factor for the economy. Depending on the factors causing a high level of the natural real rate, for instance, it might be the symptom of a healthy and fast-growing economy or it may be a symptom of an economy which is subject to many inefficiencies and distortions. It is therefore always crucial to understand the factors driving the level of the natural real interest rate in order to assess their welfare implications for the economy.

3 THE NATURAL REAL INTEREST RATE IN THE EURO AREA

As pointed out above, the natural real interest rate is the equilibrium value around which the real short-term interest rate would fluctuate in a stable price environment in the medium to long term. In order to get some information regarding the developments of the natural real interest rate in the euro area over the past decades, it may be useful to start this section with an analysis of the evolution of the actual real interest rates. Then, the second part of the section presents some estimates of the natural real interest rate in the euro area and elaborates on the factors that may have been behind its development.

DEVELOPMENTS IN REAL INTEREST RATES IN THE EURO AREA

Real interest rates are difficult to measure because they are not directly observable. Policy-makers can only observe the nominal interest rates (which are paid on financial instruments with various maturities and risk characteristics) and inflation rates (for which, again, various measures exist). From these data, they have to infer the real interest rate used by households and firms in their saving and investment decisions.

At this point, the distinction between an ex-post and an ex-ante definition of the real interest rates should be made. While the former represents the return in real terms an investor effectively made to his investment, the latter denotes the real return which is expected to be obtained from the investment. The ex-ante definition of the real interest rate should be more relevant in understanding savings and investment decisions.

Three measurement issues arise when estimating ex-ante real interest rates. First, which nominal interest rate should be chosen? Second, which price index should be used to deflate nominal returns? And, third, how should inflation expectations be constructed?

With regard to the choice of the nominal interest rate, it is desirable to use the interest rate of a short-term financial instrument issued by an institution whose default risk is quite stable, in order to minimise the effects of variations in default/credit risk premia. Concerning the selection of a price index, it should be noted that different deflators have been proposed in empirical literature and that the real interest rate estimated is quite sensitive to the index used. A seemingly natural choice is a broad-based consumer price index, which would capture the increase in the cost of living faced by economic agents. However, it is sometimes argued that producer price indices would be preferable in this context, as these measures are more relevant for investment decisions, since they capture the price of firms' output.

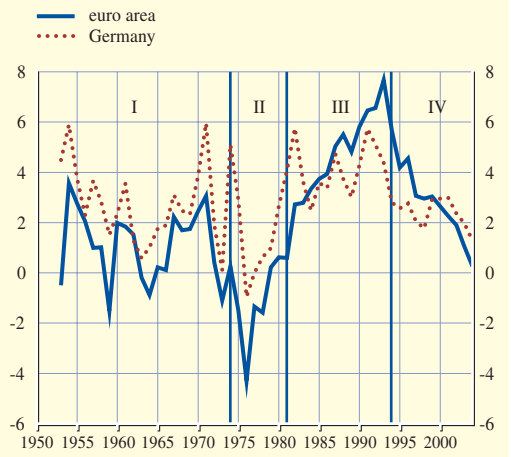
With respect to the construction of inflation expectations, the simplest approach is to assume that expectations simply reflect past inflation developments, so that the best forecast of future inflation is its most recent level. However, this hypothesis is problematical and can at best be justified when estimating the real interest rate paid on financial instruments of very short maturity, while the difference between current and expected future inflation may not be negligible for horizons longer than a few months (see the box entitled "Key issues for the analysis of real interest rates in the euro area" on page 16 of the March 1999 issue of the Monthly Bulletin).

Against the background of these caveats, Chart 1 shows the evolution of one possible measure of the real short-term interest rate in the euro area since 1952. In addition, a time series for Germany is also shown, as this country had the best track record among European countries in achieving low inflation rates over the period covered, and may thus be more comparable with developments in euro area interest rates since the start of Stage Three of EMU than past euro area averages. The measure shown in both cases is the difference between the annual average of nominal three-month interbank interest rates and the contemporaneous annual average of the year-on-year increase in consumer prices. This represents perhaps the simplest and least controversial measure of the real short-term interest rate available for the euro area over such an extended horizon, although it is obviously subject to the caveats noted above.

