V. MARKET ADJUSTMENT: THE REAL INTEREST RATE CHANNEL

Summary

A popular argument is that in a monetary union the cyclically most advanced countries experience above-average inflation rates and thus below-average real interest rates that provide an additional unwarranted stimulus to economic growth. In order to assess the risk of destabilising real-interest rate effects, this chapter looks at the experiences in the euro area. Due to persistent inflation differentials (ex post), real interest rates have varied across countries, but cyclical differences are just one of the explanatory variables of inflation differentials. But ex ante real interest rates exhibit smaller cross-country differences, particularly at longer horizons when inflation expectations converge and several reasons are found why area-wide real interest rates are becoming more important over time. This observation is supported by the lack of a stable correlation between real interest rates and indicators of real activity at the Member State level. By contrast, a close correlation is observed between national real interest rates and credit developments. It is difficult, however, to distinguish the impact of the decline in real interest rates in the 1990s and their more recent developments.

All in all, the analysis of the real interest rate channel suggests that the subject is more complicated than some early statements might have suggested. Focussing exclusively on ex-post real interest rates could be misleading and exaggerate the risk of destabilising effects. The analysis of the causes of real interest rate differentials clearly hints at the role of non-cyclical factors implying that low interest rates could also emerge in slowly growing countries. Moreover, for some economic agents, particularly for companies, it appears likely that they attach more and more weight to area-wide considerations and thus to a common area-wide real interest rate. In addition, to the extent that inflation differences due to cyclical divergences should be perceived as temporary, the private sector may adjust its medium-term inflation expectations to the ECB's definition of price stability. This process will certainly be intensified by ongoing financial integration, which will also raise the role of income smoothing via risk sharing. As regards the relative importance of real interest rates, empirical investigations argue that the competitiveness channel is strong enough to offset any possible destabilising effects.

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1. Introduction

After almost eight years of existence, Economic and Monetary Union is widely considered as a success story. The euro-area economy has successfully coped with a number of adverse shocks including periods of large exchange rate moves, external demand shocks, sharp increases in oil prices and political tensions and uncertainties. With the introduction of the single currency tensions between European economies have lost one of their main propagation mechanisms, the exchange rate channel. However, differences across euro-area countries have persisted and the question of adjustment (channels) within the euro area has not lost its relevance. Differences in cyclical positions, inflation and economic growth have attracted a lot of attention. Among the key channels of adjustment discussed have been the aforementioned competitiveness channel (see Chapter IV) and the real interest rate channel (via real interest rate differences). Both channels are expected to work in opposite directions with the real interest rates channel being presumed to work pro-cyclically.

An above-average increase in costs and prices in a country that is "out of synch" with the euro-area business cycle will not only affect the competitiveness vis-à-vis other euro-area economies, but also lower the difference between the nominal interest rate and the inflation rate, i.e. the ex-post real interest rate. A lower real interest rate, however, makes it more attractive to advance investment and consumption and thereby stimulates economic activity almost instantaneously. This linkage has raised concerns about a possibly destabilising real-interest rate channel that provides additional stimuli to countries that are already in a boom and that slows economic activity in countries that are already lagging behind. Such an "automatic destabliser" could indeed become an obstacle to inter-country adjustment and deserves therefore a careful evaluation. Questions relate to the relevance of real interest rates based on past inflation experience, to the time horizon of inter-temporal consumption and investment decisions and to the presumed national focus of decision-makers. As regards the experience in the early euro-area years, one might also wonder whether developments in costs and prices were closely associated with cyclical developments, to what extent structural factors played a role and whether a more homogeneous monetary transmission mechanism limited the role of national real interest rates. The latter could be related to the role of persisting nominal (non-policy) interest rate differentials across euro-area countries. Moreover, questions arise concerning counteracting channels that limit the relative importance of the real-interest rate channel. Lessons might also be drawn from empirical studies on US experiences. As for the competitiveness channel, the distribution of the effects over time appears to be crucial.

While the real interest rate channel is based on the assumption that decision-makers take decisions with a view to a national variable (real interest rate), other financial channels that might contribute to inter-country adjustment are based on the assumption of decisions taken with a view to developments in other euro-area countries. Cross-border borrowing and lending, portfolio diversification and cross-border ownership of productive capacity decouple domestic income and output. Such risk sharing helps to smooth income and consumption for a given country-specific shock, although it might also contribute to specialisation of productive capacity that amplifies idiosyncratic fluctuations. As regards the euro area, however, the question arises as to whether risk sharing is already as important as it has been shown to be for adjustment across the states of the US.

This section looks at the real interest rate channel in the euro area, discusses its relevance and presents a preliminary assessment after almost eight years of the euro area. It is organised as follows. Section 2 gives an overview of measurement aspects and developments of real interest rates in the euro area and euro-area Member States. Section 3 discusses the role of real interest rates in a monetary union. Section 4 investigates the determinants of real rate differentials with respect to possible implications for the information content of real interest rates and the functioning of the real rate channel. Section 5 presents evidence on the impact of real interest rates on the euro area as a whole

and on sectors therein. Taking into account other adjustment channels, Section 6 discusses the relative importance of adjustment via real interest rates. The final part concludes and tries to assess to what extent the concept of national real interest rates is an appropriate approach for the analysis of macroeconomic adjustment within the euro area.

2. Real interest rates in the euro area: A look at the data

This section provides an examination of the real interest rate developments in the euro area. The focus here is on documenting developments in real interest rates across Member States within the euro area. The section is organised as follows. It starts with some general considerations regarding the definition and measurement of real interest rates. The second part looks at developments in ex-ante and ex-post real interest rates prior to the start of the third stage of EMU, while the final part examines the euro-area years. Particular attention is paid in these sections to assess differences in developments due to the choice of the inflation measure. Specifically, for ex-post calculations, differences in the most commonly used measures of realised inflation: the GDP deflator, the private consumption deflator and the Harmonised Index of Consumer Prices (HICP) are considered. For ex-ante calculations, the difficult issue of measuring inflation expectations is explored, and evidence using survey results is examined.

2.1 Definitions and some general measurement issues

It has been argued that since euro-area Member States share the same nominal interest rates, realised real interest rates in each country should differ to the extent that national inflation rates diverge within the monetary union. As a preliminary step in analysing the role of real interest rates as an adjustment channel in monetary union, it is therefore important to establish a clear framework for thinking about real interest rates and their link to inflation developments. This is what is briefly done in this section, by providing a working definition of real interest rates, discussing the difficulties in measuring real interest rates and examining the degree to which developments vary across the most commonly used approaches.

The *real interest rate* is generally thought of as capturing the cost in terms of real resources (e.g. a consumption basket) of transferring income (funds) across time periods. For saving decisions, for instance, the real interest rate conveys information on how much goods which foregone consumption today would be worth at a future time period. Similarly, for investment decisions financed by borrowing, the real interest rate tells us how many goods one can expect to return at a future date in exchange for access to extra goods to be put in some productive activity in the current time period. In essence, then, the real interest rate may be thought of as the price in terms of real goods of transferring access to resources across time periods (i.e. the inter-temporal price of consumption goods). This stands in contrast with the notion of the *nominal interest rate*, which captures the cost in terms of *monetary units* of transferring nominal income (funds) across time periods.

These two notions are closely linked. In a monetary economy, where money is the unit of measurement of all prices, it is therefore the presence of inflation which makes the distinction between the two notions important. In such an economy it is the nominal interest rate which is readily observable. However, since households ultimately consume goods, not money, it is the real interest which matters for consumption/saving and investment decisions. More formally, following Fisher (1922), both notions are linked via the relationship:

$$(1 + r_t) = (1 + i_t) / (1 + \pi^e_t) \qquad (1)$$

where r_t is the real interest rate for year t (by definition, then borrowing one basket of goods this period, requires in exchange to return the equivalent of $1+ r_t$ in the following year), i_t is the nominal interest rate for year t (indicating similarly that borrowing i_t units of currency this year, requires a payment of $1+ t_t$ units of currency next year) and π^e_t denotes the expected rate of inflation between this year and the next. Rearranging terms, and for relatively small rates, one gets the simpler approximation:

$$r_t \approx i_t - \pi^e_t \qquad (1')$$

It is clear from expressions (1) and (1') that, conceptually, real interest rates are derived by adjusting nominal interest rates for the expected inflation rate over the relevant horizon. It is then also clear that computing real interest rates is not straightforward in practice. The computation involves substantial conceptual and practical difficulties.

The first difficulty is that the expected inflation rate is not an observable variable. Therefore, it has to be estimated in order to obtain the corresponding real interest rate. Several approaches to this estimation are possible, but there is no agreement on which one is more appropriate in general, with each possessing advantages and disadvantages. Another difficulty is due to the fact that economic agents are heterogeneous. This means that a given measure of the real interest rate might not be relevant for all economic agents. For instance, national interest rates might be relevant for firms operating nationally, but perhaps less relevant for firms operating on an international scale, with investment choices over several countries. Firms operating internationally may also look at inflation in their export markets to derive their real interest rates, even if they invest mostly at home.

While these expressions establish a clear link between real interest rates and inflation, it is worth bearing in mind factors other than inflation that may also influence interest rates (i.e. other than inflation differentials in a monetary

union). In particular, these factors include expectations about future growth prospects, market assessment about the sustainability of the governments' fiscal balances, liquidity and risk considerations, and the overall saving-investment position of the economy as well as tax considerations. In the case of the euro area, for example, there is a comprehensive discussion in the literature as to whether (and if not, why not) financial markets are pricing appropriately the public debt of Member States.[1] Given that the focus of the analysis here is intra-area adjustment in the short-to-medium term, the real interest rate channel is investigated by looking mainly at short-term rates.[2] Short-term nominal interest rates examined here correspond to the three-month money market interest rates, while the long-term nominal interest rates correspond to ten-year government bond yields.

Ex-post and ex-ante real interest rates

As mentioned earlier, measuring the real interest rate is not straightforward, as it involves estimating first the expected inflation rate. This is a demanding task, as both in theory and in practice it is not fully settled yet which expectation formation mechanism is best suited for deriving the relevant expected inflation rate.

Broadly, one can distinguish three approaches to deriving inflation expectations in practice. One approach consists of using statistical techniques or economic modelling to estimate the expected inflation rate. A second approach works with financial market instruments to derive estimates of inflation expectations. A third approach is to directly ask economic agents about their inflation expectations, this is the survey method. Every approach has its specific advantages and disadvantages. However, they all share, to varying degree, the drawback of having to introduce additional layers of assumptions for computing estimates of the expected inflation rate, which widens the scope for measurement error.

In practice, cross-country empirical studies usually work with real interest rates obtained by simply adjusting the appropriate nominal interest rates by some measure of realised inflation, such as the GDP deflator or a consumer price index like the HICP in the EU. That is, most studies work with *ex post* or realised real interest rates, rather than with *ex ante* real interest rates– i.e. adjusted by expected inflation.[3]

There is a full range of options for computing *ex post* real interest rates. Some studies report using a given headline deflator, others favour using a core version of the deflator (i.e. excluding some volatile items from the overall price index), yet others report using some type of moving average of a given deflator. A rationale for using either of the latter two is to abstract from the effect of transitory shocks to current inflation, which may cause current inflation to be a distorted measure of expected inflation.[4] It is also sometimes argued that depending on the issue of interest one should use a particular price index, for example, a CPI if one is interested in studying consumption and a producer price index for studying investment. Naturally, depending on the choice of the price index for doing the adjustment, the results can vary somewhat, which underscores the degree of uncertainty surrounding the measurement of real interest rates.

Other than its simplicity, a further rationale for working with such a proxy of inflation expectations is that inflation is typically a persistent process.[5] It can then be argued that domestic inflation expectations would tend to follow developments in measured inflation relatively closely, particularly at short-term horizons.[6]

Selecting the appropriate price index

How much variation can be expected due to differences in price indicators? There are several reasons why the broad price trends described by the three most commonly used price indicators (the GDP deflator, the private consumption deflator and the HICP) could be expected to be rather similar over the medium term, despite differences in coverage and statistical methodology. Indeed, the data examined in the chapter on inflation developments (Section III.2.3) shows that, for most euro-area countries, these price indicators have followed each other rather closely since the

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1 See for example Faini (2006) and the references therein.

2 However, it is worth noting that if the analysis were carried out with long-term interest rates, none of the findings reported next in this section would be altered in a significant way, as over the time period considered both short and long term interest rates showed similar trend movements.

3 The use of *ex post* real interest rates can be understood and justified as using "the *ex ante* rate adjusted by unpredictable short-term fluctuations in inflation" (ECB, 2003d, p. 39).

4 Note that when inflation is hit by a particularly sharp transitory shock, larger distortions could also arise even at short time horizons,. A case where this problem seems less relevant is with averages over medium to long-term periods, as shocks to inflation tend to cancel each other out over time and also, from a conceptual perspective, since its seems implausible to assume that economic agents make systematic errors in predicting inflation for prolonged periods of time (over the medium-term systematic errors in inflation expectation would tend to be negligible).

5 On the persistence of inflation in the euro area, see the wealth of recent research produced by the "Inflation persistence network (IPN)" of the Eurosystem. The results of this extensive research are summarised in Altissimo, Ehrmann and Smets (2006).

6 In other words, the current realised level of inflation is assumed to be a good estimate of the inflation rate expected for the next period. See also Lane (2006), who makes a similar argument.

early 1990s. This means that real interest rates derived using any one of these price indicators should indicate broadly the same evolution over time, although not necessarily identical levels at any given point in time.

Given that the picture in terms of price developments and inflation dispersion is fairly close across the three indicators considered, this section focuses on real interest rates deflated using the HICP. This price indicator is chosen as it has the advantage of being the most comparable price measure in the EU, thus minimising the possible differences in inflation developments among countries due to cross-country variation in statistical methodology. Note also that, in addition to being an indicator that sums up all inflationary price developments in the economy, a consumer price index is also the best known price measure among private economic agents and, consequently, also the price indicator most often referred to in national nominal contracts (in product, labour and financial markets). Moreover, from a theoretical perspective, a CPI inflation indicator would be appropriate, as it is ultimately consumer welfare that concerns policy making. Nonetheless, it may be also argued that that for looking specifically at firms, a producer price index (PPI) could be appropriate, as this indicator may better reflect entrepreneurial decisions.

For *ex ante* real interest rates, the approach taken here is to use the inflation expectations reported by Consensus Economics. This firm reports, on a monthly basis, survey results for key macroeconomic variables from prominent forecasters in several countries. Typically these are commercial banks, investment banks, central banks, research institutes and international organisations. The surveys feature individual and consensus (average) forecasts for 9-15 key economic indicators for G-7 economies (United States, Japan, Germany, France, United Kingdom, Italy and Canada). For a larger set of countries, the surveys include consensus forecasts for 3-4 variables each (GDP growth, consumer price inflation, industrial production and current account balances). The forecasts are for annual figures for the current and following year. Data on inflation forecasts (for the consumer price index) from this source are available since the early 1990s for most euro-area countries (all except Greece and Luxembourg, while data for Greece is available only from 1993).

The annual figures for *ex ante* short-term real interest rates used here were computed by deflating the annual average of 3 month money market rates by the annual average of the inflation forecasts from Consensus Economics for the current year. Since data on inflation forecasts for the euro area as a whole are only available since 2002, area wide figures for previous years were constructed by aggregating the national forecasts using the historical HICP country weights. Developments in the resulting *ex ante* real interest rates are discussed below.

2.2 Developments in the run-up to the adoption of the euro

In the run-up to the creation of the euro area, substantial convergence towards lower real interest rates occurred, reflecting progress towards low and stable inflation and the vanishing currency risk premia. On an ex-post basis, real short-term interest rates for the area as a whole declined by some 300 basis points (basis points) from around 6% in the early 1990s to somewhat below 3% in 1998. On an ex-ante basis the decline was somewhat more pronounced, the area average real short-term interest rate fell by roughly 400 basis points, from close to 7% in the early 1990s to about 2½% in 1998. One year later, real interest rates, both *ex post* and *ex ante*, fell further to around 2%. Hence, at the beginning of the third stage of EMU, real short-term interest rates were in general at the lowest level of the decade. In fact, real interest rates stood in 1998 at a lower level than the average of the preceding seven years for all Member States, except Greece.[7] This can be seen as an important early feature of the efforts made to meet the Maastricht convergence criteria in order to participate in the third stage of EMU.

