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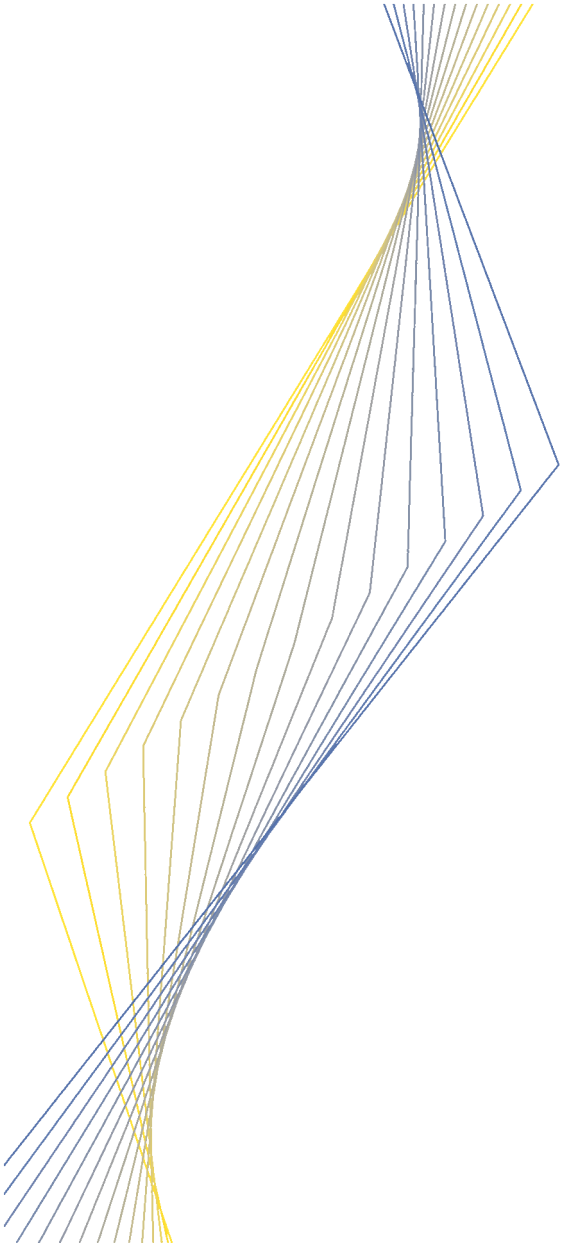

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MONETARY POLICY TRANSMISSION IN THE EURO AREA: ANY CHANGES AFTER EMU?[1]

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AND MICHAEL EHRMANN[2]

July 2003

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Contents

Abstract

We examine the euro area monetary policy transmission process using post-1999 data, with two main questions in mind: has it changed after – and because of – EMU and, if so, is it becoming homogeneous across countries. Given the data limitations, we concentrate on three blocks of transmission: the banking, interest-rate and asset-market channels.

We find evidence that the transmission through banks has become more potent and homogeneous across countries because of EMU. On the financial-market channels, our evidence is somewhat weaker but suggestive. The interest-rate channel appears to have changed even before EMU, and to now affect national economies in a broadly similar way. The asset-market channel (proxied by the stock-market effects of monetary policy) also seems to work rather homogeneously across national markets (no comparison with pre-EMU is available here).

A positive answer to both questions raised above represents, in our view, the best working hypothesis under current knowledge.

Keywords: monetary policy transmission; euro; bank and financial integration

JEL Classification Numbers: E43, E52. G21

Non-technical summary

In this paper we attempt a first assessment of the euro area transmission process, using the most recent data. We focus on post-EMU data, reserving earlier samples for comparison. We make extensive use of evidence from other countries ("controls"), to identify EMU-specific changes.

We are interested in several questions: Has the euro area MTP changed lately? Has it changed *in coincidence* with EMU? Has it changed *because of* EMU? What is the direction of change? Do any ongoing changes make the MTP more or less uniform within the euro area?

Studying the monetary policy transmission process in the euro area is difficult at this stage, due to the scarcity of data. For this reason we focus only on a selected number of variables at the intermediate stages of the transmission process, regarding specifically banking and financial markets. These sectors are of key importance among the transmission channels. In these sectors, EMU-related changes are likely to occur rapidly, and a wealth of high frequency and cross-sectional information is available, which makes them a natural focus of attention.

Regarding the transmission via the banking sector, we are primarily interested in seeing if there are signs of increasing integration and competition across countries that may suggest that the MTP has become more homogeneous. We find partial, but significant progress towards integration. Looking at the effect of monetary impulses on lending and deposit interest rates, we find evidence of change and convergence across countries. The size of the impact of monetary policy changes on bank rates has increased around 1999, something that is hard to interpret without a direct causal role from EMU.

To study transmission through the financial markets, we focus first on the co-movements of riskless interest rates at short and long maturities across countries in the euro area, using other countries as controls. We show that co-movements in real rates have increased considerably, a sign that the "interest-rate channel" of monetary transmission has become more homogeneous. The convergence, however, seems to have taken place largely before 1999. Next we turn to stock markets, finding evidence that equity prices do generally react to monetary policy signals after EMU in a homogeneous way. Unfortunately, no control evidence is available here.

1. Introduction and summary

Monetary policy transmission in Europe has become a much more interesting research subject lately. EMU is a major institutional reform, likely to change the European economy in many ways. The monetary policy transmission process (MTP) – the set of links through which monetary policy affects the economy – is a central element in this transformation. While these changes unfold, and before they are even fully understood, the ECB needs the best available information on how transmission works in the new arrangement in order to conduct its policy. Not surprisingly, research on this subject has intensified since 1999.

In this paper we attempt a first assessment of the nexus between EMU[1] and the euro area transmission process, using the most recent data. At least since Lucas' celebrated "critique", it has been recognised that regimes changes impact on the expectations formation mechanisms and hence on the economy's response to policy. It is hard to think of examples where this line of reasoning could apply more forcefully than EMU. However, it is important to bear in mind that EMU is a *process*, not a one-time event. The transition to a new currency and monetary policy was something economic agents had time to prepare for, and adjust to, over a number of years. This complicates significantly the task of identifying causal links. In any event, there are several related questions, only partly of causal nature, that we are interested in: Has the euro area MTP changed lately? Has it changed *in coincidence* with EMU? Has it changed *because of* EMU? What is the direction of change?

The last question links up with a specific issue of great policy relevance, namely, that of the *differentiation* of the effects of monetary policy across euro area countries. Several authors have argued that the euro area monetary transmission process is uneven across countries, in a way that could complicate the conduct of the single monetary policy. Cecchetti (2001) concluded that the deeply entrenched legal and judicial differences affect the financial structures of euro area member nations, creating asymmetries in the response to policy. Mihov (2001) provided econometric evidence in support of this conclusion. Kieler and Saarenheimo (1998), Guiso et al. (1999) and Angeloni, Kashyap and Mojon (2003) have shown, on the other hand, that such differences are not robust to changes in empirical methodology and data. The jury is still out, as we shall argue in more detail below.