In Chart 1, four different periods can be identified. The first period lasts from the early 1950s until 1973, when the post-war international monetary arrangements based on fixed – albeit adjustable – exchange rates were finally abandoned. During this period, the real short-term interest rate in the euro area moved in the range of -2% to 4%. In order to interpret these figures correctly, it should be noted that the institutional environment prevailing for most of that period differs in important respects

Chart 1 Measures of real short-term interest rates in the euro area and Germany

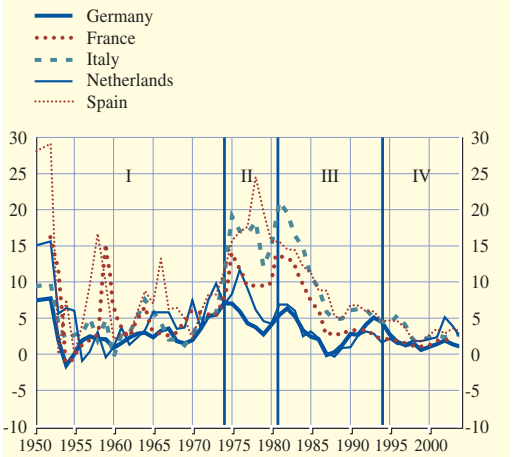
(percentages per annum; annual data)



Sources: NCBs, BIS, Eurostat and ECB calculations.
Note: Three-month interbank interest rates or closest available substitutes deflated by annual consumer price inflation up to 1990, and by annual HICP inflation thereafter.

Chart 2 Inflation developments in the five largest euro area countries

(percentages per annum; annual data)



Sources: NCBs, BIS, Eurostat and ECB calculations.
Note: Before 1991 consumer price inflation is used and HICP inflation thereafter. For Germany, consumer price inflation is used before 1996 and HICP inflation thereafter.

from that now prevailing in the euro area. In particular, capital controls, which were applied in Europe during and in the aftermath of the Second World War, were an important constraint on households' decisions to allocate their savings to the most productive uses on an international basis. In addition, the 1950s were characterised by relatively large swings in inflation in several countries, which affected the measures of the short-term rates (Chart 2). While monetary policy in Germany and, to some extent, also in other European countries favoured an environment of high economic growth and relatively stable inflation after the stabilisation in the early 1950s, inflation in some other countries was more volatile and less predictable, particularly in the 1960s. This situation, coupled with restrictions on the international mobility of capital, may thus explain the occurrence of negative real interest rates even in face of high rates of expansion in production and income.

The beginning of the second period is marked by the abandonment of the fixed exchange rate regime and the upsurge in oil prices in 1973. The 1970s started with overheated economies in which consumer price inflation and wages were rising, against the backdrop of decelerating potential growth and reduced labour market flexibility. In this context, oil price rises and the removal of the external constraint of fixed exchange rates created conditions for laxity in monetary and fiscal policies in most countries. Over this period, inflation rates rose rapidly, while nominal interest rates increased at a relatively slower pace and, as a consequence, measures of real interest rate fell substantially below zero, reaching a trough of -5% in 1975. Importantly, the relatively high inflation rates over the subsequent decade seem to indicate that the actual real rate was somewhat below the natural real interest rate, i.e. monetary policy was "too loose" on average during this period to be compatible with stable inflation (see the box entitled "Current euro area interest rates from a historical perspective" on pp. 25-28 of the September 2003 issue of the Monthly Bulletin).

The third period, from 1981 to 1993, is characterised by a substantial increase in the real interest rate, which culminated in the historical highs reached in the early 1990s. The rise in public deficits in many G7 countries and

the rise in inflation risk premia after the economic developments during the 1970s may have been factors pushing up real interest rates. In addition, after the high inflation rates which characterised the previous decade, most European monetary authorities pursued a monetary policy oriented towards disinflation that contributed to the decline in consumer price inflation throughout the 1980s and beyond. Therefore, the real rate was on average presumably above the natural real interest rate in this period, i.e. monetary policy was relatively tight. Overall, the need to curb inflation expectations and re-establish price stability after the experience of the 1970s was costly in terms of growth and employment. The high economic costs of fighting inflation once it had hovered around high levels for a long period of time strengthened the resolve of monetary authorities to commit to more stability-oriented policies later on.