Indeed, among the important explanations for the observed convergence towards lower real interest rates in the run-up to the third stage of EMU is the increased credibility attached by markets to the commitment of Member States to a sustainable low inflation and irrevocably fixed exchange rate regime implied by participation in the monetary union. That is, the convergence was driven by the anticipation of the introduction of the single currency and the corresponding gradual elimination of intra-euro-area exchange rate risk premia. This convergence process was also helped by the substantial fiscal consolidation observed during the same time period.

Three further aspects about developments in real short-term interest rates during this period are worth noting. Firstly, it is also the case that this convergence took place with interest rates falling proportionally more in some of the countries that previously had high interest rates (Graph 1). Proportionally smaller declines were observed in countries that had a history of relatively low interest rates, perhaps linked to their respective track record of inflation performance. For example, the average decline in Spain, Ireland and Finland – economies that had among the highest real interest rates at the beginning of the 1990s – was around 480 basis points for *ex post* short-term rates and around 500 basis points for *ex ante* rates. For Germany, France and Austria – countries that had relatively low real interest rates at the beginning of the previous decade – the decline in short term rates was close to 300 basis points on an *ex post* basis and nearly 350 basis points on an *ex ante* basis. These figures suggest considerable differences in the monetary impetus on demand across Member States from the convergence process in the run-up to the third stage of EMU.

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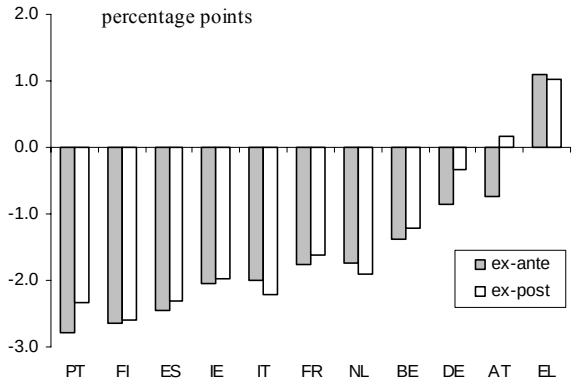
7 The experience of the latter country should be viewed in relation to its late entry into the euro area, on 1 January 2001.

Graph 1: Initial real interest rates - (1998 vis-à-vis historical average 1991-1998)



Note: For EL, inflation expectations data are only available since 1993.

Source: Commission Services, Consensus Economics and own calculations

Secondly, over the decade of the 1990s the relative positions of Member States in terms of real interest rates changed markedly. At the beginning of the third stage of EMU, Spain, Ireland, the Netherlands, Portugal and Finland had clearly below-average real interest rates (both *ex ante* and *ex post*). In contrast, in 1998, Germany, France and Austria had the highest real interest rates.

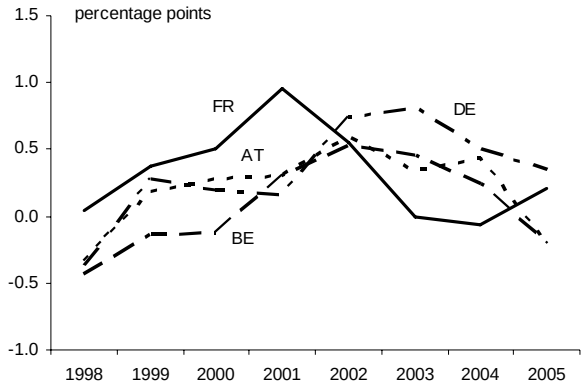
Finally, the data used here suggests that measures of real interest rate dispersion declined only since the mid-1990s and by similar magnitudes for both *ex post* and *ex ante* rates. The spread between the Member State with the highest and lowest real interest rates fell from around 10 percentage points in 1994 to 7½ percentage points in 1998, while the standard deviation declined from around 3 percentage points in 1994 to close to 2 percentage points in 1998.

2.3 Real interest rates in the euro-area years

Turning to the developments since the creation of the euro area, the forces at play in the run-up period still seemed to be present to a certain extent. While real interest rates generally continued to decline across the board, some of the differences in the sharpness of the adjustment, which were apparent in the run-up period, continued after 1999. In particular, the largest declines in both ex-post and ex-ante short term real interest rates during the first seven years of the euro area were experienced in Greece, Ireland and Spain. More generally, as a result of the continuation of the downward trend, real interest rates in the euro area have reached values that are very low from an historical perspective.

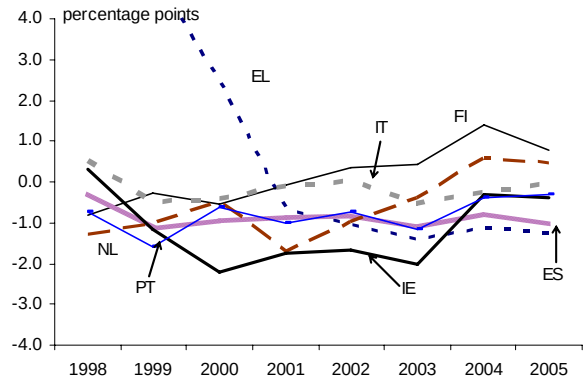
In terms of their *relative positions* compared to the euro-area average, two groups of countries can be distinguished. A first group of four countries, which includes Germany, Austria, France and Belgium, registered mostly above-average real interest rates during the past seven years (Graph 2). A second larger group made up of mostly small counties, Ireland, Portugal, the Netherlands, and Greece, but also including Spain and Italy, recorded mostly below-average real interest rates (Graph 3). Of these countries, the Netherlands shifted to above-average short-term real interest rates since 2004. Finland is a country, which entered monetary union with below-average short-term interest rates and which began registering above-average real interest rates after three years of membership in the euro area.

Graph 2: Short-term real interest rates relative to the euro area (Member States mostly above the euro-area average in 1998-2003)



Source: Commission Services, Consensus Economics and own calculations

Graph 3: Short-term real interest rates relative to the euro area (Member States mostly below the euro-area average in 1998-2003)

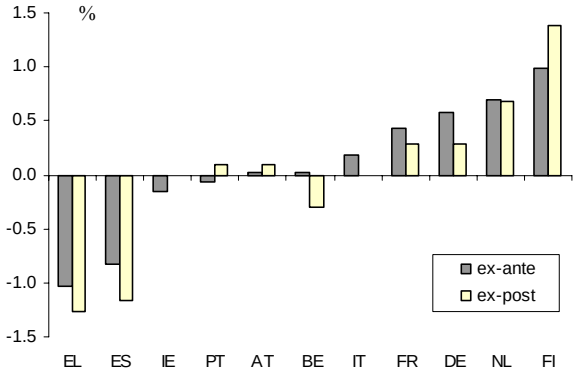


Note: For EL, the value for the short-term interest rate differential is 6.3 percentage points for 1998 and 5.1 percentage points for 1999.

Source: Commission Services, Consensus Economics and own calculations

The real interest rates observed in 2005, the last full year for which data are available, are shown in Graph 4. Comparing across Member States, the highest rates are found in Finland, the Netherlands, Germany and France. The lowest rates are found in Greece, Spain, Ireland and Portugal, where *ex ante* real interest rates are negative. Considered against the background of the divergent growth performance over the last few years, the developments highlighted here suggest that differences in real interest rates might indeed be closely associated with cyclical differences between euro-area Member States.

Graph 4: Real short-term interest rates in 2005



Source: Commission Services, Consensus Economics and own calculations

However, the graph also shows that using an explicitly forward-looking approach to compute real interest rates yields less dispersion than using an ex-post approach. Indeed, both the standard deviation and the spread between the Member State with the highest and lowest real interest rates have been lower every year since 1999 for *ex ante* rates. In addition, the decline in average dispersion between the periods prior and following the start of the third stage of EMU was more marked for *ex ante* real interest rates. The greater dispersion of *ex post* real interest rates suggests that the extent of the possibly destabilising effect of the real interest rate channel would tend to be overestimated by studies relying only on *ex post* measures.

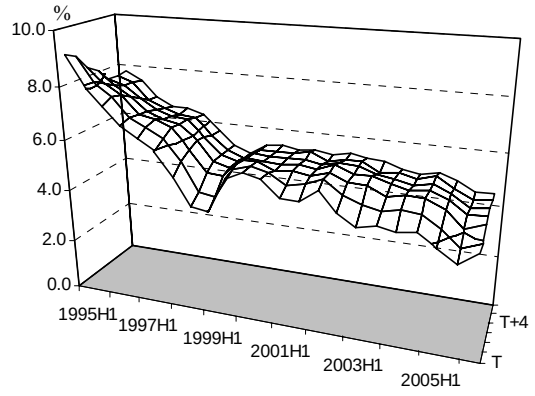
A measurement issue in the context of analysing the real interest rate channel in the adjustment dynamics within a monetary union is whether one should look at developments in the short- or in the long-term rates.[8] Since the real interest rate can also be interpreted as the inter-temporal price of a given consumption basket, changes in short-term rates may also give rise to some adjustments in consumption/saving behaviour in the short-run. Conceptually, however, it is often argued that long-term interest rates are those that would matter most for investment decisions, since such decisions are generally taken for projects realized over a medium- or long-term horizon. Accordingly, we turn our attention next to developments in long-term interest rates.

Like in the case of short-term rates, some data are available for two components of ex-ante long-term interest rates: expectations for long-term interest rates and for consumer prices. The source used here is again Consensus

[8] Indeed, a further complication here is that, in principle, short- and long-term interest rates are linked via forward-looking expectations (for instance, according to the so called expectations hypothesis of the term structure).

Economics, which provides two data points each year for the largest euro-area economies and the euro area as a whole. Graph 5 displays expected average euro-area long-term interest rates at different horizons. The graph indicates that, alike for short-term maturities, the expected long-term rate has substantially declined since the mid-1990s reflecting interest rate convergence towards the levels prevailing in the economies with the largest degrees of price stability. Since the start of the third stage of EMU, the expected euro-area long-term interest rate has remained in a relatively narrow interval by historical standards reflecting the credibility of the price-stability oriented policy framework.

Graph 5: Expected long-term interest rates in the euro area for different time horizons[1]



Note: Time horizons are: 1, 2, 3, 4, 5, and 6-10 years. Calculated from Consensus Forecast data for five countries using relative HICP weights of the reporting years.

Source: Consensus Economics and own calculations

The relatively flat development of the expected long-term average interest rate hides some of the differences that can be found in the data on national expectations. Table 1 summarises the average differences between expectations in Germany and in the other euro-area countries for which data are available. The spreads appear to be relatively small and about of the same size as spreads between government bond yields. This interpretation is supported by the range of spreads that have been observed over time. For instance they show that the long-term rate expected by Spanish respondents was resulting in a positive average spread vis-à-vis German rates at all maturities, but that also for all maturities (except at the short-term) there were time periods in which Spanish yield expectations were below German expectations.

Table 1: Average expected yield spreads vis-à-vis Germany at different time horizons (in basis points)

	Time horizon (years)						
	T	**T+1**	**T+2**	**T+3**	**T+4**	**T+5**	**[T+6;T+10]**
1999-2006							
Spain	13 [0; 40]	11 [-10; 30]	13 [-30; 60]	9 [-40; 50]	14 [-60; 90]	21 [-50; 90]	21 [-30; 80]
France	9 [0; 20]	5 [-20; 20]	-8 [-50; 40]	-15 [-50; 30]	-8 [-70; 40]	-13 [-60; 40]	-15 [-60; 40]
Italy	18 [0; 30]	13 [0; 30]	10 [-50; 70]	3 [-40; 50]	-9 [-60; 40]	-16 [-80; 60]	-14 [-60; 50]
The Netherlands	8 [0; 20]	7 [-20; 30]	-2 [-70; 70]	-5 [-40; 40]	-5 [-90; 60]	-2 [-60; 60]	2 [-40; 60]

Note: Minimum and maximum spreads in square brackets. A negative figure indicates that citizens expected a lower interest rate than German recipients expected for Germany.

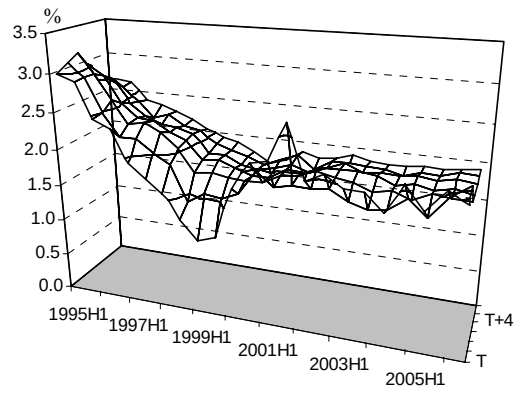
Source: Consensus Economics and own calculations

These findings for the nominal interest rate element in the calculation of real rates suggest that expectations with respect to long-term interest rates do not constitute a strong reason to reject persistent ex-ante real interest rate differentials. In that regard, the results for medium-to-long term expectations are in line with the findings for short-term interest rates, where an area wide nominal interest rate has emerged.

The second part of the analysis of long-term expectations of real interest rates has to deal with consumer price expectations. Data for different horizons are available for the four largest euro-area economies and the Netherlands. Graph 6 displays the development of the euro-area average calculated on national data. The decline in expected inflation rates until the late 1990s confirms the convergence towards area-wide price stability. The stickiness of

inflation expectations around two percent for all horizons reflects the credibility of the stability-oriented policy framework, particularly the credibility of the European Central Bank. Noteworthy in this regard are developments during the second half of 2001, when perceptions of the euro cash change-over resulted in upward adjustment of inflation expectations. As regards the horizon of expectations there have been only relatively small differences compared to the experience in the second half of the 1990s.

Graph 6: Expected euro-area inflation for different time horizons



Note: Inflation expectations over 1, 2, 3, 4, 5, and 6-10 years. Calculated from Consensus Forecasts data for five countries, using their relative HICP weights of the reporting years.

Source: Consensus Economics and own calculations

As in the case of long-term interest rate expectations, the euro-area average long-term inflation expectations hide national expectations that might differ. Table 2 summarises differences between expectations of consumer price inflation in the Member States and the euro-area average for different horizons. The figures suggest that French and German respondents had lower inflation expectations than the euro-area average at all horizons, whereas respondents in Spain and the Netherlands expected at all horizons a relatively high rate of consumer price inflation in their country (the range of differences is again displayed in brackets).

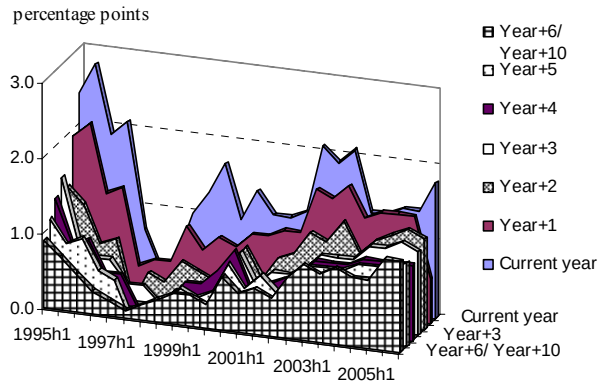
Table 2: Average expected inflation differentials

	Time horizon (years)						
1999-2006	**T**	**T+1**	**T+2**	**T+3**	**T+4**	**T+5**	**[T+6;T+10]**
Germany	-0.40 [-0.95; -0.08]	-0.26 [-0.65; 0.20]	-0.17 [-0.37; 0.14]	-0.14 [-0.36; 0.13]	-0.14 [-0.30; 0.06]	-0.14 [-0.39; 0.05]	-0.14 [-0.39; 0.07]
Spain	1.07 [0.78; 1.45]	0.86 [0.58; 1.17]	0.70 [0.37; 0.98]	0.62 [0.31; 0.85]	0.61 [0.36; 0.75]	0.60 [0.32; 0.76]	0.61 [0.24; 0.84]
France	-0.34 [-0.98; 0.10]	-0.28 [-0.54; -0.04]	-0.18 [-0.35; -0.02]	-0.16 [-0.33; 0.04]	-0.11 [-0.24; 0.02]	-0.14 [-0.35; 0.00]	-0.13 [-0.33; 0.04]
Italy	0.30 [0.01; 0.75]	0.14 [-0.20; 0.45]	0.01 [-0.26; 0.28]	0.00 [-0.17; 0.19]	-0.04 [-0.26; 0.16]	-0.03 [-0.28; 0.21]	-0.03 [-0.27; 0.21]
The Netherlands	0.46 [-0.80; -1.92]	0.30 [-0.63; 1.46]	0.17 [-0.33; 0.67]	0.15 [-0.26; 0.60]	0.17 [-0.30; 0.46]	0.23 [-0.20; 0.62]	0.16 [-0.16; 0.50]

Note: Figures in brackets show minimum and maximum differentials.
Source: Consensus Economics and own calculations

Significant differences in the euro-area aggregate terms of inflation expectations at all horizons result in larger inflation differentials between countries with above and below average expectations, such as for instance Germany and Spain. Against the background of rather similar expectations of long-term interest rates, the responses suggest that there are non-negligible differences in (expected) real interest rates at all horizons. Graph 7 displays the expected real interest rate differential between Germany and Spain.