The normative angle of MTP heterogeneity is not free from ambiguity either. Heterogeneity is unavoidable and perhaps not undesirable if it reflects differences in individual agents' choices (like time preferences for example) or differences in the composition of output across countries, since different sectors react to monetary policy in different ways. But other dimensions of heterogeneity are probably less fundamental, policy-driven, and could indeed interfere with a smooth conduct of the area-wide monetary policy. What is important for us here is that some differences, like those due to market segmentation stemming from different currencies and monetary regimes, should fade away, perhaps quickly, once a common currency is adopted. This is why the issue of regime change is intimately linked to that of differentiation: in looking at the first, we will also ask whether any ongoing changes go in the direction of making the transmission mechanism more or less uniform within the euro area.

Unfortunately, studying the monetary policy transmission process in the euro area is difficult at this stage. Four years of data are not enough to approach the issue in a

[1] In the European Treaties, the term EMU refers to the *entire process* of preparation and introduction of the single currency. In practice most people use the term to indicate just the *time of the introduction* of the euro, i.e. the beginning of 1999 (which properly should be called the start of Stage Three of EMU). We will use the two meanings interchangeably in this paper, making the distinction only when needed.

systematic way. Ideally, one would wish to estimate a comprehensive model of the euro area vs. the individual member countries' transmission processes, where changes of key parameters could be measured and tested. This is clearly not feasible. Euro area-wide models using area-wide synthetic data, including pre-EMU (Fagan et al., 2001; Smets and Wouters, 2002), serve certain purposes, but the assumption of homogeneity across time and countries that they impose blurs crucial distinctions that are at the heart of the questions we want to address. Even national data are, in many cases, not complete and homogeneous enough in key areas such as e.g. inventories, housing or durable consumption. The same problems plague time series analyses such as the ones attempted by Mojon and Peersman (2003) or Agresti and Mojon (2003).

Adapting our strategy to the nature of the problem, we focus on a selected number of variables at the intermediate stages of the transmission process, regarding specifically banking and financial markets. These sectors are of key importance among the transmission channels. In these sectors, EMU-related changes are likely to occur rapidly, and a wealth of high frequency and cross-sectional information is available. Hence these sectors are a natural focus of attention. This means looking inside the "black box" of the transmission process, rather than examining directly the effect of policy on final variables such as output and prices. We regard such direct analysis as unfeasible today. Our approach on the contrary not only is feasible, but has the additional advantage of allowing more precise statements about whether changes in the MTP are taking place, or heterogeneity exists. The ambiguities in the rankings of national transmission processes mentioned above, for example, could arise from the fact that differences at intermediate stages of the transmission are offset, perhaps by coincidence, by other differences elsewhere, say in the characteristics of labour or product markets.

We use both descriptive evidence and formal econometric analyses, trying to make them complementary. We focus mainly on post-EMU data, reserving earlier samples for comparison. We make extensive use of evidence from other countries ("controls"), to identify EMU-specific changes. From this viewpoint, we move a step forward relative to both the euro area macro models mentioned above, and the work of the so-called "Eurosystem Monetary Transmission Network", that used mainly pre-EMU data to make inference about the post-EMU transmission mechanism (Angeloni, Kashyap and Mojon, 2003). Our final step is to bring the separate pieces of evidence together, combining it with prior judgement. In sum, our strategy is close to what has been called, in another context, the "Sherlock Holmes" approach. Like Sherlock, we try to solve our case by "weaving together all the bits of evidence into a plausible story" (Leamer, 1978). Hopefully our story should be informative and suggest also where else to look in order to complete the picture.

The summary of the paper is as follows. We start, in section 2, by briefly reviewing the recent evidence on the euro area transmission mechanism. In section 3 we examine the transmission via the banking sector. Structural differences in national banking systems have repeatedly been indicated as a primary source of transmission asymmetries. Hence we are primarily interested in seeing if there are signs of increasing integration and competition across countries that may suggest that the transmission of monetary policy has become more homogeneous. We look first at descriptive evidence on cross-border banking penetration, around and after 1999, using other EU countries and the US as controls. We find partial, but significant progress towards integration. We then look at the effect of monetary impulses on lending and deposit interest rates. Here we find strong evidence of change and convergence across countries. The size of the impact of monetary policy

changes on bank rates has increased dramatically around 1999, something that is hard to interpret without a direct causal role from EMU.

Section 4 provides evidence on the financial markets. We focus first on the co-movements of riskless interest rates at short and long maturity across countries in the euro area, using other countries as controls. We show that co-movements in real rates have increased considerably, a sign that the "interest-rate channel" of monetary transmission has become more homogeneous. The convergence, however, seems to have taken place largely before 1999. Next we turn to stock markets, finding evidence that equity prices do generally react to monetary policy signals after EMU in a homogeneous way. Unfortunately, no control evidence is available here.

In the final section 5 we attempt some Sherlock-like inference on our data evidence, and indicate what are in our view the most urgent steps for further investigation.

2. The Euro Area Transmission Process: a Selective Review of Recent Literature

There has been little research so far linking the changes in the euro area transmission mechanism to the introduction of the euro. The main aspect that received attention is the determination of bank lending and deposit rates. For these rates, monthly data of some length and of high quality exist. Two recent papers address this issue empirically. De Bondt et al. (2003) compare bank interest rate setting equations, across euro area countries, and find that EMU led to a break in the direction of faster transmission. They attribute this to a decline of the volatility of the money market rate after EMU, which makes this rate a better policy signal. Hofmann (2003) estimates lending rates equations in error correction form for the 4 largest euro area countries, and calculates responses to monetary policy shocks. Again, the conclusion is that the pass-through of policy shocks to lending rates has accelerated, except in Germany. He also finds that the pass-through has become more homogeneous across countries. Ciccarelli and Rebucci (2001) take another approach, trying to estimate if the transmission of policy shocks to output has changed *in the run up* to EMU. Their idea – which implies that any changes in the transmission mechanism are likely to have preceded rather than followed the event – illustrates the difficulty, to which we referred earlier, of applying *post-hoc-ergo-propter-hoc* logic to our problem. They find that, indeed, there are signs of change in the transmission mechanism in the eve of EMU, but not in the direction of more homogeneity.