Finally, since the mid-1990s, the real interest rate has fallen steadily, mainly due to two factors: first, the stabilisation of inflation rates in the euro area at low levels, and the decline in nominal interest rates made possible by the establishment of conditions of monetary stability; and, second, the process of fiscal consolidation in most euro area economies before the start of Stage Three of EMU. Against this background, the next sub-sections aim to draw some conclusions on the most likely evolution of the natural real interest rate in the euro area over the past decades.

DEVELOPMENTS IN THE NATURAL REAL INTEREST RATE IN THE EURO AREA

The natural real interest rate is also an unobservable variable. In addition, as explained in Section 2, it is driven by a variety of fundamental factors that are not easily measured. Therefore, the natural real interest rate is even more difficult to estimate than actual real interest rates.

Most estimates of natural real interest rates are based on techniques which smoothen developments in the actual real rates. One simple approach to smoothing developments in real rates is simply to take averages of the real interest rate data over relatively long periods, where the incidental short-term fluctuations of the real rate cancel one another out. However, taking simple historical averages of actual real interest rates may not be a reliable method to compute the natural real interest rate, as a number of factors, including the stance of monetary policy, may contaminate the information content of these averages. In particular, as long as there are certain periods in which inflation was not stable, the average of actual real rates may cause misleading results.

Keeping all these caveats in mind, the table reports the historical averages of the actual real short-term interest rates in the euro area in each decade since the 1970s.

The statistical measures reported in the table point to a rate in the most recent period that is

Table Short-term real interest rates and inflation in the euro area

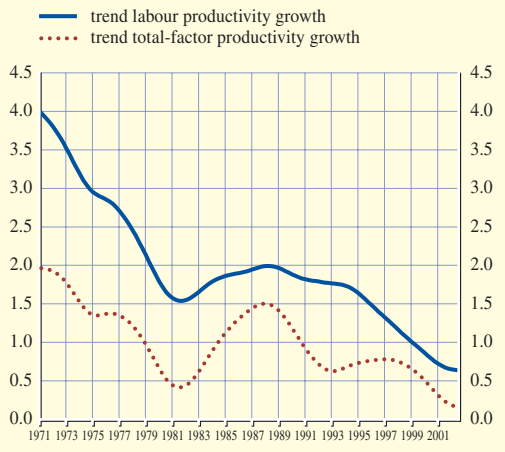
(percentages per annum; based on monthly data)

Period	Short-term real interest rate			Average inflation
	Average	Absolute minima	Absolute maxima	
1973-1980	-0.7	-5.2	2.1	10.3
1981-1993	5.2	1.5	9.1	5.5
1994-March 2004	2.4	0.0	5.1	2.0
1999-March 2004	1.4	0.0	2.9	2.0

Sources: NCBs, BIS, Eurostat and ECB calculations.
Note: See Charts 1 and 2 for details on the calculation of short-term real interest rates and inflation.

Chart 3 Measures of trend productivity growth in the euro area

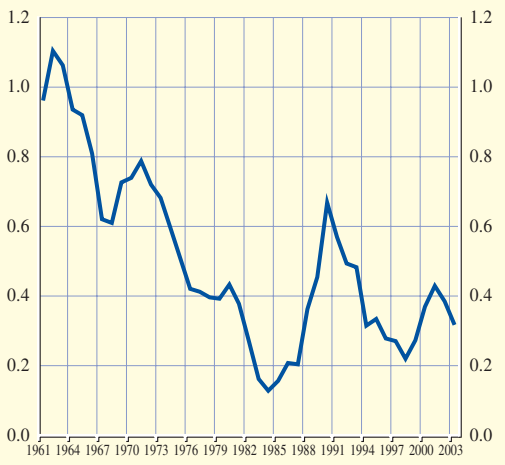
(percentages per annum; quarterly data)



Source: ECB Area-Wide Model. Labour productivity is real GDP per employed person; total factor productivity is the Solow residual of the aggregate production function.
Note: See also G. Fagan, J. Henry and R. Mestre (2001), "An Area-Wide Model (AWM) for the euro area", ECB Working Paper No. 42.

Chart 4 Total population growth in the euro area

(annual percentage changes; annual data)



Source: Eurostat.
Note: The data refer to the countries which are currently part of the euro area (excluding East Germany and Luxembourg from 1961 to 1991).

noticeably lower than the one that seems to have been prevailing over the 1980s and 1990s. This suggests that the natural real interest rate in the euro area may have declined over time. Such evidence tends to be confirmed by results generated on alternative estimation methods based on a more refined statistical filtering of time series data and on more structural approaches using macroeconomic models (see the box below).