Graph 7: Expected real interest-rate differential, Spain and Germany



Source: Consensus Economics and own calculations

The increasing sizes of the slices show that the expected real interest rate differential is larger for short horizons, suggesting that at short horizons *ex post* real interest rates might be quite similar to *ex ante* real interest rates, whereas at longer horizons ex-post real interest rates exceed ex-ante rates.[9] For longer-term horizons the expected differential is relatively small but it has increased to about one full percentage point (or 100 basis points) during the first seven euro-area years. This steady increase had been hidden behind the more moderate averages in tables 1 and 2. The V-shape of all slices indicates that convergence of long-term inflation expectations was only observed in the run-up to the third stage of EMU. For the more recent period the data suggest a substantial permanent real interest rate differential at all horizons. The argument that long-term inflation expectations converge towards the upper limit in the ECB´s definition of price stability does not receive strong support from these findings.

3. The role of real interest rates in a monetary union

Real interest rates provide the link between the financial sector and economic activity, as mentioned in Section 2, via their impact on investment and consumption decisions of economic agents. This role might explain the large number of studies on real interest rates (for overviews see Bliss, 1999, Deutsche Bundesbank, 2001), their development over time (e.g. Driffill and Snell, 2003) and their impact on macroeconomic developments (see Taylor, 1999). Many studies have dealt with time series properties of real rates or with cross-country real interest rate linkages, particularly with cross-country real interest rate equalisation.

In principle all results that are obtained for closed or large open economies are also valid for a monetary union as a whole, i.e. a group of regions or countries with a single currency. In particular the role of real interest rates as a brake on cyclical developments remains intact. In an advanced cyclical position with above average inflation and/or inflation expectations, the monetary authority of the monetary union can lower demand by raising nominal rates and, with given inflation expectations, thereby also raise the real interest rate.

In a monetary union the monetary authority sets policy interest rates for the union as a whole and this implies that regional developments will necessarily have a smaller impact on area-wide decisions than they could have had on region-specific policy decisions (outside a monetary union). By tailoring monetary policy towards the needs of the whole entity ("one size fits all") there may be regions for which it looks as if a region-specific policy decision is more appropriate. The measure that is often used to assess the appropriateness of union-wide policy for regional economies is benchmark interest rates. Real interest rates are among the most often used benchmark variables. Heterogeneous developments in prices across regions result in differences between regional real interest rates that might not be in line with the warranted stance of monetary policy from the regional viewpoint.

A region in an advanced cyclical position or a country that has been subject to a positive demand shock might have witnessed or might expect an above-average inflation rate and would therefore have a lower-than expected real interest rate. With a lower real interest rate more investment projects would be profitable and the higher investment-GDP ratio would increase the capital stock and potential output. The additional demand induced by relatively low real interest rates could be expected to push demand further and to add to the divergence within the monetary union unless other channels are counteracting and/or other policy instruments are used to offset the impact. With reference to possible cyclical causes the real interest rate channel has been described as pro-cyclical and the overall effect has been assessed as possibly destabilising. It has been argued that the destabilising effect could also originate from heterogeneous structures that result in inflation differentials.

The description of the real interest rate channel as seen within a monetary union has a fairly wide relevance as it could be applied to all countries, particularly to those that have some federal structures with economic policy decisions at different levels of government.[10] However, it has attracted most attention from large monetary unions

[9] The ECB reports similar results based on short- and long-term *ex ante* and *ex post* real interest rates. See ECB (2004c), p. 34, and ECB (2000b), p. 69.

[10] The core of the real-interest rate argument can be seen as an equivalent to Wicksell's destabilising real interest rate response (Wicksell, 1907), which he found while examining the feasibility of a nominal interest rate peg where he noted the inherent instability in the face of inflationary

like the United States and the euro area. For the latter the more recent experience of national, though not necessarily independent monetary policy might have played a role.

An increase in inflation (expectations) lowers real interest rates and thereby raises the (real) wealth of households, in particular of houses. Increased wealth is a determinant of consumption growth. Thus, lower real interest rates provide an impulse to demand via the wealth effect, adding to the direct effect on expenditure decisions of households and firms.

The role of real interest rates in economic theory is forward looking, i.e. economic agents are expected to decide on the basis of expected developments. The time horizon of such expectations is linked to the type of decision. For instance, for an investment project a firm is assumed to take into account the expected real interest rate for the full time until the end of the project. Also households are usually assumed to base their decisions on consumer durables on multi-year expectations. The emphasis on the medium- to long-term implies that short-term inflation developments and past inflation patterns can be expected to have a minor role. This is reflected in the fact that real interest rates are generally understood as an *ex ante* variable.

Economic theory assumes that households and firms form their inflation expectations on the area that matters to them. For a household considering the purchase of a house this might be a regional area, for a firm that operates only nationally it might be the domestic economy and for an export-oriented firm it might be even a broader regional coverage. Therefore different real interest rates (region, country, monetary union) could be relevant for economic decisions. The distinction of regional, national and area-wide real interest rates is only relevant, however, as long as different inflation rates are expected for the regions and/or countries. In the short to medium term, inflation differences might persist for a number of reasons (e.g. changes in indirect taxes and administered prices, idiosyncratic shocks). In the long term, inflation differences might shrink as catching-up factors decline in importance, business cycles become more synchronised and financial integration decreases the role of national financing. This suggests that over time the role of regional and/or national real interest rates will become less and less important within a monetary union.

The two main channels of monetary policy transmission are the exchange rate channel and the interest rate channel. While nominal exchange and interest rates are the same for all citizens within a currency area, real exchange and interest rates may differ across regions thereby reflecting differences in the (price) deflator. Both real rates matter for adjustment within a monetary union, but they work quite differently. While the real interest rate channel may enforce divergent developments, the competitiveness channel supports adjustment as overheated economies face a deterioration of relative competitiveness slowing activity.

The aforementioned channels of monetary transmission and channels of adjustment are related to a monetary union. The situation can be expected to differ during a transition period after such a monetary union has been established. As regards adjustment channels, a young monetary union might still be subject to ongoing convergence processes that overshadow the regular adjustment mechanism. For instance, a substantial improvement in terms of price stability can come along with substantially lower nominal interest rates. Despite lower inflation rates this could result in a substantial decline in *ex post*- and *ex ante*- real interest rates, whereas countries that had smaller gains in terms of price stability would not face any substantial change in real interest rates. Therefore even identical real interest rates in these countries may have different effects on macroeconomic developments. This effect, however, is an initial one-off effect that is particularly relevant in the run-up to monetary union and the first years of its existence. As regards monetary transmission, initial differences across economies within a monetary union can be expected to remain relevant for some time, but to lose importance as integration progresses.

All in all, the role of national real interest rates in the regions and countries in a monetary union can be expected to be substantially smaller than for countries outside. Deviations might still exist in a newly created union, but enhanced economic and financial integration will reduce such deviations over time.

4. Real interest-rate differentials in the euro area and their causes

The presentation of measurement issues related to the calculation of real interest rates has already hinted on factors behind real interest rate differentials. While several factors could be considered as playing a role (e.g. transaction costs)[11], inflation differentials appear to be the key driver of reported real rate differentials. This section starts with a closer look to inflation differentials in order to assess whether their causes can be expected to matter for the functioning of the real interest rate channel (Section 4.1) and whether their persistence also reasonably characterises real rate differentials (Section 4.2). The remainder of the section looks at commonly used equilibrium concepts for real rates and for inflation rates and asks about their link to actual developments in the euro area (Section 4.3).

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shocks. With fixed nominal interest rates, an increase in inflation would cause real interest rates to fall, boosting demand, pushing up prices, and in turn causing real interest rates to fall further, and so on. He found that this mechanism will apply to economies facing deflation shocks when they have zero nominal interest rates and are constrained from cutting interest rates by the liquidity trap.

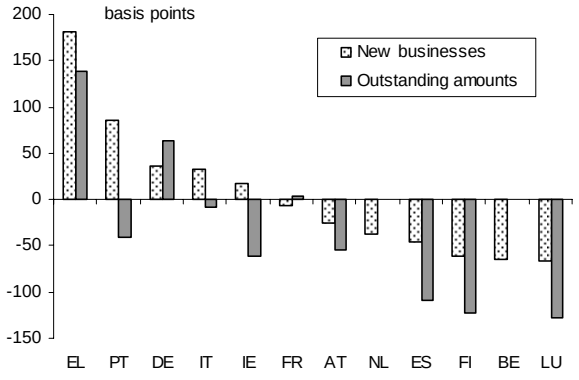
11 Transaction costs have been shown to be too small to account for real interest rate differentials (Al-Awad and Grennes, 2002).

4.1 Components of real interest-rate differentials

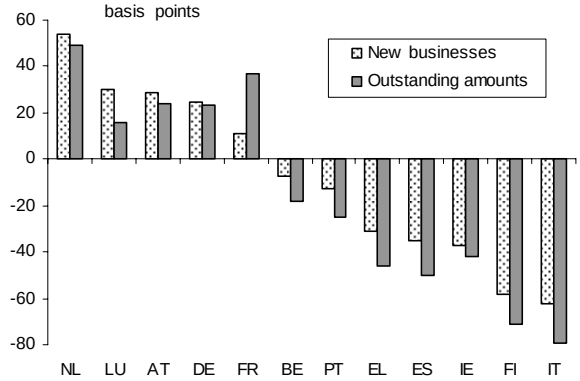
Real interest rates in the euro area have two components, a nominal interest rate and a term for the inflation expectations. In the short term the nominal market interest rate will be very close to the policy interest rate of the ECB (minimum bid rate of the main refinancing operations) and thus be almost identical in all euro-area economies. In the long term, (nominal) interest rates on similar assets can be expected to be similar across countries as is visible in long-term government bond yields. For some retail interest rates, however, there is evidence of differences across euro-area Member States (see ECB, 2006). Aggregate loan and deposit rates for new businesses and for outstanding amounts vary significantly and persistently across countries (see Graph 8). Such persistent nominal interest rate differentials matter for the calculation of real interest rate levels. Lending rates in Greece, Portugal and Italy exceed the euro-area average resulting in real interest rates that exceed those calculated on the basis of identical nominal euro-area interest rates. However, the pattern of differences does not coincide with that of the real interest rates presented in Section 2 as for instance Germany, a country with a relatively high real interest rate, exhibits above-average lending rates.

Graph 8: Nominal interest-rate differentials, loan and deposit rates (January 2003-May 2006)

a) Average lending rates



b) Average deposit rates

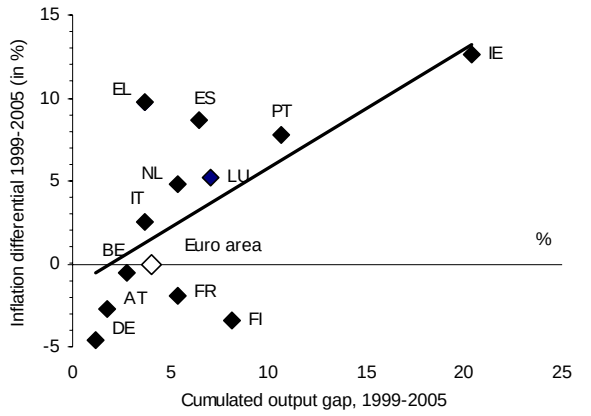


Source: ECB (2006), p. 14; own calculations

The size of nominal interest rate differentials, in particular those observed for deposit rates, is small compared to the size of real interest rate differentials. Having said this, it is obvious that most of the differences across countries relate to the inflation (expectations) component and thus to inflation differentials. As argued before, although inflation expectations are the more relevant ingredient to the calculation of real rates, for practical reasons very often ex-post inflation rates have been used for the calculation of real interest rates and this sheds light on observed inflation differentials across euro-area economies.

The latter have been the focus of empirical analysis since the start of the third stage of EMU. Differentials were initially (and are still sometimes) described as being similar to those in other monetary unions such as the United States (see Section 6.2). More recent contributions have reiterated this finding only with respect to the size of differentials but emphasised the much stronger persistence of deviations from the area-wide average. Euro-area countries with above average inflation in one period tended to exhibit the same type of deviation in subsequent years and vice versa. This observation has raised questions about the reasons and also about the impact (and possible policy implications). As a part of the latter, national real (*ex post*) interest rates attracted attention as they reflect euro-area inflation differentials.

Graph 9: Inflation differentials and cyclical conditions



Note: Figures for Greece are for the period of its participation in the third stage of EMU (2001-2005).

Source: Commission Services

- *Cyclical determinants.* The main line of reasoning in the real-interest argument rests on the assumption of a link between cyclically advanced positions and the occurrence of inflationary pressures. This means that inflation differentials across euro-area economies would reflect differences in output gaps, i.e. the difference between actual and potential output. The results, shown in Graph 9, suggest a positive relationship between the cumulated output gap and the (multi-year) inflation differential. Indeed for most countries the size of the inflation differential seems to be broadly in line with their cyclical position, i.e. countries with relatively large positive output gaps had above-average inflation.[12] However, at the same time it has to be acknowledged that in the short-term factors other than cyclical conditions played an important role for inflation differentials.[13]
- *Policy-induced determinants (e.g. indirect taxes and administered prices).* Some of the divergence of inflation rates can be attributed to national policies. Among the examples are the VAT and energy tax increases in the Netherlands in 2001 that are estimated to have raised the inflation rate by about one full percentage point. Such increases in indirect taxes should only exert a temporary effect unless wage indexation schemes keep the effect alive. Thus, the decline in (*ex post*) real interest rates will also be of temporary nature and it appears questionable whether such a temporary decline will strongly affect decision making by households and firms.
- *Structural causes.* Euro-area Member States differ in terms of the economic, financial and institutional characteristics and these differences are related to inflation rate differentials and thereby to real interest rate differentials. For instance, the oil (or more generally energy) intensity of production varies across countries and so does the share of energy consumption on total expenditures (as is also visible in HICP weights). Different exposure to exchange rate moves results in different responses to large changes in the external value of the euro. Honohan and Lane (2003) found for the first three euro-area years (1999-2001) that much of euro-area differentials are attributable to the differential impact of exchange rate movements. In particular in the case of Ireland the euro depreciation in 1999 and 2000 had resulted in a larger inflationary impulse than in other countries reflecting Ireland's distinctive trade pattern. The level of economic integration can also play a role if Member States entered the euro area with different price levels. As integration proceeds price levels will converge and the accompanying increase in the rate of price changes will lower (*ex post*) real interest rates.

Inflation differentials caused by policy actions or structural differences affect (*ex post*) real interest rates, but they raise doubts as to what extent resulting real rate differences affect the decisions of economic agents as structural factors may become less important over time and policy measures might have a one-off impact on inflation.