Looking back at the last 10 years, most of the literature on monetary transmission in Europe has been concerned with two main questions. The first was how the strength and timing of the transmission process compared across countries. Rankings were compiled, and meta-analyses conducted, in the attempt to identify the possible factors generating differences across national transmission processes. The second strand of literature aimed at testing for the existence of a bank-lending channel, following Kashyap and Stein (1997). This banking channel theory has considerable appeal in Europe, due to the importance of bank credit as source of funding in Europe and to the small average size of both banks and non-financial firms in many countries.

A detailed survey of these broad strands of literature would take us too far from our main lines of argument. Besides, good surveys already exist, like Guiso et al. (1999). Our reading of the first of these two strands of literature leads to conclude that the search for reliable and robust rankings across countries of the potency of monetary policy effects on output and prices has, in the main, remained elusive. This is well illustrated by the variety of results that have been reported. Mojon and Peersman (2003) provide an overview of 16

recent VAR studies on euro area countries. The range of maximum output effects of a standard monetary policy shock reported in those studies is quite large, although Germany comes on top of the list for intensity of output effects more frequently than other countries, followed by Italy and France. A parallel study by van Els et al. (2003), based on structural econometric models, produces yet a different ranking, with Spain first. In a frequently quoted paper, Kieler and Saarenheimo (1998) suggest that part of the puzzle may be explained by problems in VAR identification. Computing estimates of transmission strength across all "plausible" identification schemes, they show the wide range of results that can be obtained, which is likely to lead to various possible rankings in comparative studies.

The empirical literature on the bank-lending channel in Europe is also large. A comprehensive study, including estimates for the 6 largest EU countries, is provided in a book by de Bondt (1999). He finds evidence of a bank-lending channel for several countries, relatively stronger in Germany and in the Netherlands. Ehrmann et al. (2003) extend and update this evidence for the 4 largest euro area countries, confirming the existence of bank-lending channel effects. An exception in this literature is Favero et al. (1999), who do not find evidence of a bank-lending channel when looking at the impact of the 1992 monetary policy and exchange rate shocks. However, their result could be due to the particular nature of the shock in question, which was exceptionally strong and temporary.

The Eurosystem Monetary Transmission Network, a group of economists from Eurosystem central banks, has recently completed a comprehensive study of the monetary policy transmission in the euro area[2]. We mention here five messages from that project that have a bearing for our study.

1. The euro area – taken as a whole – and the US economies seem to be characterised by broadly similar economic cycles. The broad features of the response of the economies (prices and output) to a random monetary shock are also rather similar (Peersman and Smets, 2003). This suggests that shocks and propagation mechanisms may also be comparable (see also Smets and Wouters, 2003). Hence analytical frameworks and models adopted for the US transmission process may apply to the euro area as well, at least to a first approximation. A summary of such frameworks, used as a reference in this paper, is the 1995 survey published in the Journal of Economic Perspectives (Mishkin, ed. 1995).
2. The broad patterns of transmission found for the euro area tend to hold also for the individual countries. The papers by Mojon and Peersman (2003) and van Els et al. (2003) provide evidence in this respect. Though cross-country rankings of the overall transmission strength are not unambiguous, some clearer differences emerge if one looks more deeply into the details of the transmission channels[3]. It is to those differences and to the effect of EMU on them that we give attention in this paper.
3. The exchange rate affects output and prices of individual euro area countries rather significantly. This statement remains true even if the effects from changes in intra-area exchange rates are excluded from the model simulations, as appropriate when analysing

[2] The results are forthcoming in Angeloni, Kashyap and Mojon (2003).

[3] For example, there seems to be very little doubt that the bank-lending channel is particularly relevant for Germany. See Worms (2003).

a currency area[4]. However, the link between monetary policy and the exchange rate is not systematic. Only if such link is *assumed a priori* does the exchange-rate channel become an important element in the transmission process. Mainly for this reason, the exchange-rate channel is not analysed in this paper[5].

4. Micro evidence on non-financial firms' behaviour supports a joint role of interest rates and of cash or liquidity constraints in determining their investment behaviour (see in particular Chatelain et al., 2003). This finding confirms that euro area financial markets are not frictionless and opens the way for the credit and the interest rate channels to operate together. In this paper, we examine both channels.

5. Micro evidence on banks tends to support that the bank lending channel, as proposed by Kashyap and Stein (1997), is a relevant element in the transmission process in at least for a number of euro area countries (Ehrmann et al., 2003, and references therein). The quantitative importance of this channel for the area as a whole remains an open question. In any event, the focus placed on bank behaviour in transmitting monetary policy in this paper is warranted in light of these results.

3. Evidence on the Bank-Lending Channel

As we noted, banks are potentially very relevant for the transmission mechanism, given their overwhelming role in financial intermediation in continental Europe. Banks are also likely to have adjusted early, and quickly, to changes in market conditions following the introduction of the euro, given their daily operational contact with central banks and with the money market, which was fully integrated since day one. Moreover, relatively large data sets on banking are available. Recently, Eurosystem central banks have published methodologically consistent euro area and national aggregates for a number of balance sheet and interest rate variables. We will make full use of them in the following.

To recap: We want to detect any changes that may have taken place in recent times, specifically around 1999, that have a bearing for the characteristics of the transmission mechanism via banks. Evidence on cross border integration is obviously relevant, as it may tell us whether cross border segmentation and asymmetries are being removed. Moreover, evidence on how banks price their products (mainly, the different categories of loans and deposits that they offer) is also relevant. Clearly, as we noted earlier, any EMU-induced changes need not coincide with 1999. EMU is a *process*, not a single-time event. Market expectations built up gradually, or in steps, in the second half of the 1990s. Some banks formed correct expectations and acted on them early on, others lagged behind.

We proceed in steps. We first survey some qualitative evidence on cross-border banking, using the most recently available data. Foreign diversification of banking activity would be an element suggesting that monetary transmission is becoming more homogeneous, because it would imply that households and firms have access to an increasingly homogeneous supply of bank products (loans and deposits, primarily) throughout the area. However, this evidence by itself would not be conclusive. Banking markets could be contested, and virtually integrate, even without significant cross-border activity. The converse, however, would not be true: if sizeable cross-border business is observed, this

[4] This can be done, in the spirit of Dornbusch et al. (1998), by cutting off the movements of such rates in appropriately specified econometric models; see van Els et al. (2003).

[5] Another reason is that it is probably too early to assess how the pricing behaviour of exporting firms has adjusted to the new exchange rate regime.

should be *prima facie* evidence of integration. Evidence of cross-border "action" would then constitute a sufficient condition, but not a necessary one. In any case, we will combine and crosscheck the balance sheet data with information on how interest rate changes induced by monetary policy are transmitted to bank customers.