Various factors may help explain the apparent decline in the natural real interest rate in the euro area over the past decade.

First, *productivity growth* in the euro area declined over the most recent decade. Indeed, Chart 3 suggests that productivity growth in the euro area (no matter whether measured as output per employed person or as total factor productivity) seems to have followed a declining trend since the early 1970s.

Second, *population growth* in the euro area has declined over the past decade and may also have contributed, albeit only slowly and gradually, to reducing the level of the natural real interest rate. In this regard, Chart 4 displays the decline in the growth rate of the total population in the euro area, from around 1% in the 1960s to approximately 0.3% in 2003.

These two factors, productivity growth and population growth, can be thought to have a downward effect on the risk-free real short-term interest rate. However, most estimates of the natural real interest rate are based on techniques which smoothen developments in the actual real short-term rates, which are not entirely risk-free. Therefore, the existence of risk premia in short-term rates may distort, in practice, the estimation of the natural real interest rate. The following paragraphs elaborate on three different types of risk premia which may have also been a factor in the decline in the estimated natural rate over the past decades: *exchange rate risk premia, default risk premia and inflation risk premia*.

The introduction of the euro in January 1999 resulted in the disappearance of intra-euro area exchange rate premia. Indeed, the euro has contributed to reducing the uncertainty that investors face when making transactions and business decisions across euro area countries. This has caused the cost of borrowing in real terms, i.e. the real interest rate, to fall in the euro area. It must be noted that the lower the exchange rate uncertainty, the larger the amount of resources that may be diverted from (unproductive) hedging activities to productive activities. This is one of the mechanisms by which the single currency may have contributed to an environment more favourable to risk-taking and business activity, thereby possibly fostering economic and employment growth in the medium term.

A factor that may also have led to a decline in risk premia in the euro area is the process of *fiscal consolidation* that took place in the euro area economies from the early 1990s to the commencement of Stage Three of EMU in 1999. This process was motivated, inter alia, by countries' efforts to meet the requirements imposed by the Maastricht Treaty. In this respect, the great efforts undertaken by euro area countries in the 1990s to reduce their fiscal deficits and their debt-to-GDP ratios were rewarded with higher investor confidence and lower risk premia in medium to long-term government bond yields, which also had an impact on real short-term interest rates.[1] However, investors' confidence could be dented and risk premia embedded in medium to long-term government bond yields might rise again if the recent trend towards increased fiscal deficits in euro area countries were not to be reversed.

Finally, the central banks of euro area countries and, subsequently, the ECB have been successful in their attempts to stabilise inflation at low levels over the past decade. As noted in the previous section, a more stable inflation rate is easier to predict by consumers, investors and social partners, leading to lower inflation risk premia. As a consequence, the central bank can keep its interest rates lower than would otherwise be possible in order to achieve its objective of price stability as it already has a higher credibility; in other words, lower inflation risk premia also allow the natural real interest rate to fall.

All in all, the natural real interest rate is likely to have declined over the last decade, due to the combination of the aforementioned factors. As shown in the box, most – although not all – techniques suggest point estimates lying in the range of 2% to 3% in recent years. However, these estimates are subject to a large degree of uncertainty, not only regarding estimation uncertainty (i.e. the degree of confidence on the point estimates), but also the uncertainties on how to construct the real interest rate time series, which sample period should be chosen, which is the appropriate methodology to use and the details of the specific economic and statistical models employed. The estimates therefore typically differ from one study to another, and they need to be interpreted with a great deal of caution.

1 For a description of the effects of fiscal policy on savings and interest rates, see the article entitled "Fiscal policies and economic growth" in the August 2001 issue of the Monthly Bulletin.

Box

ESTIMATES OF THE NATURAL REAL INTEREST RATE IN THE EURO AREA

This box presents some technical details on various methods used in literature to estimate the natural real interest rate in the euro area.

1. Averages of actual real interest rates

This method is based on the law of large numbers and proposes that the average of actual real rates over a long enough period of time should average out the short-term deviations between the natural real interest rate and the actual real rates. An illustration of this particularly intuitive approach to the estimation of the natural real interest rate is provided in the main text.