Euro-area figures suggest that at least the HICP figures are strongly affected by non-cyclical factors such as changes in indirect taxes, administered prices on the domestic side and oil and other commodity prices on the external side. Moreover, the services sector is found to have contributed over-proportionally. These findings put a question mark behind the idea that there has been a clear link between above-average inflation rates and the cyclical position and in turn this means that above-average inflation rates were not only observed in strongly growing countries.

All in all, a closer look to the reasons for inflation differentials across euro-area countries suggests that it is rather unlikely that all discrepancies between national inflation rates (and inflation expectations) are caused by the same factors or that common factors will dominate in the near future.

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12 This finding is in line with the results of empirical studies reported by the ECB (2003d, pp. 35-39). Canzoneri et al. (2006) find that inflation differentials are positively correlated with growth differentials.

13 Another approach to the analysis of real interest rates could relate output gaps and real interest rates, but due to the area-wide nominal interest rate results should qualitatively be similar. For the US the cyclical properties of real interest rates have been analysed in that way. Dotsey, Lantz and Scholl (2003) find that the real interest rate is contemporaneously positively correlated with GDP and with lagged cyclical output. They also present evidence that high real rates are associated with strong cyclical output one quarter into the future.

Box: The role of services inflation in euro-area inflation differentials

By historical standards or in comparison to other monetary unions or regions within countries, euro-area inflation dispersion does not appear to be large. What is remarkable, however, is that, since 1999, a majority of euro-area Member States have recorded either persistently positive, or persistently negative, inflation differentials vis-à-vis the euro-area average. Taking a closer look, it can be seen that, since 1999, it is the core inflation sectors, and in particular services, that have contributed most to euro-area inflation dispersion.

Services inflation has a large impact on inflation developments in the euro area, both due to its large weight in the HICP basket (over 40% for the euro area) and the typically higher inflation rate in services than in goods. Since January 1999, euro-area services inflation has averaged 2.3% compared to 0.7% for non-energy industrial goods. In a number of Member States, high inflation rates are recorded in particular in financial services, transport services, health services, recreational services and housing services. Services inflation above 2% has been a feature of most Member States since the introduction of the euro.

Higher inflation in services than in goods is to an extent to be expected due to the higher labour intensity in production (and typically lower productivity growth) and limited international competition, reflecting the low degree of tradability of many services. Apart from this, sectoral and country-level analysis highlights a number of factors contributing to high inflation in services in euro-area Member States. These include notably long-term demand shifts towards services consumption, related to real convergence and to changes in life styles (particularly evident in recreational services). In some Member States, Balassa-Samuelson effects are also likely to have contributed to higher inflation in the non-tradable sector.

Table B1: Inflation in the five main HICP categories, 1999:01-2006:07 (average annual change in %)

Item	**BE**	**DE**	**EL**	**ES**	**FR**	**IE**	**IT**
Services	2.1	1.3	3.7	3.8	2.1	5.0	2.7
Non-energy industrial goods	0.9	0.1	2.0	1.6	0.4	0.0	1.6
Processed food including alcohol and tobacco	1.8	2.0	4.0	3.3	2.8	3.7	2.3
Energy	5.6	6.6	6.0	5.2	4.3	6.5	4.3
Unprocessed food	2.1	0.7	2.7	4.0	2.1	2.0	2.5
Item weight in 2006 (%)	**LU**	**NL**	**AT**	**PT**	**FI**	**EA**	Euro area
Services	2.7	3.1	2.2	4.0	2.5	2.3	39.8
Non-energy industrial goods	1.1	0.9	0.3	1.6	0.3	0.7	31.7
Processed food including alcohol and tobacco	3.8	1.9	1.6	2.7	0.7	2.4	12.1
Energy	7.2	7.6	4.5	5.0	4.7	5.5	8.6
Unprocessed food	2.7	2.0	1.5	2.3	1.3	2.2	7.8

Source: Commission Services

Temporary shocks such as increases in oil prices tend to affect services inflation in all countries, in particular via higher transport and housing services. Services prices also tend to be influenced by changes in administered prices, sometimes linked to policy reforms (for instance the health care reforms carried out in a number of Member States in recent years). Barring second-round effects, the impact of a rise in administered prices on inflation is in principle temporary. Beyond these benign or temporary factors, however, high services inflation also reflects shortcomings in market functioning (notably inefficiencies in regulation and lack of competition), that call for policy responses. In most Member States there are services sectors (not necessarily the same in all Member States) that operate in a regulatory environment not conducive to low inflation. Some examples are: professional services, where entry barriers and price regulations put upward pressure on prices; wholesale and retail trade, where factors partly related to non-economic considerations, such as shop-opening hours, zoning restrictions and restrictive labour regulation put a brake on productivity growth and competition; retail financial services, where EU integration is less advanced than in the wholesale financial sector and some domestic markets appear insufficiently competitive; and traditionally regulated sectors where the scope for liberalisation has not yet been exploited, such as railway transport or postal services.

The substantial declines in prices in the telecommunications sector demonstrate the success of the regulatory reform undertaken in the sector over the last decade, working together with a high rate of technological innovation. Even in this sector, however, there appears to be room for further enhancement of competition.

There seem to be four main areas of policy action to curb inflationary pressures in the services sector: i) stepping up efforts to implement EU single market initiatives like the Financial Services Action Plan; ii) removing regulatory distortions at state and local levels and increase competition, in particular, in sectors such as retail financial markets, network industries, retail trade, and professional services; iii) promoting wage flexibility, so as to better align wage developments with productivity growth; and iv) fostering the spread of new technologies, in particular ICT, would improve productivity in services sectors and thereby lower inflation.

4.2 Persistence of cross-country differences in real interest rates

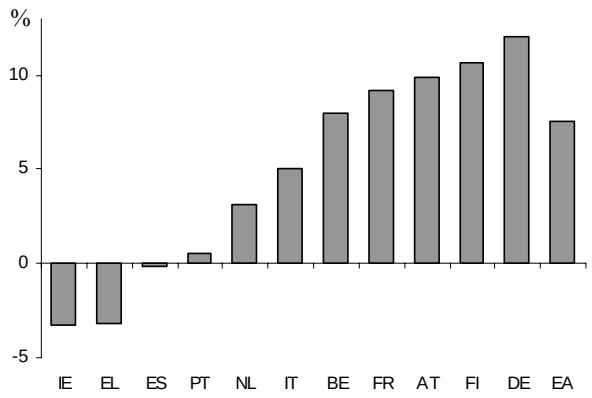
Inflation in the euro area has been found to be persistent. The Eurosytem's Inflation Persistence Network has evaluated some of the reasons (for a summary see Altissimo, Ehrmann and Smets, 2006). As regards the relevance of inflation differentials, Angeloni and Ehrmann (2004) conclude that inflation persistence is the single most relevant determinant of (persistent) differentials. By definition inflation persistence results in a more rigid development of real interest rates across euro-area economies. The correlation coefficients calculated for real interest rate differentials vis-à-vis the euro area in consecutive years (see Table 3) indicate such persistence of real rate differentials.

Table 3: Persistence of real interest-rate differentials - (correlation coefficients, annual data, 1995-2005)

Between … and the following year	1999	2000	2001	2002	2003	2004
All 12 countries	0.83	0.18	0.83	0.89	0.64	0.89
The largest 4 countries	0.97	0.96	0.94	0.92	0.87	0.92

Source: Own calculations

Graph 10: Cumulative real interest rates, 1999-2005



Note: For Greece the cumulative rate from 2001 to 2005 is shown.
Source: Commission Services

At the level of the Member States, the counterpart to high correlation coefficients can be seen in persistent country differentials. Countries with below-average real interest rates in one period can be expected to exhibit below-average rates again in the successive period. This persistence implies that the response to changes in the cyclical position can be expected to be limited. Without persistence one might have expected countries to have relatively similar multi-year real interest rates (accumulated interest rates). As Graph 10 suggests this persistence has resulted in substantial overall changes in real rates in the first seven years of the euro area. The seven-year rate of real return in Spain and Portugal has been close to zero and negative in Ireland and Greece, where the figure refers to its five-year period of euro-area participation. The accumulated return in Austria, Finland and Germany has been at or above the ten percent level. The evidence found in favour of the hypothesis of the persistence of real interest rates suggests that differentials are only to a limited extent reflecting cyclical developments. This could suggest that the pro-cyclicality of the real interest rate channel is limited by the persistence of real rates.

4.3 Implications of equilibrium concepts for real interest rates

At the level of the euro area, there has been substantial research on equilibrium real interest rates, i.e. rates at which inflation rates are stable and output grows in accordance with potential. As the trend growth rate may vary over time, the equilibrium real rate will also move. In the short run, however, interest rates will move around the neutral rate as economies are subject to economic shocks that create risks to price stability. In monetary policy analysis the equilibrium real interest rate plays an important role as an element of the estimation of Taylor rates. Thus the estimates of an equilibrium or natural rate of interest have often been used for assessing the stance of monetary policy.

Several determinants of the equilibrium interest rate have been named in the economic literature. Among them are productivity and population growth, risk premia, fiscal policy, the time preference of consumers and the institutional set-up of financial markets (e.g. ECB, 2004a). These factors represent preferences, technology, demography and the institutional and macroeconomic policy framework and it is quite obvious that equilibrium rates might differ across euro-area countries. In addition, the list of factors strongly suggests that the equilibrium rate will change over time.

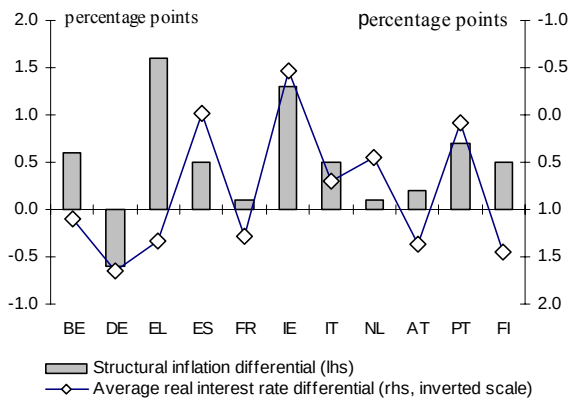
The role of the determinants of the equilibrium rate differs across euro-area countries suggesting the existence of different equilibrium rates. For the assessment of real interest rates this implies that the same real interest rate in two

countries can reflect different monetary and financial conditions for the countries (in terms of deviations from equilibrium real interest rates).

The argument on country-specific equilibrium real interest rates has a counterpart on the inflation side. Studies on structural factors of euro-area inflation rates often argued that there are good reasons for different inflation rates across euro-area economies. The different level of economic development was put to the fore claiming that such different equilibrium rates would have policy implications. The debate regularly leads to the call for a higher upper bound in the definition of price stability of the European Central Bank that would allow more advanced economies to derive a less strict "national" version of the definition of price stability. Several institutions (e.g. the IMF, the OECD) and academics (e.g. Sinn, De Grauwe) were among those arguing that the ECB definition bears deflationary risks for countries such as Germany.[14]

Studies of the Balassa-Samuelson hypothesis have produced estimates of inflation rates that would be implied by differences in national productivity trends (for an overview see ECB, 2003d, p. 32). Assuming that these estimates would be fully reflected in inflation expectations, different real interest rates across countries could result in long-lasting real interest rate differentials. Countries like Germany would be faced with long time spans with above-average real rates, while countries with a catching-up background such as Portugal and Greece would exhibit relatively low real interest rates. Graph 11 displays a comparison of the observed average annual real rate differential vis-à-vis the euro-area average (1999-2005) and the structural inflation differential vis-à-vis the euro-area average as implied by the average of estimates in selected studies on Balassa-Samuelson effects.

Graph 11: Real interest-rate differentials and structural inflation differentials [1]



Note: 1 - Average annual real interest rate differentials (1999-2005) calculated using ex-post short-term real interest rates. Structural inflation differentials are calculated using the average estimates on "equilibrium" inflation rates implied by Balassa-Samuelson effects as summarised in ECB (2003, p. 32).

Source: Commission Services

A comparison of both series indicates that in six of the eleven countries (no estimates were available for Luxembourg) the signs of the estimated structural inflation differential and the average real interest rates were the same and that for two more countries differences appeared to be rather small (France, Austria). In particular for Germany, Ireland and Portugal the structural inflation differentials and the observed real interest rate differentials almost coincided. These findings are compatible with the hypothesis that a non-negligible part of real interest rate differentials is related to structural factors and that the cyclical component contributes only partially to the explanation of real rate differentials. Empirical research has, however, raised doubts as sectoral price and productivity developments could not be reconciled with the Balassa-Samuelson hypothesis (e.g. Lopez-Salido, Restoy and Vallés, 2005).

Differences between actual and hypothetical real rate differentials could be explained by a number of reasons, particularly the weakness of the estimation method that is strongly backward oriented and rests on strong assumptions.

A number of different methods have been suggested for estimating an equilibrium real interest rate (for an overview see Lemmen, 2005). Most of these methods were first applied to US data:

- *Simple statistical approach.* The simplest approach is the calculation of trend real interest rates on the basis of historical data using standard econometric tools. This could for instance mean just averaging historical data (e.g. ECB, 2004b) or applying the Hodrick-Prescott filter. A problem closely related to this approach is the possible bias in times of substantial variation in output and inflation. In periods of falling inflation rates the approach tends to suggest that the real interest rate clearly exceeds the estimated equilibrium level.
- *Yield-spread based techniques.* Bomfim (2001) uses data from the yield curve of inflation-indexed government securities to derive the equilibrium real interest rate. In an earlier study (Bomfim, 1997) he had

[14] The ECB's mandate is to maintain area-wide price stability. At the ECB press conference on 8 June 2006, ECB President Trichet said: *"The difference between the average euro area inflation level and the national inflation level is the responsibility of the national authorities. Again, at the level of the Eurosystem we can only ensure price stability and the credibility of price stability over time for the euro area as a whole, and that is very important. And of course we call on the national authorities to be fully conscious of their responsibility vis-à-vis their inflation differential with the average."* But the ECB has also said to consider inflation differentials in its strategy, which *"attributes a secondary role to inflation differentials when calibrating the safety margin for admissible inflation in the euro area"* (ECB, 2003d, p.6)

used the Fed's MIP-Penn-SSRC model (MPS model) to estimate the equilibrium rate also emphasising the information that can be derived from yield spreads.

- *Time series models.* Several studies estimate equilibrium interest rates as an unobserved component in an IS equation relating the output gap to the difference between the real and the equilibrium real interest rate (e.g. Chen, 2001). Following the pioneering work by Laubach and Williams (2003) several studies have estimated simultaneously the trend output growth rate and the equilibrium rate by using a Kalman filter. The advantage of the method is that it strikes a compromise between a theoretically coherent dynamic stochastic general equilibrium model and ad-hoc statistical approaches.
- *Structural models.* The lack of structural foundations in the simple approaches and times series models can be overcome by constructing general equilibrium models on the basis of optimising behaviour of economic agents with nominal frictions. One of the advantages of the model is the ability to estimate time-varying equilibrium rates (see e.g. Giammarioli and Valla, 2003, and Smets and Wouters, 2003).

Table 4: Selected studies on equilibrium real interest rates in the euro area

Study	*Method*	*Result*
Giammarioli and Valla (2003)	Dynamic Stochastic General Equilibrium (DSGE) model	1973-2000: up to 6%; 1994-2000: 3.0-3.7; 2000: 2.75%.
Smets and Wouters (2003)	DSGE	-10% to +10%; 2000: about -2%.
Cuaresma et al. (2004)	Multivariate unobserved components model	1999-2002: slightly above 2%, Spring 2002: 1½-2%.
ECB (2004b)	Eclectic approach	Recent years: 2-3%.
Gerdesmeier and Roffia (2004)	Averaging with correction for the effects of specific shocks	1985-2002: 2.1-3.3%; 1993-2002: 1.8-2.9%.
Manrique and Marqués (2004)	Small scale macroeconomic model, Kalman filter	2001Q4: 2.5%.
Mésonnier and Renne (2004)	Laubach-Williams approach, Kalman filter	2002Q4: about 1%.
Amato (2005)	Latent variable model	
Browne and Everett (2005)	CCAPM estimates	2005Q1: about 1.5%.
Garnier and Wilhelmsen (2005)	Laubach-Williams methodology.	Gradual decline from 4% in the 1960s to slightly less than 2% in 2004.
Lemmen (2005)	Forward yield estimates of the level of the equilibrium real interest rate	April 2005: 2.1%.
Wintr, Guarda and Rouabah (2005)	Kalman filter	2004: close to 0.5%.
Catão and Mackenzie (2006)	Calculations mainly based on price-earning ratios.	2005: estimates for all euro-area countries except LU imply an arithmetic average of 2.9%.
Cour-Thimann, Pilegaard and Stracca (2006)	Extended Laubach-Williams approach based on the definition of the natural rate as the (unobservable) component of the real interest rate.	Significant fluctuation between about -1% in the 1970s and about 5% in the early 1990s, about 1½% in 2003.