3.1 - Evidence on bank penetration

Chart 1 shows recently compiled Eurosystem data on cross-border loans to non-banks for Germany, France, Italy and the whole euro area[6]. For each country, the chart shows loans made by domestic-resident banks respectively to borrowers residing in the rest of the euro area, in other EU countries, and in other non-EU countries, as a percent of domestic loans. We see some increase of within-euro-area lending, but not much. For Germany and the whole euro area, the increase as a ratio to total lending is in the order of 1 percent between 1997 and 2002. Moreover, the increase seems to be part of a general rising trend, since loans to outside the euro area increase in a similar way. Hence, there seems to be no evidence of a decisive change after EMU so far. Nonetheless, in quantitative terms the increase of cross-border loans in the area may not be negligible. Given the size of the total loan volume in the denominator, about 10,000 billion euro at the end of 2001 (144% of GDP), at the margin a 1 percent increase in cross-border lending could be significant, at least in some countries.

Chart 2 shows the same numbers for interbank loans. Banks normally consider the cost of interbank funds as an internal benchmark for pricing loans to their non-bank customers, hence interbank integration, *even in the absence* of cross-border loans to non-banks, could indirectly produce loan market integration as well. Here the movements that we see are significantly stronger. The increase of cross-border interbank loans for the euro area between 1997 and 2002 is from around 25 to around 33 percent; interestingly, this is not part of a general trend: interbank loans outside the area declined during this period. Germany shows the clearest pattern, with a very large increase. However, no sign of break in the trend is visible around 1999.

Even clearer movements are visible in charts 3 and 4, showing bank holdings of securities, issued respectively by non-banks and by banks. For the euro area, these holdings increase from 20 to 60 percent (for non-bank issues) and from 15 to 30 percent (bank issues) in the 5-year span. For Germany and for the euro area, an acceleration of the upward trend is visible in 1999. No similar trend is visible for securities issued in the rest of the EU and in the rest of the world. Increased cross-border securities holdings have a bearing for monetary policy transmission insofar as banks' portfolios will be affected by changes in the value of the underlying securities (e.g. through changes in monetary policy) in a more homogeneous way. This makes their balance sheet conditions, and thus the working of the bank-lending channel, more similar.

[Charts 1 to 4 about here]

Direct contact with foreign customers is not the only way in which banks operate abroad. Opening of branches or subsidiaries, stock acquisitions and mergers are alternative ways, each with different organisational, regulatory and tax implications. We look first at evidence on branches and subsidiaries. Dermine (2002) recently noted that cross-border branching is not a very popular form of foreign penetration by EU banks, despite the existence of "single passport" provisions, due a number of tax and regulatory

[6] Full data also for the remaining countries is available on request.

segmentations. Our data confirms this. Table 1 shows the total assets of subsidiaries and branches of credit institutions from the EEA in each EU country, as a ratio to the total assets of domestic banks in that country. Foreign penetration in this form is fairly stable in the period under investigation (1997-2001) at what seems a relatively small level (8-9 percent). The presence of foreign banks is more sizeable in the smaller countries, which one would expect to be more open to foreign banking. Furthermore, the level of foreign penetration found for the euro area countries lies in a similar range than the one in the control group of Sweden, the UK and Denmark (although the numbers stand higher for the UK, reflecting London's importance as financial centre).

The comparison with the US, where interstate banking was gradually liberalised in recent years, is of particular interest in this context. During the 1970s and 1980s and up to 1994, state legislation in the US gradually allowed bank holding companies to operate across states, thereby effectively circumventing the prohibition of interstate banking. After the repeal of the restrictions (Riegle-Neal Act, 1994) bank holding companies' assets were incorporated into single banks. Hence, post-1994 data are probably distorted, but pre-1994 data can be very informative. Table 2 reports, for selected years, the percentage of total assets in each US state that is held by Bank Holding Companies which are incorporated in other US states, using data and methodology similar to that of Morgan et al. (2002)[7]. We note that, first, the progress of interstate banking in recent US history was very slow, and the orders of magnitude of the increase are not dramatically different from those we have for the euro area. Second, banking centre states, like California or New York, are subject to very little penetration, similarly to what we observe, for example, in Germany. On the other hand, recently – between 1990 and 1994 – a sharp rise is visible in the overall US measure of penetration. This is a much stronger movement than the one observed in the euro area yet, 10 years after the completion of the Single Market and 5 years into the age of the euro.

[Tables 1 and 2 about here]

A somewhat different picture emerges if one looks at M&A activity. On this, the perception in recent years, shaped by Danthine et al. (1999), has been that supervisory and regulatory impediments are responsible for the lack of cross-border bank mergers in continental Europe. Table 3 collects recent data on the number of M&A operations, distinguishing whether the target is a domestic bank, a bank in the euro area or another bank.[8] Some progress in cross-border merger activity emerges after 1999. Though domestic mergers are still prevalent, cross-country ones within the euro area are on the rise: the yearly average is 17.7 after 1999, as against 9 before. This is a large increase in relative terms, by the standard of other countries shown in the table. Most of the activity in the euro area has taken place in countries where bank concentration is lowest (see the Herfindahl index), suggesting that the starting asymmetries in concentration, albeit still high, are diminishing. As an aside, it is interesting to note how high is the number of domestic mergers in the US: several hundreds a year. This is a telling measure of the different competitive environment that exists in banking between the two areas.

[Table 3 about here]

[7] We thank Phil Strahan (without implicating him) for giving us access to his data, and for suggestions on how to adjust his measure of bank penetration to make it comparable to that of Table 1. Basic data are taken from the Commercial Bank and Bank Holding Database of the Federal Reserve Bank of Chicago.

[8] The data are drawn from SDC Thomson Financial. They cover only mergers and acquisitions beyond a certain size threshold. Especially in countries with many mergers among small banks, the SDC numbers can underestimate actual numbers (see also ECB, 2000).

What do we conclude from this? No doubt, bank integration in the euro area is not advancing fast. The introduction of the euro does not seem to have triggered revolutionary changes so far. But there are significant changes going on. Movements look more marked after 1999 in some key measures, such as interbank flows, securities holding, and to a lesser extent M&As. However, it remains an open question whether the current level of bank integration is sufficient for a homogeneous transmission of monetary policy. To answer this question, the reaction of prices of banking products to monetary policy should provide a more direct answer. We now turn to this.

3.2 - Transmission of monetary policy to bank interest rates

We use monthly data on lending and deposit interest rates, across a variety of instruments and maturities, on a comparable basis for 5 euro area countries and for the euro area as a whole[9]. Our aim is to study how bank lending and deposit rates react to changes in the money market rates. These results provide answers to the set of questions posed in the introduction in two ways. First, changes in the passthrough parameters over time can tell us something about whether the transmission through bank rates has changed. Breakpoints in 1999 are obviously a focus of attention. Moreover, also the direction of change – e.g., more powerful transmission; or a more rapid one – is of interest. Second, the wealth of sectoral and country data allows a variety of tests of cross-country homogeneity. Obviously, we are particularly interested in the question of whether post-1999 the pass-through of monetary policy to bank rates has become more homogeneous across countries.