2. Average of actual real interest rates corrected for the effects of specific economic shocks

The estimation technique based on simple averages of actual real interest rates can be refined in order to take into account the specific shocks that may have implied asymmetries over longer periods of time in growth and inflation performance. In economic literature, the computation is often conducted by deriving the natural real rate from estimations of the *Taylor rule*. This rule, originally proposed by Taylor (1993),[1] takes the form,

$$r_t = r^* + \beta(\pi_t - \pi^*) + \gamma x_t$$

where r_t corresponds to the real short-term interest rate, r^* represents the natural real interest rate, π^* symbolises the inflation objective of the central bank, π_t denotes the percentage change in the price level from time t-1 to t, and x_t stands for the output gap at time t. The rule states that the central bank typically allows deviations of the actual real interest rate around the natural real interest rate if inflation is not consistent with the central bank's objective, or if the output gap is non-zero. In order to estimate the natural real interest rate r^*, the average of the real interest rates observed is then corrected for those fluctuations in actual real interest rates which are due to inflation being different from its target or the output gap being positive or negative.

By proceeding in this way, an ECB Working Paper (2003)[2] provides estimates of the equilibrium real rate of interest. Using euro area data from 1985 to 2002 to estimate a large number of different Taylor-type specifications, the vast majority of the natural real interest rates estimated lies between 2.1% and 3.2%. However, in the sample period starting from 1993, lower levels of the equilibrium rate, between 1.8% and 2.9%, were estimated.

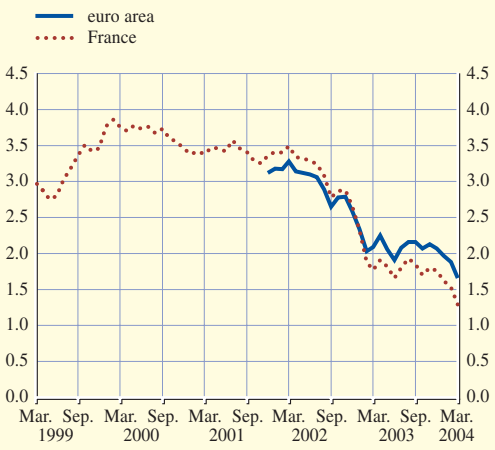
3. Real yields on inflation-linked bonds

This method consists of calculating the level of the real yield on an inflation-linked bond. Such an approach builds on the view that the expectations computed by market participants are the best measure available of the rate that would prevail in the distant future. On average at a

1 J. B. Taylor (1993), "Discretion versus policy rules in practice", Carnegie-Rochester Series on Public Policy 39, pp. 195-214. On the caveats to using Taylor rules in the analysis of monetary policy decisions, see the article entitled "Issues related to monetary policy rules" in the October 2001 issue of the ECB Monthly Bulletin.
2 D. Gerdesmeier and B. Roffia (2003), "Empirical estimates of reaction functions for the euro area", ECB Working Paper No 206.

Real bond yields in the euro area and France derived from French inflation-linked bonds

(percentages per annum; monthly averages)



Sources: French Treasury, Reuters and the ECB.
Note: French index-linked bond linked to the French CPI is maturing in 2009. The French index-linked bond linked to the euro area HICP is maturing in 2012.

sufficiently long horizon, e.g. ten years, it is reasonable to assume that a real long-term bond yield should be a valid measure of the natural real interest rate, at least as perceived by market participants. While this approach exhibits notable advantages over ex-post historical averages, namely its forward-looking character, its simplicity and its availability on a daily basis, it also has significant shortcomings. First, inflation-linked bond yields may be distorted by significant premia, e.g. due to liquidity or tax factors, which may also vary over time. Second, inflation-linked bond yields cannot measure the natural real interest rate per se, but only the market perception thereof, which might – at times of exceptional optimism or pessimism – be distorted.

A further limitation for the euro area is that no long series for inflation-linked bonds are available. Bonds indexed to the euro area HICP have only existed since November 2001. In addition, bonds indexed to the French CPI have existed for somewhat longer. The chart shows the available time series. While both time series show a fall in index-linked bond yields in 2003, the time period available appears to be too short to assess the information content of this measure for the natural real interest rate in the euro area.