Source: Aforementioned studies and Cuaresma et al. (2004), pp. 42-43.

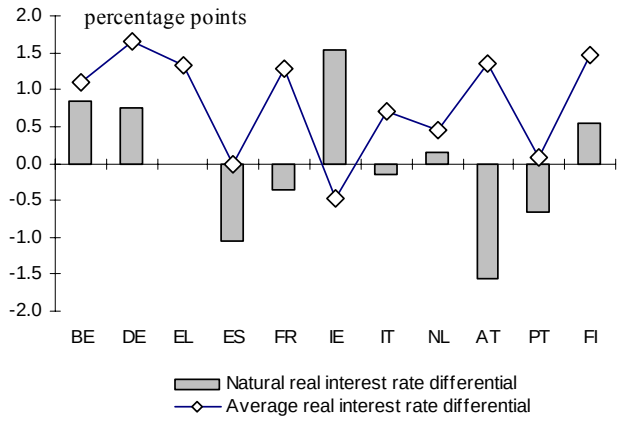
For the US, empirical studies suggest that equilibrium real interest rates have varied considerably over time. For example, Laubach and Williams (2003) found a decline from 4.5% in the mid-1960s to 2.5% in the mid-1970s. Wu (2005) reports on estimates of about 2% in the 1960s to about 6% in the early 1980s and 3% in the mid-1990s. Moreover, estimates vary considerably across studies, which can be partly related to difficulties in estimating the

output gap. For the latter the "one-sided filtering problem", i.e. the need to have only data up to today available for an estimate of today's output gap, has been shown to result in substantial revisions in later (two-sided) estimates. Data revisions and uncertainties about model specification add to these difficulties. A number of studies have also highlighted the difficulties in estimating the equilibrium real interest rate on the basis of contemporaneous data and concluded that such estimates would be difficult to use reliably in monetary policy making (e.g. Clark and Kozicki, 2005).

The US observations regarding the equilibrium rate in terms of variability over time and diversity across studies were shared by euro-area experience. The calculation of averages for the euro-area years until March 2004 results in an average short-term real interest rate of 1.4% in the euro area (ECB, 2004b, p. 62). By widening the observation period to 1994, the average rate moves up to 2.4%. This contrasts with a much higher rate for the period from 1981 to 1993 (5.2%) and a negative real rate of -0.7% in the period from 1973 to 1980. The ECB reports that other techniques resulted in equilibrium rates of between 2.1 and 3.2% using data from 1985 to 2002 (ECB 2004b, p. 65).

As for the US, the range of empirical estimates for the euro area can also be described as relatively wide (see below). However, almost all studies report a decline in euro-area equilibrium rates which is estimated for most recent periods centre around two percent.

Graph 12: Observed and estimated equilibrium real interest-rate differentials[1]



Note: 1 - Average annual real interest rate differentials (1999-2005) calculated using ex-post short-term real interest rates. Estimated real interest rate differentials are calculated using estimated implicit equilibrium interest rates (Catão and Mackenzie, 2006, p.17).

Source: Commission Services

The overwhelming interest in the use of equilibrium real rates for the assessment of monetary policy has shifted interest almost exclusively to euro-area wide analysis and only very few studies deal with single euro-area economies. A recent study by Catão and Mackenzie (2006) presents equilibrium real interest rates for a large group of industrialised countries comprising all euro-area economies except Greece and Luxembourg. The real interest rate differentials resulting from these estimates can be compared with average real interest rate differentials in the euro area (see Graph 12). It is clearly visible from the graph that actual rates differed markedly from equilibrium values and that deviations were found on both sides suggesting exerting strong caution in interpreting results. As regards the estimates of Catão and Mackenzie (2006), the largest differences (AT, IE) occur in countries with arbitrary assumptions on the equity risk premium.[15]

5. The impact of real interest rates in the euro area

The real interest rate channel-argument contains presumptions about the relation of real interest rates and macroeconomic indicators. This section starts with a look to selected correlations of real rates and indicators such as domestic demand and output gaps and continues with a closer look to the role of national real interest rates for the behaviour of economic agents (banks, households, firms).

5.1 Monetary transmission, real interest rates and economic activity

The analysis of monetary transmission in the euro area is dealing with the impact of changes in monetary policy, particularly in policy-controlled interest rates, on output and prices. Since changes in nominal policy rates come along with immediate changes in real rates findings on monetary transmission contain information on the impact of real interest rates on macroeconomic performance. Before investigating the relationship between real rates and key indicators it appears therefore useful to look at recent results on monetary transmission in the euro area.

[15] The equity risk premium is "set arbitrarily at 2.5" (Catão and Mackenzie, 2006, p. 17, fn. 17) for AT, IE and PT as time series are assessed as having insufficient length. With an equity risk premium of just 0.1 in DE, a difference of 2.4 percentage points between real interest rates in DE and AT can be explained by the assumption on the equity risk premium.

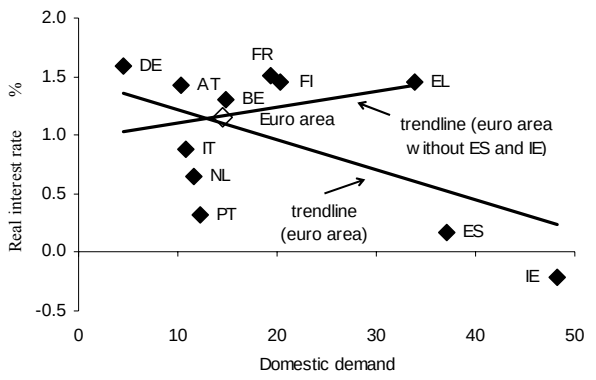
Several studies have found evidence on the heterogeneity of monetary policy transmission across EU Member States in the period before the start of the third stage of EMU (e.g. Angeloni and Ermann, 2003). Among the sources of heterogeneity were structural features (e.g. production structures, preferences, technologies, labour market characteristics, and incomplete capital mobility), policies (e.g. asymmetry within the European Monetary System, regulatory differences) and idiosyncratic shocks. Against the background of ongoing convergence and integration there were expectations that the introduction of the euro could reduce differences in monetary transmission and thus make area-wide monetary policy more effective. Changes in the monetary transmission mechanism were already identified in the run-up to the third stage of EMU (Ciccarelli and Rebucci, 2006). Studies covering the years after the creation of the euro area in 1999 did not find strong evidence in favour of robust differences in monetary transmission across euro-area economies (ECB, 2002: for a survey see Peersman, 2004). Van Els et al. (2003) found a qualitatively similar pattern of results following a monetary policy shock across different models, but also report heterogeneous results in quantitative terms.

Differences in the monetary transmission mechanism matter for the size of real interest rate differentials and for their impact on economic activity. A differentiated transmission across countries can add to inflation dispersion (ECB, 2005, p. 69), particularly in the presence of nominal rigidities. A more homogenous transmission mechanism could enhance transparency and reduce the persistence of (*ex ante*) real interest rate differentials. A specific question in that regard is to what extent differences in monetary transmission are related to differences in financial structures that will diminish as financial integration progresses. Several elements of the monetary transmission mechanism can be associated with the state of financial integration:

- *The substitution of consumption.* An increase in the real interest rate creates an incentive to delay consumption and increase saving and exerts thereby a negative impact on economic activity. The size of the impact will depend on the interest rate sensitivity of consumption. This sensitivity depends on the financial conditions (e.g. credit constraints), which can be expected to entail a local and/or national component.
- *The cost of capital and investment.* An increase in the real interest rate means a higher cost of capital that should lower the optimal capital-output ratio and slow investment. The size of this effect depends on the financial conditions of firms (e.g. credit constraints, maturity structure of debt) and on the economic structures as for such as the capital intensity of production (for a recent survey on industry effects of monetary policy see Peersman and Smets, 2005).
- *The wealth channel.* An increase in the real interest rate raises the borrowing costs and lowers thereby the discounted value of future payoffs of assets requiring a downward adjustment in households' net wealth. The impact of changes in real interest rates depends on the size of net wealth and the sensitivity of consumption to wealth.

These examples indicate that the state of financial integration is related to differences in monetary transmission across countries. It is difficult, however, to identify the importance of monetary transmission channels on the impact of real interest rates on economic activity. In order to bring together some pieces of evidence about the possible link between real interest rate differentials and economic activity at the aggregate country level it appears promising to start with a look to real interest rate levels and to continue the analysis later at the sectoral level (see subsequent parts).

Graph 13: Real interest rates and domestic demand, 1999-2005



Note: Average short-term real interest rate in % (1999-2005); change in domestic demand (excluding inventory) in percent (1998-2005).

Source: Commission Services

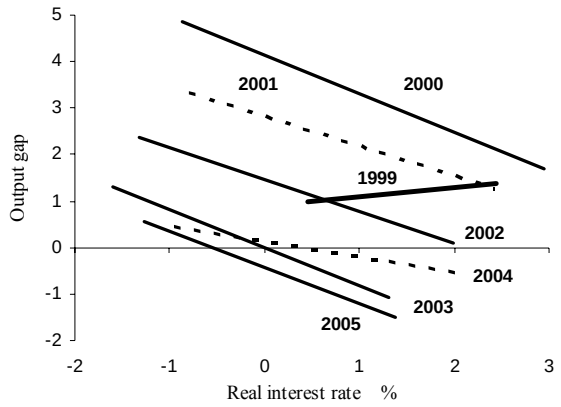
According to the real-interest rate argument, countries with low real interest rates would be those with strong growth of domestic demand reflecting good investment opportunities. The country evidence from the first seven euro-area years seems to support this presumption. As Graph 13 shows, the two countries with the lowest real interest rates (Spain and Ireland) recorded the strongest growth and the country with the highest real rate performed worst in terms of domestic demand growth. A negative correlation is also suggested by the trend line for the euro-area countries. A second look to the graph, however, raises some doubts. Three countries with relatively low real interest rates exhibited weak demand growth (Italy, the Netherlands and Portugal). At the same time countries with relatively high real rates experienced dynamic growth of domestic demand (e.g. France and Finland). Indeed, a low inflation rate can be due to weak demand, but may also result from above average productivity growth reflecting profitable investment opportunities (see ECB, 2005a, pp. 67-68). The lack of stability in the presumed relationship is also visible in the second trend line in Graph 13, which has

been calculated for all euro-area countries except Spain and Ireland and which is upward sloping. Therefore the observed correlations do not provide arguments in favour of the causal link suggested in the real interest rate reasoning.

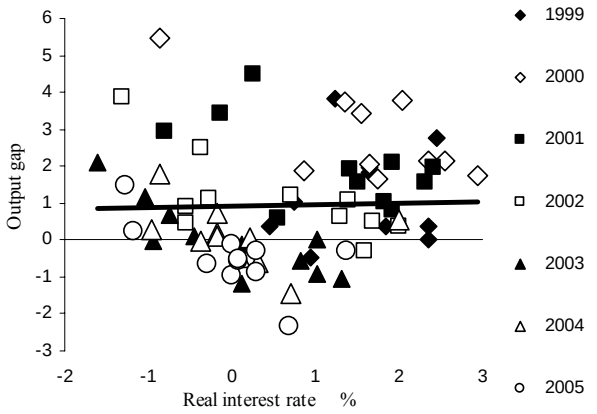
Another implication of the real-interest-rate argument is that cyclically advanced countries (positive output gap) would exhibit relatively high inflation rates and would therefore face below-average real interest rates. This relation could be expected to show up in a close negative correlation between the real interest rate and the output gap. Graph 14 displays available evidence for the euro-area years. Trend lines drawn for the years 1999 to 2005 (panel a) tend to support the hypothesis of a negative correlation. A closer look to observations in single countries and years (panel b), however, again raises some doubts, as the combinations are not only widely spread, but the overall trend line also appears to be rather flat and even slightly upward sloping.

Graph 14: Real interest rates and output gaps, 1999-2005

a) Annual trend lines



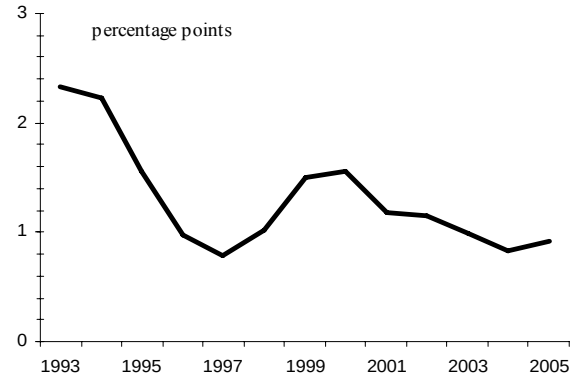
b) Observations and all-time trend line



Source: Commission Services

According to the real-interest argument real rate differentials across countries can be expected to enhance cyclical differences. The destabilising effect would increase cyclical differences across euro-area countries because advanced countries would get additional stimulus from below-average real interest rates. In that case the standard deviation of output gaps across euro-area economies should have increased in the first seven euro-area years. As Graph 15 shows there is little support for the hypothesis of increased diversity within the euro area. This suggests that either the impact of real interest rate differentials is negligible or that there are other factors at work that offset their impact.

Graph 15: Cyclical diversity in the euro area
(standard deviation of output gaps)



Source: Commission Services

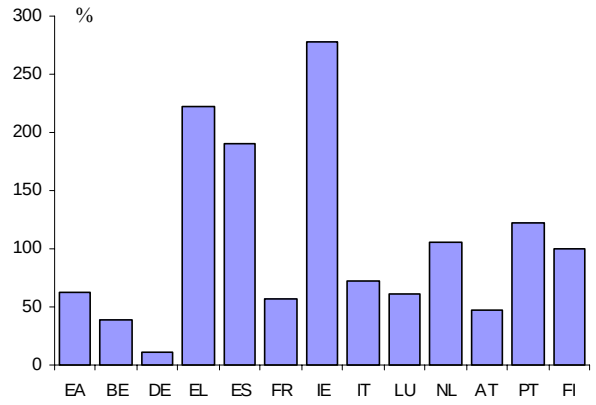
These observations suggest that in several cases there have been correlations as formulated in the real-interest rate argument, but this could not be interpreted as a hint on a causal relationship and the counterexamples raised further doubts about the validity of the argument. In order to further explore the argument, a closer look to economic agents' behaviour looks promising.