We calculate three parameters: the impact effect (within a month); the maximum effect (whenever it occurs); the time needed to reach this maximum effect. We calculate these parameters across all rates and countries, and for the euro area average, using two models. The impact effect is estimated using a simple regression of changes in the bank rate on changes in the money market rate and a constant, whereas we use a simple bivariate VAR in levels to calculate the peak effect and the timing[10]. The results are summarised in table 4 (results grouped by country) and table 5 (grouped by type of instruments). More information about the calculation of the models and the tests is provided in the table footnotes.

Table 4 reports results for the five largest euro area countries, for the area as a whole, and for a "control group" of countries (UK, Sweden, Japan, US) not affected by EMU. The impact, peak, and timing parameter (in months) are reported, separately for two subperiods: 1990-98 and 1999-2002. Data are averaged across types of rates for each country (the number of rates available for each country is indicated). We also indicated the number of rates, within each country, where the coefficient moves up or down, accompanied where possible by information about statistical significance. There is a clear upward movement of the impact response and the peak response, except in Germany, where both decline slightly. This phenomenon is completely absent in the control group. Moreover, the dispersion of these two parameters across the euro area countries, measured by the coefficient of variation, declines sizeably in the second period. These results speak unambiguously in favour of a stronger response, both on impact and over time, of most bank rates, and of

[9] This set of statistics, available at www.ecb.int, was assembled by the ECB based on information collected by Eurosystem National Central Banks. The raw data used in our econometric estimates are shown in charts A1 and A2 in the Annex.

[10] Clearly, the simple regressions do not allow a sufficiently detailed dynamic analysis. The VAR shocks were all standardised by dividing by their standard error.

more area-wide homogeneity of these effects. On the contrary, we find no evidence that the speed of the passthrough to bank rates is faster, either in the euro area or in the control group. Overall, the message is: a stronger and more cohesive transmission mechanism after 1999, but not a speedier one.

[Table 4 about here]

Table 5a allows further interesting insights. There we show the same coefficients averaged by instrument type, to draw information on where specifically the changes in the potency of the transmission may be located. Mortgage loans and loans to corporations stand out in showing the largest increase in the impact coefficient between pre-1999 and the successive period. This speaks in favour of a more potent transmission channel to both households (mortgage owners) and firms.

Other aspects are also worth noting. The first concerns again the cross-country comparisons. Some tests of cross-country restrictions calculated on the impact coefficient are shown in table 5b. The idea behind these tests is that, even though there is smaller variation across countries, nothing ensures that the coefficients are actually similar after EMU. In fact, they are not. With the exception of mortgage loans, loans to corporations (long term) and time deposits (long term), in all cases the equality of coefficients across countries is rejected at the standard significance levels. Interestingly, maturity seems to matter: equality is accepted in all the long-term loan and deposit categories, and rejected in the short-term ones. In all events it is clear that, despite the sizeable changes that have taken place between our two time subperiods, considerable ground still needs to be covered before a full or near homogeneity of the transmission through bank rates is achieved in the euro area.

[Tables 5a, 5b about here]

More importantly, we need to check whether the break that apparently takes place between the first and the second subperiod is indeed located at or around the start of 1999. For this purpose we repeat the simple regressions of tables 4 and 5 (first column), estimated with rolling-window samples of 36 months. The results, reported in chart 5 for a selection of euro area rates, are very suggestive. A vertical line marks the first window that includes observations post-EMU. The coefficient generally starts rising once observations after 1999 enter the regression window and keeps on rising while new observations from the new regime are added in. It is clear from chart 6 that no such pattern can be found for the countries outside the euro area.

[Charts 5 and 6 about here]

A separate but related issue worth a mention concerns the maturity of bank loans. One established empirical regularity is that the maturity (or duration) of financial contracts tends to be inversely related, across countries, to the level and the variability of inflation (Borio, 1995). High inflation countries tend to be characterised by shorter financial contracts. The loan market of the euro area is no exception to this rule; countries with a recent history of high inflation, such as Italy and Spain, were until recently characterised by shorter average loan maturity than, say, Germany. This has a potential implication for the transmission process, since a shorter (or equivalently, floating rate) loan or mortgage contract tends to generate cash-flow responses to changes in policy-driven interest rates that are different from those of long contracts (at fixed rate). The interesting message coming from table 6 is that such differences are in the process of being reduced in the euro area. For all categories of loans taken into consideration (covering loans to both non-financial corporations and households) the cross-country variance of maturity (measured crudely by the share of loans

with original maturity over 5 years) is on a declining trend. The maturity in Spain and Italy is on the rise, conceivably as a result of the fact that expectations of price stability have been strengthened; in France it is roughly constant. Interestingly, in Germany, which has had historically the highest share of loans beyond 5 years, maturity is slowly declining.

[Table 6 about here]

To conclude, the overall message from the evidence from bank interest rates seems rather clear. There has indeed been a structural change in the way euro area banks set their lending and deposit rates. The change is in the direction of a stronger response of bank rates to central bank signals. The starting point is around 1999. Since this effect is not found for countries outside the euro area, we conclude that it is caused by monetary union. There is also evidence that the estimated responses of banks to policy signals are increasingly homogeneous across countries.

4. Evidence on the Financial Market Channels

In focusing on the non-bank financial sector, we are again looking for evidence that can help us characterise the post-EMU transmission process and to show whether any change has taken place, particularly with regard to the degree of cross-country homogeneity.

Relative to the bank-lending channel, which at least conceptually is relatively straightforward to define (though quite difficult to identify empirically), the range of financial market channels is broader, more articulate and complex to pin down. Transmission through the financial markets can take place in a number of different ways, involving difficult issues of conceptual as well as empirical identification. A short discussion on the logical framework can be of help.

Our conceptual reference is the survey of the transmission mechanism published in 1995 by the Journal of Economic Perspectives (see, in particular, the contributions by Mishkin, John Taylor, Meltzer and by Bernanke and Gertler). In this section we are interested in what Mishkin calls there the "interest rate" and the "asset price" channels. According to Mishkin, the first consists of the traditional Keynesian effect whereby a monetary tightening is transmitted, through liquidity and expectations effects, to the structure of nominal and real interest rates, and indirectly to investment and consumption plans by non-financial firms and households. A slightly more specific definition is to say that the interest rate channel (IRC) is the mechanism that operates in the absence of capital market imperfections, i.e. only through intertemporal reallocation of expenditures that follows a change in expected real interest rates (which are the *prices* of such reallocation; see Angeloni, Kashyap and Mojon, 2003). In principle this definition should exclude asset market effects or "broad credit channel" effects stemming from changes in "external finance premia", emphasised by Bernanke and Gertler (1995) and Bernanke, Gertler and Gilchrist (1999). In practice, however, it is very difficult to empirically distinguish between a "pure" IRC and these other influences (a point recently made by Bernanke[11]).