4. Time series models

To take the possibility of persistent time variations in the natural real interest rate into account, a small but growing body of literature, especially that using US data, has built simple time-series models explicitly allowing a time-varying natural real interest rate. Generally speaking, this literature is based on so-called "unobservable-component" techniques, which help to disentangle the trend movements in the natural real interest rate from transitory higher-frequency fluctuations in the real short-term interest rates.[3]

Such techniques make it possible to calculate the equilibrium real rate in the euro area,[4] using a multivariate econometric model on monthly data for industrial production, the real interest rate and inflation from 1991 to 2002 with the Kalman filter. The natural real interest rate, corresponding to the non-stationary component of the real rate series, is found to have declined to levels around or slightly above 2% in the most recent years.

3 One important contribution in this regard is T. Laubach and J. C. Williams (2001), "Measuring the natural rate of interest", FEDS Working Paper No 2001-56, who propose a simple macroeconomic model to estimate in a simultaneous manner the trend growth rate of output and the natural rate of interest in the United States by using a Kalman filter over a sample period from 1960 to 2000.

4 J. C. Cuaresma, E. Gnan and D. Ritzberger-Gruenwald (2003), "Searching for the natural rate of interest: a euro-area perspective", Oesterreichische Nationalbank Working Paper No 84.

As pointed out earlier, an advantage of the statistical filtering approach is that it provides for time variation in the natural real interest rate. In addition, the estimates generally turn out to show relatively little dependence on the precise specification of the model used. However, this methodology does not give a structural interpretation to the movements in the equilibrium real rate, i.e. the approach is silent on the possible structural reasons for the time variations.

5. Structural models

The problem just described of a lack of a structural foundation can be addressed by using fully specified structural models of the economy. One class of structural frameworks that has received increasing attention features general equilibrium models constructed on the basis of explicit "optimising" behaviour on the part of households and firms and nominal frictions, whereby prices are sticky and thus do not adjust instantaneously to economic shocks. This approach is able to deal with the problems of calculating a time-varying natural real interest rate and, at the same time, providing a structural explanation for the estimated changes in the natural real interest rate. In particular, these types of models can be used to generate a time path for the natural real interest rate over a certain period by constructing a "flexible-price scenario", characterised by the absence of nominal rigidities in the economy. The path of the natural real interest rate is then identified with the path of the actual real interest rate that the model generates in response to the estimated shocks under that counterfactual scenario. An example of this approach provided an estimate of a time-varying measure of the equilibrium real interest rate for the euro area.[5]

Two aspects are worth emphasising in this respect. The first is that the very notion of the "natural real rate of interest" underlying these exercises differs in some notable respects from that adopted in this article. Rather than measuring the level around which real short-term interest rates should be expected to fluctuate over a medium to long-term horizon – being driven by slow-moving determinants – the natural real interest rate implicit in this estimation approach is intended to provide a benchmark for the setting of the short-term interest rate at very short horizons. As a consequence, this measure is typically found to be quite volatile, as it indicates the way in which the real short-term interest rate should be allowed to react in response to economic shocks in a frictionless economy.

The second aspect that is worth emphasising is that the possibility of identifying the structural shocks that drive the natural real interest rate over time generally comes at the price of generating explanations and estimates that are highly model-specific, i.e. different model assumptions will naturally lead to different outcomes, because the channels through which a shock affects the real rate may differ substantially across models. Moreover, it should be emphasised that these models typically attribute a great deal of importance to preference and productivity shocks, while the factors listed in Section 2 (related to risk, fiscal policy and institutional considerations) are typically, though not always, left out of the analysis.

5 F. Smets and R. Wouters (2002), "An estimated stochastic dynamic general equilibrium model of the euro area", ECB Working Paper No 171.

4 MONETARY POLICY AND THE NATURAL REAL INTEREST RATE

As mentioned in Section 2, the natural real interest rate is the level of the real interest rate at which inflation is stable and output is equal to its potential level. Over the medium to long term, it can be assumed, if inflation is close to the central bank's objective, that a central bank will on average set the real interest rate close to the natural rate, and output will be close to its potential level. In the short run, however, the

economy may be hit by shocks which could, if not offset by the monetary authority, represent a risk to price stability over the medium term. A central bank following a stability-oriented policy will therefore move the interest rate that it controls in a way that offsets (or at least smoothens) the effect of these shocks on price developments. As a consequence, actual real interest rates will often differ considerably from measures of natural interest rates.