5.2 Monetary and Financial Institutions, real interest rates and credit growth

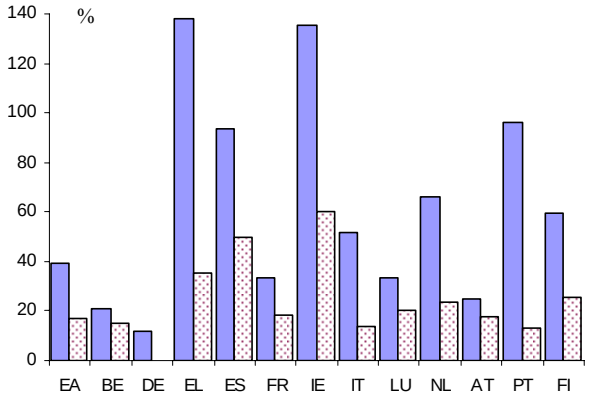
Almost all calculations of real interest rates start from the market interest rate and in the case of cross-country analysis area-wide market rates are used. This appears reasonable in an integrated euro-area banking sector. But empirical studies of the interest-rate pass-through (from market rates to bank interest rates) point to differences in the pass-through possibly resulting in heterogeneous bank interest rates in euro-area countries.[16] The heterogeneity has two main components, the long-run equilibrium pass-through and the speed of adjustment to the long-run equilibrium. Among the explanatory factors are structural differences in the financial systems (e.g. competition, bank size) as well as the legal and regulatory system.[17] Closely related are studies on bank margins that also present evidence of cross-country differences.[18]

Graph 16: Loans to euro-area residents other than MFI and governments (%)

a) Overall growth since the start of the third stage of EMU (December 1998 – December 2005)



b) Growth in 1999-2003 (right columns) and 2004-2005 (left columns)



Source: ECB

An indicator to consider lending activity is credit growth. Loans to euro-area households increased substantially in recent years in some of the strongly growing euro-area economies. Between the start of the third stage of EMU and March 2006 loans to the private sector (euro-area residents other than monetary and financial institutions and governments) increased by a total of 62% (equivalent to an average annual rate of about 7%). Across countries credit growth has been rather different. Among the initial euro-area countries the strongest credit growth was reported in Ireland, Spain, Portugal and the Netherlands (see Graph 16) and by far the slowest growth in Germany.

The profile of credit growth differed substantially across euro-area countries. Some of the countries with the fastest credit growth in the first few years of the third stage of EMU continued to exhibit strong growth while others displayed substantial declines. In 2005, loans increased by about 27% in Spain and Ireland, while rates growth had substantially slowed for instance in Italy (about 8%) and Portugal (about 7%) which joined Germany (0.3%) in the group of the three countries with the lowest rates of credit expansion. This change in profiles is visible in the right-hand panel of Graph 16 that compares average annual growth rates in the first five years of the euro area with those in 2004 and 2005. While credit expansion in Germany was only 13.5%, in half of the euro-area economies the volume of loans more than doubled (Ireland +297%; Greece +235%, Spain +208%, Portugal +125%, the Netherlands +108%, Finland +104%). These rates reflect the sharp decline in real interest rates in countries like Greece, Spain and Portugal during the convergence process up to the third stage of EMU. But beyond this initial impact there are hints for an ongoing loan growth. Between the end of 2003 and the end of March 2006 area-wide loan growth stood at 20.3% and with a substantial variation across countries. Loans to households other than MFI and government increased by 1.3% in Germany, but by more than 40% in Ireland (+68.6%), Spain (+59.0%) and Greece (+40.9%).

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16 According to calculations by Angeloni and Ehrmann (2003), for the years 1999-2002 the impact effect of money market rates on bank lending and deposit rates (within one month) varied between 0.387 in Germany and 0.621 in France with a euro-area average of 0.380 (p.476). In a more recent study, Sørensen, Kok and Werner (2006) find a sluggish and heterogeneous bank interest rate pass-through across euro-area countries using a harmonised set of data commencing in January 1999. They also summarise the approaches followed in other studies to which they provide references.

17 See e.g. Sander and Kleimeier (2004).

18 See e.g. Maudos and de Guevara (2004).

Given that real interest rate differentials were rather persistent over the last years, the differences in loan growth rates might suggest that the adjustment to the initial real rate fall has not yet come to an end.

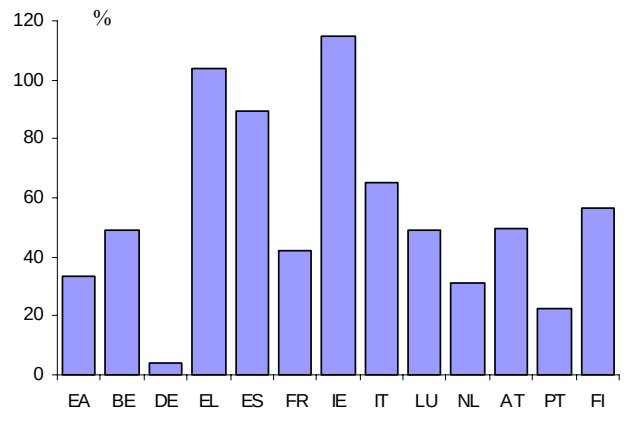
5.3 Private households and decisions on durables and house purchases

Private households optimise their behaviour by smoothing consumption over time unless frictions or market imperfections (e.g. borrowing and/or liquidity constraints) prevent them from doing so. The smoothing decision depends on the conditions in credit markets as households could borrow against future income or save money for future consumption. The relative price of a household's current consumption in terms of his future consumption is set by the real interest rate. A decline in the real interest rate makes it more attractive for a household to raise today's consumption as savings will give a smaller return in terms of future consumption. In the case of a real interest rate decline there will therefore be a positive substitution effect on consumption. This effect is complemented by a wealth effect. A lower interest rate implies that a household that has been a net debtor will pay less on the debt, which will reinforce the substitution effect. The contrary can be expected for a net creditor household.

As regards the euro area, the sharp decline in real interest rates in the run-up to the third stage of EMU can be expected to have contributed to a relatively strong increase in consumption which pushed domestic demand (see previous section and Graph 13). In addition, the initial decline in real interest rates should have pushed borrowing by private households. The strong growth of credit to private households in the euro area since 1999 provides supportive evidence of the link between real interest rates and household behaviour at the level of the euro area as a whole.

A separate issue is whether differences in real interest rates across countries are reflected in household behaviour in the euro-area Member States. A question that arises for households is whether their inflation expectations are identical to those of economic experts (professionals). The calculation of uniform real interest rates assumes that a key determinant of decisions is the same. This is in contrast to results of some recent empirical work on the formation of inflation expectations by households. Döpke et al. (2005) have – based on sticky information models – shown for Germany and Italy that household inflation expectations are less precise than experts' expectations, partly due to the lower speed of information updating. The evidence suggests that *perceived* real interest rates may lag behind actual values (the aforementioned study finds that households update their inflation expectations on average once a year). A slow response means that the impact of the initial decline in real interest rates at the start of the third stage of EMU has longer-lasting effects than often assumed (and suggested by rational expectation models). Arnold and Lemmen (2006) found that consumers' expectations as expressed in the European Commission's Consumer Survey depend more on past national inflation rates than on the ECB's definition of price stability and that convergence in inflation expectations is not more pronounced than that of actual inflation rates.

Graph 17: Growth rates of lending for house purchases, 2003-2005 (%)

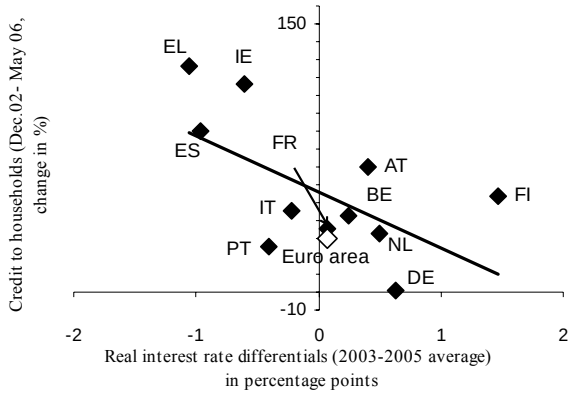


Source: ECB

The comparison of pre-1999 real interest rates with those in the first few years of the euro area had shown that real interest rates declined almost everywhere, but in particular in countries of the periphery. Their improved credit accessibility resulted in strong growth of lending and strong house price dynamics. A substantial share of credit growth of households can be attributed to growth of loans for house purchases (see Graph 17). Against the background of historically low nominal and real interest rates strong increases were reported in most euro-area countries. The lowest rates were recorded for Germany, Portugal and the Netherlands.

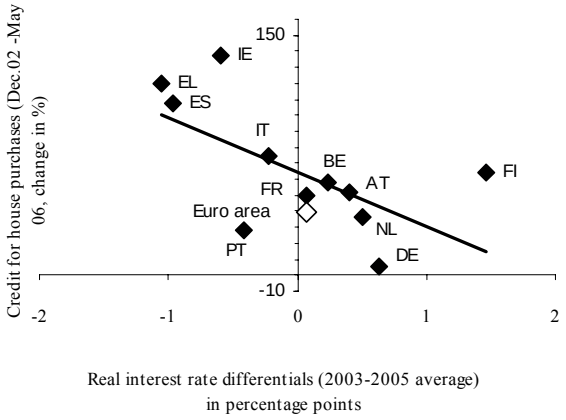
Graph 18: Real interest-rate differentials and credit developments, 2003-2006

a) Household credit growth



Source: ECB (August 2006) and own calculations

b) Growth of credit for house purchases



Source: ECB (August 2006) and own calculations

The economic activity of private households can be expected to be based on information from a regional and/or national context. For house purchases the national house price index might convey less relevant information than a neighbourhood or local price index. In that regard households would focus more on national real rates than on area-wide real rates. Therefore, a relatively strong link can be expected between national real interest rates and loans to households. Graph 18 displays some evidence for the euro-area Member States. For both credit aggregates one observes that countries with high real rates had relatively slow credit growth. Credit growth volumes for house purchases grew most strongly in Ireland, Greece and Spain, i.e. in the three countries with the lowest real interest rates.

5.4 Non-MFI firms and their investment decisions

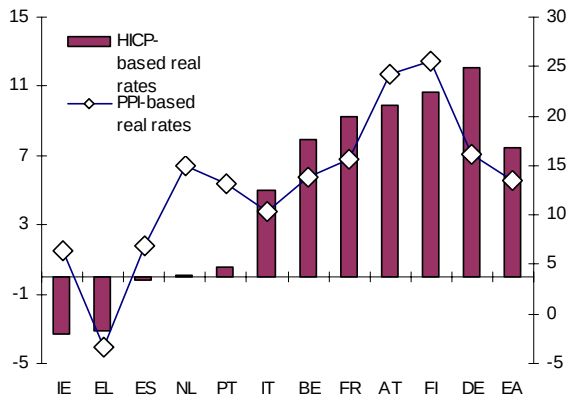
In order to asses the relevance of real interest rate differentials for investment decisions by firms both components, nominal market interest rates and inflation expectations have to be looked at. Relevant interest rates can be expected to have experienced a structural break at the occasion of the adoption of the single currency (changes in risk premia, more integrated financial markets), but to have been rather similar in the euro-area years. As regards inflation expectations, firms might not only look at consumer prices but also other indices. They might also take into consideration longer time horizons than other economic agents (e.g. households) and they might also put more weight on inflation developments in the euro area as a whole or in all their export markets inside and outside (hedged for exchange rate moves) the euro area.

The introduction of the euro had a substantial impact on risk premia and therefore a strong impact on financial conditions in the euro-area economies. At the corporate level empirical studies found an impact of the introduction of the euro on the cost of capital. Bris, Koskinen and Nilsson (2006) show that the euro has resulted in higher investment rates, which is consistent with positive valuation effects. According to Tobin's Q the market value of the company's capital divided by its replacement costs gives the investment opportunities (in the empirical literature usually proxied by the market-to-book ratio). Empirical studies have shown that Tobin's Q for firms in euro-area countries that had relatively weak currencies before 1998-99 (i.e. currencies that were in the centre of foreign exchange market turmoil in the 1990s) increased relative to that in other euro-area countries.[19] It could be argued that these firms had to cope with a significant currency risk premium before 1998 and thus a relatively high cost of capital. This could point to a reason that occurred in parallel to the initial impact of real interest rate differentials due to the fall of the interest rate in these countries in 1999. However, one has to take into account that exchange rate risks for countries from the former stable-currency countries ("core countries") also shrank to the extent that their companies had had significant exports to weak-currency countries. Bartram and Karolyi (2006) present evidence supporting this argument. In addition there is evidence in favour of the hypothesis that already ongoing financial integration lowered the cost of capital at the same time (see Hardouvelis, Malliaropoulos and Priestley, 2004).

[19] Bris, Koskinen and Nilsson (2006) report an increase of 8.7% on average (p.2).

Which time horizon matters for euro-area firms? Annual *ex post* real interest rates can hardly be expected to serve as the basis of calculations of rates of return for investment projects that last many years. As shown in the analysis of inflation expectations (Section 2.3), the longer the time horizon the closer inflation expectations are to the two-percent level. This means, however, that real interest rate differentials that matter for investment decisions are substantially smaller than the ones discussed for short-term horizons.

Graph 19: Cumulative real interest rates, 1999-2005 (%)



Note: Figures for EL and NL for 2001-2005 only. (EL: euro adoption in 2001; NL: PPI from 2001 onwards only).

Source: Commission Services

Which price index matters for firms' calculations of real interest rates? Most of the empirical analysis on real-interest rate differentials is based on consumer price developments and/or expectations. Although consumer prices provide a standard yardstick for inflation, producer prices might contain the more relevant information for investment decisions. The importance of the distinction depends on differences resulting from calculations of real interest rates either with a consumer price index or a producer price index. Graph 19 displays the real interest rate differentials vis-à-vis the euro-area average based on both types of price indices in the format of a real rate of return for the first seven euro-area years. In most cases differentials have the same sign and very often they have similar relative size. But there are significant differences for some countries that display the lowest HICP-based real rates (Ireland, Portugal) and for Germany. While real rates for Portugal and Ireland are markedly higher than on the basis of consumer prices the opposite is observed for Germany suggesting that Germany does not have the highest real rates in the euro area and that the difference from the average is smaller than presumed on the basis of consumer prices.

Does the sectoral component of inflation matter? Empirical analysis of inflation differentials has shown that the diversity of inflation has a sectoral dimension. The dispersion of services price inflation has been higher than that observed for the overall HICP index (see ECB, 2005a, pp. 64-65). The dispersion might have been even lower in the non-services components, had the implementation of the Single Market and the introduction of the euro not contributed to price level convergence towards area-wide long-term levels. As regards future developments this could suggest a further decline in inflation differentials of non-service goods and thus of real-interest rates calculated on the basis of non-services inflation rates.

Which territorial inflation rate matter for euro-area firms? The argument on the real interest rate adjustment assumes that economic agents use national deflators to calculate real interest rates (or expectations thereof) and then base their decisions on them. It appears quite obvious that some agents might be more oriented to their country of residence than others. In an integrated market one can expect that the euro-area real interest rate is relevant for firms that sell to all euro-area markets and not just to their domestic (national) market. In a recent study on the implications of inflation differentials, von Hagen and Hofmann (2004) have estimated (backward-looking) IS curves for ten euro-area economies including both national and euro-area estimates. They concluded that the euro-area real interest rate may be more important for aggregate demand than the national real interest rates. Remsperger and Hofmann (2005) have extended the analysis by allowing for a forward-looking term and a direct spill-over across countries (via the output gap) in the IS curve of all euro-area economies (except Luxembourg) and their panel approach provide support for the importance of the euro-area real interest rate.[20]

6. The relative importance of the real-interest rate channel of adjustment

The discussion of the real interest rate adjustment channel has presented some evidence on the empirical relevance of the role of national real interest rates in the euro area. In practice the overall effect is unobservable, however, because other channels are operating at the same time and may be not only counteracting the real rate channel but more than offset it. This section starts with a closer look to counteracting channels in the euro area (Section 6.1). While a more conclusive answer can be expected from model simulations (see Chapter VII), for some preliminary hints

[20] It has been argued that these results contrast with the so-called Walters critique, which deals with a similar mechanism that matters in the case of entry into a fixed exchange rate system. It looks at the case where nominal interest rates in the joining country with relatively high inflation have to fall to the level prevailing in the system with implications for the relevance of national inflation rates for borrowers and lenders. Already the UK Treasury Study (five tests) had assessed the argument as "distinct" since it matters for adjustable pegs, but not for single currency. Nevertheless, it is reiterated in publications that stress the destabilising effect of real interest rate differentials.

experiences in the United States may be useful (Section 6.2). A brief review of empirical studies that have presented results on the overall importance of the real interest rate channel (Section 6.3) complements the analysis.