Attacking empirically all these subtle distinctions would be impossible with our limited data. Our pragmatic way forward is to concentrate, first, on something that approximates the IRC in its purest form, looking at measures of cohesion among nominal and real interest rates (short and long term) on riskless assets. We do this in the next subsection. After this,

[11] See his discussion in Angeloni, Kashyap and Mojon (2003).

in the following subsection we approach (at least one angle of) the "asset price" channel, by comparing the impact of monetary policy on different national stock markets.

4.1 - Interest rate channel

Our basic idea here is that, if the IRC has become homogeneous in the euro area after 1999, then it must be true that the structure of riskless rates in real terms follows the same law of motion in all member countries. Specifically, it must react to monetary policy signals in the same way. This is obvious for nominal rates, which after EMU are forced to coincide by arbitrage given the absence of exchange-rate risk. It is not obvious for real rates, which include also expected inflation. A homogeneous comparison between pre- and post-EMU evidence can be based on measures of co-movements of real interest rates, at different maturities, across the two time periods.

We use nominal short and long-term rates on 3-month interbank rates and 10-year government bond rates. Our crude measure of inflationary expectations is the 12-month forward changes of national Harmonised Indices of Consumer Prices[12]. Lacking robust evidence on the stationarity of the data[13], we look at both levels and changes of the data. We examine three time periods. The first, 1990-1994, spans from the removal of short-term capital controls to the ERM crisis of 1992-93 and its aftermath. The second, 1995-1998, covers a time when interest differentials were strongly affected by the so-called "convergence trades" in the financial markets, driven by expectations of EMU. This has conceivably produced a convergence in interest rate levels, but not necessarily in higher-frequency movements. The third, 1999-2002, coincides with the first 4 years of EMU, and is the period we are most directly interested in.

Table 7 contains measures of interest rate co-movement, within the euro area countries and for three control groups: the euro area vs. the rest of the EU; the euro area vs. the US and Japan; and four main US Census regions among themselves[14]. As measure of co-movement we use the *variance of the interest differential*, rather than the more common *correlation coefficient*[15]. The bilateral variances are aggregated using GDP weights[16]. The *within* euro area variance, expressed as a single number, can then be compared with that *between* the euro area and the control groups, and with that *within* the US.

[12] Using backward inflation rates gives similar results.

[13] With our short data samples, standard tests of stationarity would probably lack power. Looking at levels and changes together should provide some robustness. Some evidence on stationarity will emerge from our results.

[14] US regional price data from the Bureau of Labor Statistics (www.bls.gov/cpi/) refer to four regions: West, Midwest, South, Northeast. We also tried with city data, available from the same source (results available), finding that the variance of between-city inflation differentials is much wider that that of between-region differentials. Hence, US regional data seem to provide a closer analogue to our euro area country data. We thank Steve Cecchetti, without involving him, for useful information about this data.

[15] The variance of the differential seems more accurate for our purpose. A correlation coefficient of 1 is necessary but not sufficient for the variance of the differential to be zero: if the variances are different, the differential varies even if the two rates are perfectly correlated. Hence the variance criterion is more restrictive. On the other hand, the variance of the differential can fall if the variances change, even if the correlation remains constant or even declines.

[16] The formula is $\Sigma w_i w_j Z_{i,j} / \Sigma w_i w_j$, where $Z_{i,j}$ are bilateral variances and w_i are weights based on GDP. Croux, Forni and Reichlin (2001) use similar weighting to calculate "cohesion measures" across regional cycles in an economic area.

As one would expect, the variance of the nominal interest rate differentials vanishes after 1999 in the euro area, but not between the euro area and the control groups. More interestingly, the variance of the *real* interest differentials (in level), short and long, dramatically declines too. In the control countries, there is also some decline, but less strong. There is no decline among the US regions. Data in first difference (lower panel) show a different pattern of convergence. The main reduction in the variance is between the first period (1990-94) and the second (1995-98), not after 1999; there is a similar decline between euro area and other EU, but not with the other control groups. Within the US the variance of the differential does not decrease. The overall message is mixed: there is a sharp convergence, but it does not take place unambiguously after EMU (it depends a lot on whether levels or changes are considered), nor does it exclusively take place among euro area members. The other EU countries (UK, Sweden, Denmark) converge too. The developments are instead quite different if one looks other areas (euro area vs. US and Japan, or within US).

It is interesting to compare the absolute values of our variances. Post-EMU the euro area variances are .39 and .10, for levels and changes respectively. The comparable values for the control groups are similar or (for short-term rates) higher. In the US, the variance of the real interest rate differential in level is .32, and in first difference is .19. These figures are qualitatively the same as in the euro area.

[Table 7 about here]

Table 8 provides another reading of the results of table 7, focusing however on bilateral differentials rather than on weighted averages for country groups. The table "counts" the number of bilateral variances that decline between each pair of samples. The number of significant declines (at the 5 percent level) is indicated in parenthesis. Earlier conclusions are confirmed. For the euro area, there is a fairly large number of significant declines after 1999, both considering interest rate levels and changes (33 and 27 over 45, respectively). However the decline before 1999 is stronger. In all our control groups, such pattern emerges less clearly or not at all. In sum: convergence in the euro area is evident, and stronger than in the control groups, but 1999 was not a clear watershed.