According to many views expressed in academic literature, these deviations between actual and natural interest rates can be regarded as a measure of the monetary policy stance. In fact, an upward deviation of the real interest rate from its natural level that is driven by the monetary authority tends to have a short-term contractionary impact on economic activity and creates downward pressure on inflation. Conversely, a downward deviation tends to stimulate economic activity and therefore brings upward pressure to bear on inflation. This is one channel of transmission of the monetary policy impulses to the economy. Clearly, the appropriate extent and duration of the deviations of the real short-term rate from the natural rate will depend on the magnitude and nature of the threat to medium-term price stability, and thus on the type of the shock hitting the economy.

Therefore, the level of the natural real interest rate is, in theory, an important benchmark for monetary policy. If it was possible to estimate the level of the natural real interest rate with precision in real time, it would allow central banks to gain a better understanding of the impact of monetary policy on economic activity and prices. Therefore, the natural real interest rate is, in principle, a useful concept.

However, as was illustrated above, central banks have a very imperfect knowledge of this variable. While it is already difficult to assess the level of the natural rate ex post, the difficulties are exacerbated even further in real time. Therefore, central banks are always confronted with estimates which are subject to a high degree of uncertainty. Only in specific situations is it possible to assess that a certain level of the real interest rate is above or below any plausible estimate of the natural rate. In most cases, the sign – let alone the size – of the deviation of the real rate from the natural rate is very difficult to ascertain. Indeed, recent research has shown more generally that policy recommendations based on real-time estimates can differ significantly from those based on ex post (revised) data.[2] This suggests caution in relying the policy decisions on indicators which can only be vaguely estimated in real time.

Taking these difficulties into account, the natural real interest rate is, in practice, often a concept which does not add much value to monetary policy-making from an operational perspective. These structural difficulties may explain why the concept of the natural rate is rarely used in official central bank communications of current policy decisions. While it is always useful to assess the level of the real short-term rate in a historical perspective, other indicators, such as money and credit developments and measures of excess liquidity, may provide at least equally useful information on the stance of monetary policy. In addition, the central bank also has to take account of other pieces of relevant information in order to assess the appropriateness of the monetary policy stance. All this implies that it is difficult in practice to have a simple measure of the monetary policy stance. In the end, the central bank should always assess the appropriateness of the monetary policy stance against the prospects of achieving its objective in the medium term. Such assessment should always be based on the full set of available indicators and information in the economic and monetary analysis.

2 See, for instance, A. Orphanides (2003): "Monetary policy rules based on real-time data", American Economic Review, 91(4), pp. 964-985.

5 CONCLUSION

This article has illustrated the potential usefulness of the concept of a natural real interest rate. However, it has also pointed to the enormous difficulties of operationalising this concept in practice, given the significant estimation problems. This notwithstanding, the evidence reviewed in this article shows that the natural real interest rate may have declined in the euro area in the course of the 1990s. There are several factors that might explain this decline. First, the slowdown of productivity and population growth in the euro area may have contributed, albeit only slowly and gradually, to reducing the level of the natural real interest rate. Second, the disappearance of intra-euro area exchange rate risk premia should also have contributed to a decline in the natural real interest rate in the euro area over the past decade. Third, the process of fiscal consolidation in the euro area countries before the start of Stage Three of EMU ought to have been a factor in reducing the natural real interest rate. Finally, a fall in the inflation risk premia in the euro area should have been another factor in reducing the natural real interest rate.

In this context, most estimates point to a range between 2% and 3% for the natural real interest rate in the euro area at present. At the same time, it has to be borne in mind that these point estimates are subject to a considerable degree of uncertainty and should therefore be interpreted with a great deal of caution. Moreover, the data, techniques and definition of the natural real interest rate all remain a subject of intense debate, much of which has yet to be resolved.

In practice, the significant uncertainties around the estimations of the natural real interest rate suggest that those estimations cannot easily be used (and doing so might imply a high risk) in the process of monetary policy decision-making. In this regard, it is necessary to take a broader view, as reflected in the ECB's monetary policy strategy, and to consider all the information provided by all the different indicators so as to be as well equipped as possible to assess the outlook for price stability over the medium term.