6.1 Counteracting adjustment channels in the euro area

The impact of real interest rate differentials depends on the strength of other adjustment mechanisms that are related to the underlying inflation differentials across countries and on existence of further financial adjustment channels that could limit or counteract the impact of the real-interest rate channel. As regards the former the aforementioned competitiveness channel can be expected to play a key role. As regards the latter, portfolio diversification, cross-border lending and borrowing, and cross-border ownership (see also Section VIII.2.3) determine to what extent idiosyncratic shocks are smoothed across countries.

Competitiveness channel

Different developments of prices across euro-area countries result in changes in the relative price competitiveness vis-à-vis other euro-area economies. A country with below-average inflation, as for instance due to weak domestic demand, will gain in terms of price and cost competitiveness. The resulting push to demand (via foreign trade) can be expected to counteract the opposite (pro-cyclical) impact that might originate from the above-average real interest rate. This so-called competitiveness channel (see Chapter IV) can thereby offset the impact of the real-interest channel. For the assessment of the relative importance of the real-interest-rate channel the distribution of both effects over time is crucial. In principle, the interest rate effect can be expected to become effective without any delay, whereas the change in competitiveness might take a while (see Section 6.3).

Risk sharing via portfolio diversification and cross-border ownership

In the literature on currency unions the possibility of mitigating country-specific shocks by the means of portfolio diversification has been emphasised (see e.g. Mundell, 1973, pp. 120-2). As in the case of an individual who holds different financial assets in order to diversify risk, regions and/or countries can be understood as owners who diversify their risk of being subject to a country-specific shock by holding assets in other regions and/or countries. In a country with a more advanced cyclical position the cyclically-induced increase in the inflation rate lowers the domestic real interest rate and widens the real interest rate differential vis-à-vis other economies. With cross-border risk sharing, however, the additional stimulus is distributed across the countries of the monetary union as all countries hold claims on each other's output in the single currency[21]. The larger the monetary union and the wider the risk sharing, the smaller the impact of an asymmetric shock. In that respect the risk-sharing channel partially offsets the real-interest rate channel.[22]

Empirical studies in the last century, however, have found a surprisingly high correlation of domestic saving and investment that has been named the Feldstein-Horioka puzzle[23]. Among the factors that could possibly explain this observation were barriers to cross-border capital movements, a "home bias" for domestic assets reflecting investors' better knowledge about domestic investment opportunities, and exchange rate risks. More generally a lack of risk sharing is seen to be closely related to the state of international financial integration.

In EMU full capital mobility has been established, knowledge about investment opportunities has been enhanced and in the euro-area economies all intra-area exchange rate risks have ceased to exit. For these reasons, before the start of the third stage of EMU, it was expected that monetary union would increase risk sharing (e.g. Melitz and Zumer, 1999). Several more recent studies presented evidence of much broader risk sharing (e.g. Kalemli-Ozcan, Sørensen and Yosha, 2005, Sørensen, Wu, Yosha and Zhu, 2006). Although increased risk sharing can also be associated with globalisation, the introduction of the euro and ongoing financial market integration has certainly been one of the key determinants of increased risk sharing via portfolio diversification. At the same time a lack of financial integration in several fields (e.g. consumer credit, mortgage credit and insurance) could explain the relatively low level of risk sharing in the euro area.

6.2 Adjustment experiences: Are there lessons from the United States?

In an attempt to benefit from experiences fully established several, old monetary unions research projects have aimed at deriving general conclusions and policy implications from evidence found in Canadian provinces, Japanese prefectures and U.S. states. Particularly the latter have attracted a lot of attention. In terms of adjustment a rich

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[21] It is for this argument that McKinnon (2004) concluded that Mundell had taken sides in favour of a rather large monetary union, whereas Mundell's early contribution on optimum currency areas "leans towards making currency areas smaller and more homogeneous – rather than larger and more heterogeneous" (McKinnon, 2004, p.689).

[22] Cross-border risk sharing might result in increased specialisation which could amplify the effect of country-specific shocks making it more difficult to assess the overall impact of increased risk sharing (see e.g. Kalemli-Ozcan, Sørensen and Yosha, 2001).

[23] For an overview, see Lewis (1999).

literature existed on risk sharing and cross-country burden sharing in case of state-specific shocks, but relatively little is found on the competitiveness channel and the real interest rate channel.

The great importance of risk sharing via cross-state ownership in the U.S. has been shown in a pioneering article by Asdrubali, Sørensen and Yosha (1996), who found that about 39% of the impact of idiosyncratic (state-specific) shocks to per-capita GDP of individual states was smoothed via cross-state ownership whereas only 13% were smoothed via the fiscal system. As this result appeared to be closely linked to the fully integrated U.S. capital market, advances in financial integration have been identified as a key element of cross-country adjustment in a monetary union.

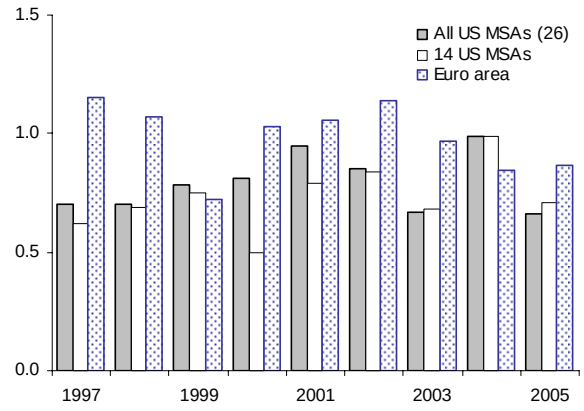
In the 1990s, real interest rate differentials across euro-area countries were substantially wider than such differentials within the US, both for short- and long-term interest rates. Towards the end of the 1990s, and thus in the first years of the euro area, indicators of dispersion in the euro area have become more similar to those for the United States.[24] The emergence of similarities has raised the question whether there are also other US experiences that might contain lessons for the euro area. One of the areas under consideration has been adjustment channels. While an analysis of inflation differentials could help to assess similarities between the underlying factors, a broader analysis of US adjustment could help to assess the relative importance of cross-region differences in real interest rates for macroeconomic developments in the regions.

The analysis of real interest rate differentials in the euro area and within the US suffers from a limited availability of data. For the US, the US Bureau of Economic Analyses publishes consumer price inflation data for Metropolitan Statistical Areas (MSA), but not for the States, whereas the output data are available for the States. For 3 MSAs monthly data are published and for another 11 bimonthly data (7 in even months, 4 in odd months) are available, but for a total of 26 MSA's annual CPI data for at least 5 years are published. In response to this situation several studies derive conclusions on the basis of 14 out of the 27 MSA (e.g. ECB, 2003).

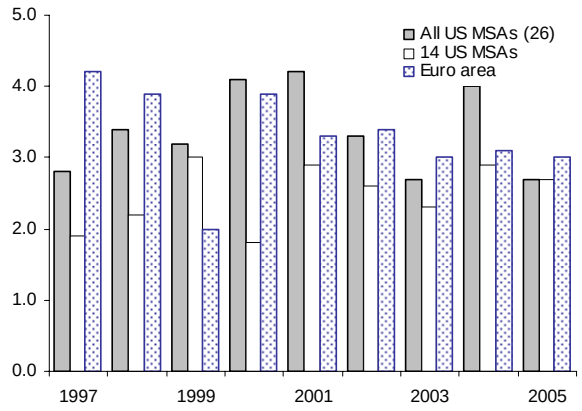
The diversity of annual inflation rates in the euro area has been more or less similar to that among Metropolitan Statistical Areas in the US. Spreads between regions with maximum and minimum inflation rates have been quite similar (see Graph 20), while standard deviations have been slightly higher in the euro area, with most of the difference due to Irish data.

Graph 20: Inflation diversity, 1997-2005

a) Standard deviation of inflation rates (unweighted)



b) Maximum inflation rate spreads (percentage points)



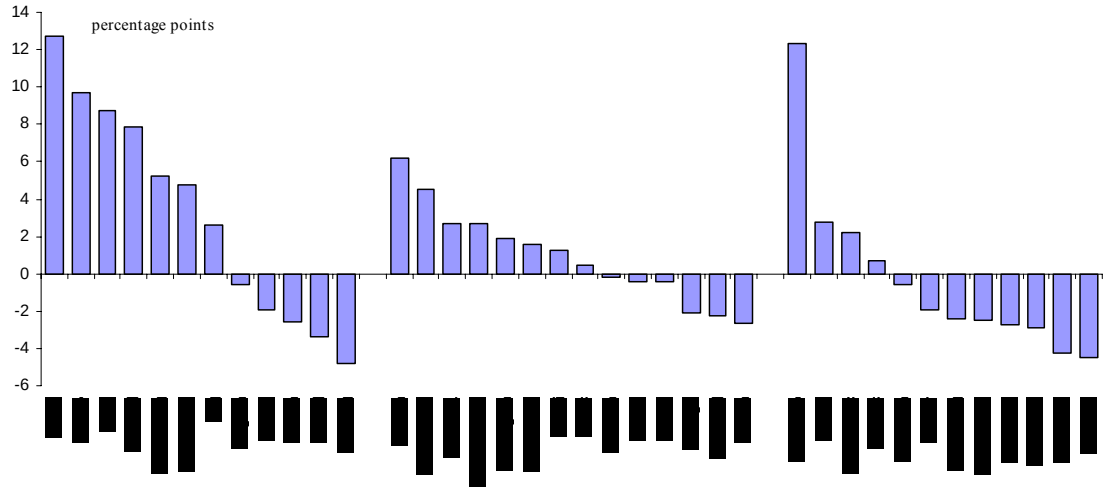
Source: US Bureau of Economic Analysis and Commission Services

Often it has been argued that the main difference between euro-area countries and US regions is the stronger persistence of inflation differentials in the euro area. Observations support this view as some countries have accumulated a substantial positive inflation differential (e.g. Ireland, Greece, Spain, and Portugal) while others have accumulated a negative differential (e.g. Germany). The ECB has compared these figures with those obtained for a sample of 14 US MSA and concluded that persistence is weaker in the US (ECB, 2003, pp. 11-13). The difference between the euro area and the US is less clear when all US MSA are taken into consideration. In that case the

[24] See for instance Angeloni and Ehrmann (2003, p. 485), who derive this result on the basis of measures of interest rate cohesion using either 3-month interbank rates and 10-year government bond rates.

accumulated differentials of Ireland and San Diego (on the upper side) and of Germany and Milwaukee and Honolulu (on the lower side) appear to be quite similar (see Graph 21).

Graph 21: Cumulative inflation differentials in the euro area and the US, 1999-2005



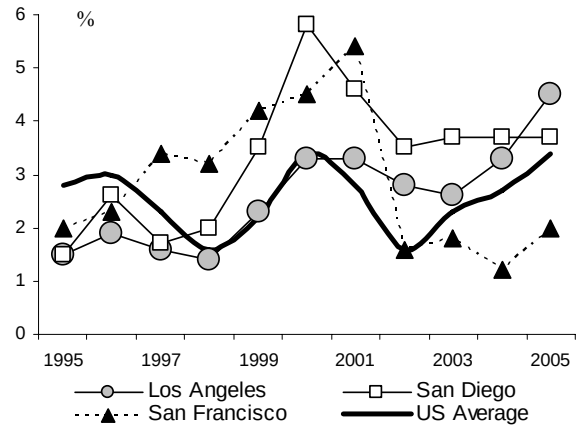
Note: Inflation differential vis-à-vis the euro-area HICP inflation rate and the US city average CPI inflation rate respectively. Names of the MSAs are abbreviations. The full names of the US Metropolitan Statistical Areas are shown on the website of the US BEA.

Source: US Bureau of Economic Analysis and Commission Services

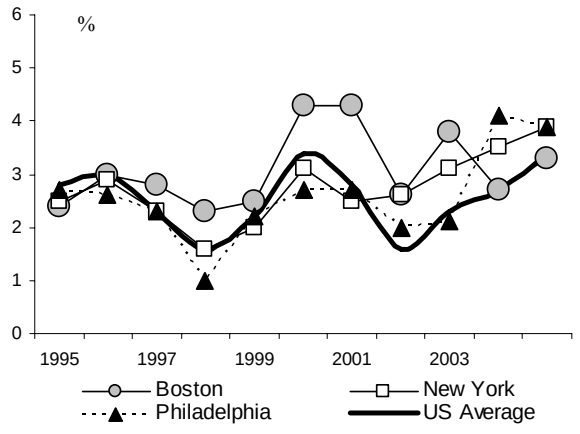
These observations suggest caution in deriving conclusions from a sub-sample of US Metropolitan Statistical Areas. The greater dispersion observed for the full sample of available annual inflation data could be expected to be related to a greater regional diversity with more diverse types of economic activity or other structural features (e.g. energy intensity). A closer look to adjacent MSAs (see Graph 22), however, suggests that vicinity does not necessarily imply more similar inflation patterns. While three Northeast MSAs display a quite similar inflation development, the three US MSAs in California show wide inflation dispersion.

Graph 22: US city inflation diversity, 1997-2005

a) Northeast (3 MSAs)



b) California (3 MSAs)



Source: US Bureau of Economic Analysis and Commission Services

Several studies have investigated the impact of macroeconomic differences in the US. Structural differences have been shown to result in a different regional impact of US economic policy. These studies have mainly looked at

production structures and output responses without taking inflation differentials into account.[25] One of the reasons for the negligence of inflation differentials and thus real interest rate differentials can be found in the aforementioned lack of inflation data at the State level. One option for circumventing the problem is the calculation of real Gross State Product (GSP) data by applying national deflators to output components. Developments in the relation of nominal and real GSP give then an idea of inflation differentials. Based on GSP data, Arnold and Kool (2004) have found that changes in real interest rates that are due to movements in regional inflation rates result in an expansionary effect on domestic demand that even temporarily exceeds the opposite effect of the competitiveness channel based on partial equilibrium analysis. They find that it takes 3-4 years until the overall effect is dominated by the competitiveness channel, i.e. they state that the pro-cyclical real interest rate channel dominates for some time in the case of the US. They also suggest that it takes 3 to 4 years until the real exchange rate effect (competitiveness channel) dominates the real interest rate effect.[26]

6.3 Assessing the overall importance of the real-interest-rate channel

Adjustment within the euro area is just one mechanism that affects the development of euro-area economies. Responses to global imbalances, the country-specific impact of changes in the external value of the euro and long-term developments such as globalisation affect the economy in parallel. Therefore it is rather difficult to disentangle the relative importance of the real interest rate channel and results should be interpreted with caution.

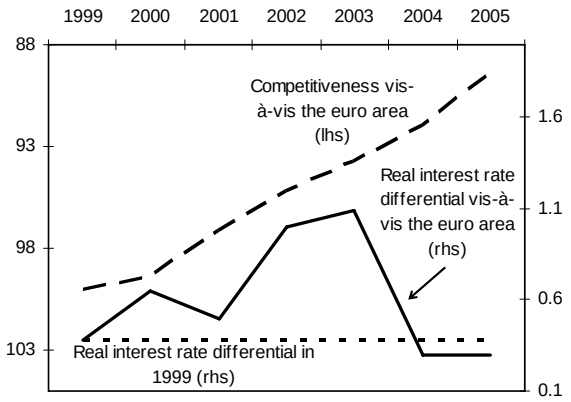
A first idea about the overall importance could be derived on the basis of the components for the overall effect, i.e. the real interest differential vis-à-vis the euro area on the one hand, and the country's competitiveness vis-à-vis the other euro-area economies on the other. Graph 23 displays these components for selected euro-area economies. It highlights developments since the first year of the euro area by displaying the real interest rate differential in comparison with the differential observed in 1999. The development of price and cost competitiveness is measured by the real effective exchange rate vis-à-vis the euro area based on nominal unit labour costs.

[25] Carlino and DeFina (1998, 1999). More recently, Owyang and Wall (2006) have estimated regional VARs for the US States to evaluate the transmission of monetary policy.