[Table 8 about here]

Further insight can be gained from chart 7, showing spectral densities of real interest rates, in both level and first difference form in the euro area. The spectral density allows more precise statements concerning co-movements at different frequencies. The area below the spectrum over the whole frequency range equals the variance (Hamilton, 1994, p.158). Hence one can see where the variance concentrates across frequencies. The chart shows a frequency range between zero (lowest) to π (highest), passing through 0.5 (about 12 months), 1.0 (about 6 months), 2.0 (about 3 months). The charts on the levels show that the variance is concentrated in the lowest frequency ranges (above 6-12 months), in all three periods. There is a sharp reduction in the variance at these frequencies as one moves towards subsequent periods, particularly after 1999, signalling that the low frequency components of the variance are being removed. In the charts on short term and first difference data, a hump shape shows up in 1990-94 in the spectrum between 3 and 6 months. This evidence is suggestive. Recalling the modalities and timing of foreign exchange crises in the ERM years, e.g. the ones of 1992-93, it is plausible to think that such concentration of variance be attributable to divergent conduct of monetary policy to contrast exchange-rate tensions. The disappearance of the hump in 1995-98 and 1999-2002 confirms this. In the later periods the spectral density of short real rate differentials flattens,

suggesting that the stochastic processes driving short real rates in different euro area countries may approach random noise. The typical spectral shape of a white noise (flat) is reached only after 1999, however. Moving to long-term rates, the picture is slightly different. The hump characterising the spectrum in the first period is around 12-24 months. In the subsequent periods the spectrum again flattens, particularly after 1999 (comparison with the previous chart should be made keeping in mind the different scale). The large decline in variance particularly at the low frequencies is interesting insofar as this is likely to be the relevant frequency for firm investment decisions. All this confirms that the convergence in the stochastic processes driving real rates (short and long) took place well before 1999, but that after 1999 there was further progress. After 1999, real rate differentials in the euro area (levels and changes) look a lot like white noises.

[Chart 7 about here]

We rationalise this evidence[17] using a simple framework of how the IRC operates in a two-country area without and with monetary union. We start from two simple equations representing the effect of a monetary policy signal ($m_{A,t-j}$) on financial market interest rates and on expected inflation in a generic country A:

[1] $r_{A,t} = \Sigma w_{A,j}\, m_{A,t-j} + \varepsilon_{A,t}$

[2] $\pi^e_{A,t} = \Sigma h_{A,j}\, m_{A,t-j} + \eta_{A,t}$

Where $r_{A,t}$ is a nominal rate, $\pi^e_{A,t}$ is expected inflation and $\varepsilon_{A,t}$ and $\eta_{A,t}$ are random shocks, including other factors affecting nominal rates and expected inflation. The parameters $w_{A,j}$ and $h_{A,j}$ represent the transmission process: specifically, $w_{A,j}$ expresses lagged liquidity and expectations effects acting upon the nominal rate, while $h_{A,j}$ denotes the lagged effects of monetary policy to expected inflation. The real rate is:

[3] $\rho_A = r_A - \pi^e_A = \Sigma(w_{A,j} - h_{A,j})m_{A,t-j} + (\varepsilon_A - \eta_A)$

Consider two countries, A and B. The real interest differential between them is:

[4] $\rho_A - \rho_B = \Sigma(w_{A,j} - h_{A,j})m_{A,t-j} - \Sigma(w_{B,j} - h_{B,j})m_{B,t-j} + \varepsilon$

where $\varepsilon = (\varepsilon_A - \eta_A) - (\varepsilon_B - \eta_B)$.

After A and B form a monetary union, $r_A = r_B$ and $w_{A,j} = w_{B,j}$ by arbitrage. There is only one monetary shock, m_t. The real interest differential becomes:

[5] $\rho_A - \rho_B = \pi^e_B - \pi^e_A = \Sigma(h_{B,j} - h_{A,j})\, m_{t-j} + \varepsilon$

Our problem is to verify the similarity of the transmission parameters between A and B, before and after they join the monetary union. Ideally, one would like to estimate fully specified versions of [1], [2] pre- and post-EMU, and test for equality of the coefficients. There are several problems in doing this in our case, however. First, $m_{A,t-j}$ and $m_{B,t-j}$ are not comparable with m_{t-j}, because pre- and post-EMU monetary signals originate in different central banks, using different monetary instruments acting through different money markets. Second, post-EMU data are too short to calculate reliable transmission parameters using time series data alone.

A framework to interpret our results can be provided directly by [4] and [5]. As we have seen, our differentials show a tendency to converge to a low-variance white noise from

[17] Readers puzzled by this post-data rationalisation should reflect on the following quote from Sherlock: "It is a capital mistake to theorise before one has data. Insensibly one begins to twist the facts to suit theories, instead of theories to suit facts." Doyle (1951), "*A Scandal in Bohemia*".

1990-94 to 1999-2002, with the intermediate period (1995-98) being somewhere in between. In eq. [4], i.e. prior to monetary union, $\rho_A - \rho_B$ is a low-variance white noise only if three conditions are met: (a) $m_{A,t-j} \cong m_{B,t-j}$ (the countries have similar monetary policies); (b) $w_{A,j} = w_{B,j}$ and $h_{A,j} = h_{B,j}$ (the transmission parameters are the same); (c) ε is a low-variance white noise. This is indeed a very stringent set of conditions, which can explain why we find large variances in the first period (pre-1994), and no white noise structure. Post-EMU (eq. [5]), $\rho_A - \rho_B$ is a low-variance white noise if (d) $h_{B,j} \cong h_{A,j}$ and (e) $\varepsilon \equiv \eta_B - \eta_A$ is a low-variance white noise. This seems indeed true in our data. Hence our evidence is consistent with conditions (d) and (e) – though of course it does not prove them.

4.2 – Stock market channel

The stock market is a key link of the transmission mechanism according to both monetarist and Keynesian views (see again Mishkin, 1995). Tobin's *q* theory assigns to stock prices a central role in transmitting policy shocks to firms' investment. At the same time, stock prices also affect the consumer, through wealth effects (see e.g. the article by Allan Meltzer in Mishkin ed., 1995). Structural macro-econometric models of the United States (e.g. that used by the Federal Reserve Board; see Reifschneider et al., 1999) ascribe to the stock market a major role in the transmission of monetary policy. In Europe, where stock ownership is limited but growing fast, exploring this channel is important. Furthermore, the response of stock prices reveals the markets' view of the effects of monetary policy.

A second reason for looking at the role of the stock market in our case is empirical. We have at our disposal rich high-frequency data on national and euro area-wide stock market prices, including a breakdown by country and economic sectors. We also have a new high-frequency proxy that identifies unexpected monetary policy shocks. This variable – constructed by Ehrmann and Fratzscher (2002) – compares ECB monetary policy decisions with market expectations drawn from a Reuters poll of market participants before each ECB Governing Council meeting[18]. Combining the two, we can identify exogenous monetary policy shocks and obtain precise estimates of the causal effect of monetary policy on the national stock markets. Unfortunately, these high quality data are not available before EMU, so no comparison across time can be made.