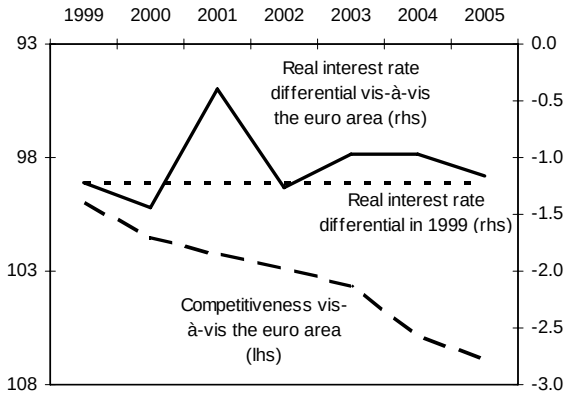
[26] The ECB reports this evidence (ECB, 2003d). It has to be mentioned, however, that the results are obtained for inflation differentials among US States although no inflation statistics exist at the state level in the US. Instead, deflators calculated from GSP (Gross State Product) are used.

Graph 23: Real interest-rate effect versus change in competitiveness in selected euro-area countries[1]

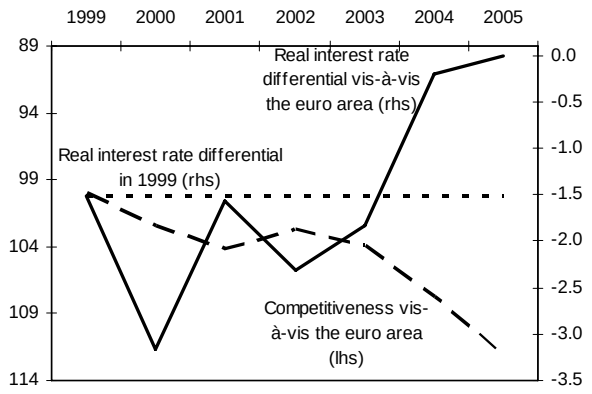
Germany



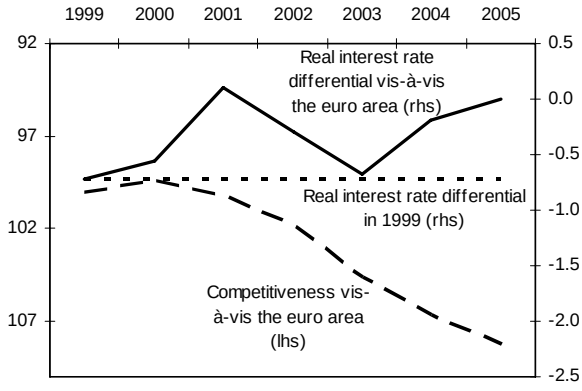
Spain



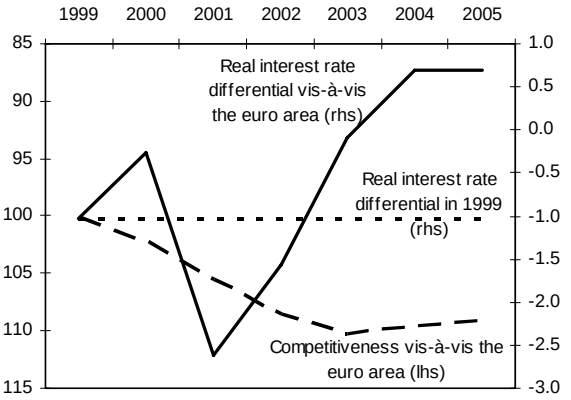
Ireland



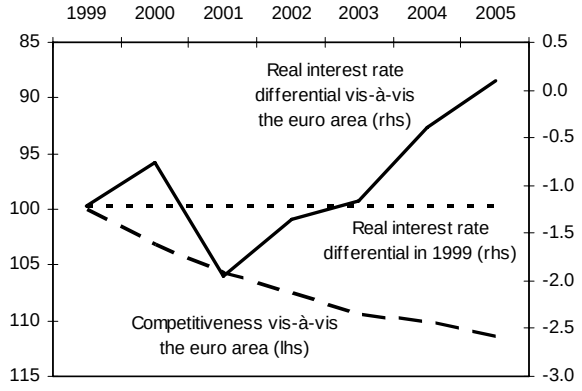
Italy



The Netherlands



Portugal



Note: 1 - Competitiveness is measured by the real effective exchange rate based on nominal unit labour costs of the total economy as regularly published by the Commission Services. The real interest rate is an ex-post short-term rate as presented in Section 2.

Source: Commission Services

A first look at the country charts indicates a somewhat steady decline or increase in the competitiveness indicator while changes in the real interest rate differential appear more volatile. This pattern of behaviour over time can be

interpreted as suggesting a relatively slow response of goods prices whereas interest rate changes move the real exchange rate relatively often. This suggests that movements in the competitiveness indicator are highly persistent. Apart from these more general findings, the country graphs show a substantial amount of diversity.[27] Examples of different developments are for instance found in the cases of Germany and Spain:

- *Germany.* Due to a low inflation rate the real interest rate differential vis-à-vis the euro area was positive all the time. In the first euro-area years the differential even widened (up to 2003). At the same time Germany's price and cost competitiveness vis-à-vis the euro area improved.
- *Spain.* A relatively high inflation rate resulted in negative real interest rate differentials vis-à-vis the euro area in all years. During this period the Spanish price and cost competitiveness deteriorated continuously.

The negative correlation of real interest rate differentials and competitiveness changes is observed in all countries but with different profiles.

The deterioration of price and cost competitiveness creates a need for relatively small future increases in costs and thus wages. Such a wage moderation (or even nominal wage decreases) can be expected to have a deflationary impact. Lower inflation expectations will immediately raise (*ex ante*) real interest rates and lower thereby domestic demand.[28]

Several empirical studies have raised concerns that the real interest rate channel of adjustment could be destabilising in the euro area.[29] What matters for the overall assessment is the relative importance of the adjustment channel, i.e. its strength as compared to other counteracting channels of the adjustment process that are also related to the underlying inflation differentials.

Another question that arises concerns changes in adjustment over time. Have changes in real interest rates become more stabilising or more destabilising on average? Answers are not straightforward since one does not know how nominal interest rates would have differed in the case of an autonomous monetary policy. In addition, the removal of exchange rate risks has affected the size and the movements of real interest rates.

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27 The approach has common features with the calculation of Monetary Condition Indices (MCI), but it does not depend on strong assumptions about the relative weights and the absence of structural breaks therein. As for MCIs one could argue that other financial assets could be included.

28 Blanchard (2006) has recently emphasised the role of this adjustment mechanism in the case of Portugal.

29 Cecchetti, Mark and Sonora (2002) and Arnold and Kool (2004) pointed to that possibility.

Table 5: Selected results on the relative importance of the real-interest-rate channel		
Study	***Subject and coverage***	***Results***
Angeloni and Ehrmann (2004)	Analysis of inflation and growth divergences with a stylised empirical model of EU-12.	The model embodies real interest rate differentials ("dis-equilibrating mechanism"), the competitiveness channel ("re-equilibrating mechanism", p.5) and stickiness features. "Inflation persistence, in one or more countries, is under plausible parameter values the factor that can propagate inflation differences most. Other explanations … seem to count less." (p. 21).
Deroose, Langedijk, Roeger (2004)	Analysis of shocks in selected euro-area economies (DE, IR, PT)	Interaction of real exchange rate and real interest channel may contribute to periods of overheating and overcooling.
Hoeller, Giorno and de la Maisonneuve (2004)		"The initial weakening of demand is reinforced by the effect of higher real interest rates due to lower inflation. However, lower inflation also leads to gains in competitiveness that, over time, become stronger than the effect of the higher real interest rates" (p. 9)
Honohan and Leddin (2005)	Analysis of adjustment channels in Ireland.	"The (Irish) experience dramatically illustrates how the adoption of an exogenous nominal interest rate … induced a pro-cyclical element because of the fact that, absent a policy response, a rise in inflation automatically generates a fall in real interest rates."
López-Salido, Restoy and Vallés (2005)	Analysis for Spain.	For Spain the study finds that the competitiveness channel "does not have a quantitatively relevant stabilising effect" (p.25).
Remsperger and Hofmann (2005)	Panel analysis including all euro-area economies except LU.	"Even in the short run, the scope for an amplification of inflation differentials via corresponding real interest rate differentials is likely to be limited". "The finding of a significant real exchange rate effect … suggests that, over the longer term, inflation differentials will be self-correcting as the effects of inflation differentials on the real exchange rate accumulate over time."

If the pro-cyclical impulse dominates other channels, the amplitude of the business cycle in euro-area economies would be higher than in pre-1999 times (as Lane expects for Ireland). This reasoning depends on the assumption that prior to the third stage of EMU, central banks were able to conduct an independent monetary policy within the framework of the exchange rate mechanism of the EMS.

The pro-cyclical effect could be counteracted not only by other channels, but also by fiscal policy (if at hand). Using fiscal policy instruments for stabilisation policies, however, requires their availability and could end up in a departure from medium- to long-term budgetary targets.

A review of the literature and a look to some euro-area figures has shown that the assessment of the relative importance of the adjustment via real interest rates differs somewhat. While research for the US has emphasised the strong role of real rate adjustment, the relevant institution, the ECB, has said the opposite for the euro area.[30]

[30] The ECB claims that the competitiveness channel is by far more important then the real-interest rate channel. At the ECB press conference on 8 June 2006, ECB President Trichet said: *"The level of inflation, which is closely correlated with the unit labour cost and the costs in general in the economy, functions in such a way that what one particular firm would theoretically gain out of a theoretical abstract computation of real interest rates is much more than offset by a loss in terms of cost competitiveness: what is lost when inflation is above the average is much greater than what you could theoretically gain with a lower level of real rates. This is very important.*"

In assessing the overall impact of asymmetric shocks some countries might look as if they had to cope with a situation that is just due to EMU. However, it should be noted that the evaluation is not looking at a benchmark case. In particular the argument cannot be understood as suggesting that things would have remained unchanged at the pre-1999 level, had a country refrained from joining EMU. For instance, in the case of Germany Hayo and Hofmann (2006) do some simulation exercises and conclude that the German rates might have been lower by up to one percentage point under a hypothetical Bundesbank regime after 1999, but they warn strongly that the long-term real interest rate is very imprecisely estimated under the ECB regime.

7. Summary and concluding remarks

While cross-country spreads between homogenous assets are relatively small in the euro area, differences between inflation rates have persisted and thus national real interest rates have varied across euro-area Member States. A popular argument is that in a monetary union the cyclically most advanced countries experience above-average inflation rates and thus below-average real interest rates that provide an additional unwarranted stimulus to economic growth. In order to assess the risk of destabilising real-interest rate effects this section has looked at the experiences in the euro-area years.

A look at the data (Section 2) started by addressing measurement issues, including the selection of an appropriate index of inflation and the distinction between *ex ante* and *ex post* real interest rate, since expenditure decisions are generally thought to be driven by expected real interest rates (*ex ante* real interest rates). Several conceptual and practical difficulties were mainly related to the fact that the expected inflation rate is not an observable variable. It needs to be estimated in order to obtain the corresponding real interest rate. Using a simple backward looking approach and a more forward-looking one, ex-post and ex-ante short term real interest rates were then calculated for all euro-area Member States for a period beginning in 1990. These data show considerable convergence towards low real interest rates in the run-up to the third stage of EMU and in the first euro-area years. This can be seen as an important benefit of the environment of low and stable inflation in EMU and the stability-oriented policy framework that underlies it. The data also show that the pre-1999 convergence process involved declines in real interest rates of different magnitude across Member States. The data analysed here indicate that, particularly for the period since 1999, dispersion in ex-ante real interest rates is lower than for *ex post* rates. In turn, this suggests that, although still present, differences in real interest rates may be overestimated by studies based solely on an ex-post approach. Ex-ante real interest rates, calculated on the basis of Consensus Forecast data, indicate that cross-country differentials persist, but that they are somewhat smaller at longer horizons. Using survey data, however, no strong support was found in favour of a full convergence of inflation expectations and thus real interest rates at longer horizons.

The role of real interest rates in a monetary union (Section 3) has recently been the subject of interest in economic theory, with studies shedding some light on the contribution of real interest rates to adjustment following idiosyncratic shocks. The aforementioned hypothesis of a pro-cyclical impact of the real interest rate channel has been in the centre of discussions. Studies on adjustment within a monetary union have also highlighted the (real) exchange rate channel as counteracting the (real) interest rate channel. The homogeneity of countries belonging to the monetary union has attracted a lot of attention. In general, monetary transmission and, thus, the interest rate channel are expected to become more similar across countries by the establishment of a monetary union.

An analysis of causes of real interest rate differentials (Section 4) began with a closer look to the factors underlying developments in real interest rates over time. *Ex post* real interest rates, calculated on the basis of HICP inflation rates, reflect the patterns of inflation differentials and therefore also share the characteristic of persistence. A closer examination of the causes of inflation differentials shows that cyclical factors are only one of a number of determinants with policy-induced and structural causes playing substantial roles. This variety of reasons reduces the relevance of the real interest rate argument that rests on linkages to the cyclical situation of countries. A second part of the analysis looked at the implications of equilibrium concepts, in particular whether estimates of equilibrium real interest rates could shed a new light on the interpretations of real interest rate differentials across countries. Structural inflation differentials as estimated in the literature on Balassa-Samuelson effects fit the pattern observed for real interest rate differentials fairly well suggesting that indeed a non-negligible part of the latter might be related to non-cyclical factors. Real equilibrium interest rates as estimated in the literature on monetary policy analysis depend strongly on the time period under consideration and on key assumptions, while adding relatively little to the analysis of real interest rate differentials.

The investigation of the impact of real interest rates (Section 5) started with a look to recent evidence about changes in the monetary transmission mechanism. Evidence was reported that Economic and Monetary Union had made transmission more similar and thus reduced the relevance of one of the causes of inflation differentials and thus real interest rate differentials. This suggested expecting a declining size in the impact of real interest rates. Data from the euro-area years provided some hints on a correlation between real interest rates and domestic demand and the cyclical situation. A closer look to different periods, however, raised doubts about the stability of the link and of the expected change over time. In response the analysis continued with a more detailed look to banks, households and firms in the euro area. Countries with relatively low real interest rates reported above-average credit growth, but it remained difficult to distinguish between the impact of the initial decline in real interest rates at the start of the third

stage and the impact of differentials observed in more recent years. Differences in the pass-through of interest rates suggested that differentials among real retail interest rates might at least slightly differ from those of real policy interest rates. Households' lending for house purchases was particularly strong in countries with below-average real interest rates. Both for households and for companies there was no conclusive evidence about the real interest rate they look at (e.g. in terms of territorial coverage and time horizon).

The final part of the analysis evaluated the relative importance of the real interest rate channel (Section 6). As the overall impact of real interest rate differentials depends on counteracting channels, the competitiveness channel had to be looked at. But also other financial market channels such as income and consumption smoothing via risk sharing (e.g. portfolio diversification, cross-border ownership) tend to mitigate the impact of country-specific shocks. Early evidence from the euro area suggests that one can expect an increasing role of risk sharing across euro-area Member States. While evidence from the US states hints on a key role of risk sharing via cross-state ownership for income and consumption smoothing, there is little empirical evidence on the real interest rate channel. A closer look to inflation differentials within the US indicated that dispersion is similar to that in the euro area, but this evidence is available for Metropolitan Statistical Regions and not for states, which might explain the lack of studies on real interest rate differentials in the US states. The final section summarised the results of empirical studies for the euro area. These studies mostly argue that the competitiveness channel is strong enough to offset possibly destabilising effects of the real interest rate channel.

All in all, the analysis of the real interest rate channel suggests that the subject is more complicated than some early statements might have suggested. Focussing exclusively on *ex-post* real interest rates could be misleading and exaggerate the risk of destabilising effects. The analysis of the causes of real interest rate differentials clearly hints at the role of non-cyclical factors implying that low interest rates could also emerge in slowly growing countries. Moreover, for some economic agents, particularly for companies, it appears likely that they attach more and more weight to area-wide considerations and thus to a common area-wide real interest rate. In addition, to the extent that inflation differences due to cyclical divergences should be perceived as temporary, the private sector may adjust its medium-term inflation expectations to the ECB's definition of price stability. This process will certainly be intensified by ongoing financial integration, which will also raise the role of income smoothing via risk sharing.