We start by analysing the national stock market indices. The focus of our interest is whether the effects on national markets are sufficiently homogeneous. Our maintained prior is that the immediate stock market impact of the news contains information on the longer run effect, relevant from a monetary transmission perspective. To isolate the effect of monetary policy surprises from those of other news, our data set includes snapshots of stock market indices between 12:30 p.m. and 15:30 CET each day. The ECB monetary policy decisions are announced on meeting days of the ECB Governing Council at 13:45. At 14:30, the ECB President's press conference starts. This meeting is a televised session in which the motivations of the policy decision are discussed. By the end of the time window, at 15:30, it can thus be presumed that further information on the meeting's outcome has been incorporated in the market. Chart 3 in the Annex illustrates these windows and the

[18] We use the mean of the survey as our expectations measure, and define monetary policy surprises as the difference between the announced interest rate decision and this expectations measure. As shown in Ehrmann and Fratzscher (2002), these expectations are unbiased and efficient.

stock market movements on a particularly interesting day, namely Thursday, November 7, 2002.[19]

The choice of a three-hour window represents an intermediate horizon compared to the existing literature. Andersen et al. (2003) analyse exchange-rate reactions to news using five-minute intervals. However, since asset prices have a tendency to overshoot in the short-run, the effects measured at such high frequencies might be overstated. An analysis of daily returns, on the other hand, might underestimate monetary policy effects especially in small samples, since a lot of additional information affects asset markets during the course of a full trading day. Only in very long samples will the additional news cancel out. We would therefore hope that an intermediate horizon can approximately capture the relevant effects, by giving markets time to process the new information and settle, without leaving too much time for arrival of further news.

Table 9a (upper panel) shows estimates of the effect of our ECB monetary surprise measure on 10 national stock market indices. We used a Seemingly Unrelated Regression model to allow for residual covariance across the indices. The models, though simple, produce estimates that are remarkably close to the theoretical priors[20]: the estimated impact of a monetary tightening on stock indices is negative in all 10 countries except Ireland, where it is positive and insignificant. The majority of the slope coefficients are significant. The effect on the area-wide Euro Stoxx, a Dow Jones capitalisation-weighted index including a large variety of euro area stocks, into 10 sectors, shown for comparison, is well within the range of the national effects, as one would expect. Focusing on bilateral differences across national coefficients (a measure of how geographically homogeneous the response is) one sees that there are three countries whose estimated coefficients are somewhat far from the average: Germany (higher negative coefficient), Portugal (higher) and Ireland (wrong sign). The Chi-square test of full cross-country homogeneity (table 9c) is rejected at the 5% level, but comfortably accepted if Portugal and Ireland are excluded. The test of equality across the 5 largest countries is also accepted at the 5 percent significance level.

[Table 9a, 9b, 9c about here]

The residual differences among the national responses could in principle be explained by a different sector composition of national stock markets. This would happen if different sectors react differently to monetary policy, and if the sector composition of national

[19] On that day, many market participants expected an interest rate cut by both the Bank of England and the ECB. Note that the Monetary Policy Committee of the Bank of England meets on Wednesday and Thursday at the beginning of each month, and the announcement of its deliberations, at 12:00 GMT, roughly coincides with the closing of the ECB Governing Council meeting (after allowing for time difference). The US Fed had reduced the federal funds target rate the day before by 50 basis points, and markets felt this might have been part of a concerted action with the Bank of England and the ECB. The decision by the Bank of England not to move rates (announced at 13:00 CET) contradicted this speculation, hence market participants apparently reconsidered their expectations of an interest rate cut by the ECB at the time of the Bank of England announcement. In the end both central banks left their policy rates unchanged. The chart shows that the "negative surprise" in the UK impacts at 13:00 CET both the FTSE and the continental European markets. A similar downward effect follows the ECB announcement. Further adjustments take place subsequently, before and during the ECB press conference.

[20] All in all, the empirical literature has not been very successful in measuring the stock market impact of monetary policy. The comprehensive survey by Sellin (2001) which reports contributions up to 1998, concludes that increases in policy rates generally lead to lower stock prices. However, several recent papers, such as Bomfim and Reinhart (2000) and Roley and Sellin (1998), on the US, conclude otherwise. Bomfim (2000) again finds evidence for the US that accords with the theoretical priors.

markets differ. To explore this we examine the composition of Euro Stoxx.[21] The monetary policy impact on the Euro Stoxx sectors is shown in the lower panel of 9a, and the sectoral composition of national stock market indices in 9b. The results are interesting, suggesting that the sector effects are quite precisely estimated and not too dispersed[22]. In fact we cannot reject at the 1% level the hypothesis that all responses across production sectors are equal, though we do reject this hypothesis at the 5% level. This already hints at a negative answer to our question, namely, if national differences can be explained by sector composition effects. The bottom section of 9c reports tests for *proportionality* of the national coefficients with the "theoretical" ones, calculated from the sector-level impact effects (9a, bottom) and the sector composition data (9b). The answer to our question is in fact negative. The test values are only slightly lower than the ones obtained earlier, when testing for *equality* of the national coefficients. We conclude that our estimated sector differences do not seem able to explain much of the observed national differences. The latter, however, as we have seen, are not very large or significant to begin with.

5. From Observation to Deduction, and Further Investigation

Our examination of the evidence stops here. There is little more, if anything, that our data can tell us. Time for our modern-day Sherlock to return to his flat, fill his pipe, measure the living room with endless strolls, and arouse Dr Watson's curiosity with his impenetrable silence. What inference can be made? Is the case settled?

There is one obvious starting point. Banks, the major suspect, have indeed changed something in their behaviour. The connection with "the crime" seems evident, *post-hoc* and conceivably also *propter-hoc*. The key bank decision variables, the prices on the products they offer, have started behaving in a different way exactly at the time and in the way one would have expected in case of guilt. This is a fact. But from here several avenues depart, and different explanations are possible. Banks *could* have behaved in such way because of increased pressure from the euro-induced new competitive environment. The evidence on certain aspects of bank international penetration hints in this direction. There are market segments (interbank lending, securities taking) where the move towards integration is sizeable enough to explain the facts. But other segments, more important from the viewpoint of the transmission mechanism (like direct lending to cross-border customers; branching and mergers abroad) lag behind. However, some comparative evidence (like that on the US) suggests that bank integration is always a slow process, even in what one would bet to be a fully integrated market.

On the other hand, other factors *could also* explain this change in bank behaviour. Useful connections may be found elsewhere. For, as Sherlock would say, one true inference invariably suggests others[23]. Financial market interest rates have also begun to move differently. Market rates are the main drivers of bank rates. There is a likely link between

[21] This is an approximation, as national indices contain more stocks and a finer sector detail than Euro Stoxx.

[22] The sector slope coefficients, all correctly signed, show some diversification across output categories. Telecommunications, consumer goods, technology and finance seem the most sensitive sectors. This seems in conflict with earlier research by Dedola and Lippi (2000) and Peersman and Smets (2002), showing that highly capitalised sectors and sectors producing durable goods are more sensitive to monetary policy changes. However, these results are based on the response of production to VAR based monetary policy shocks, with a much finer industry classifications than is available to us. These differences limit the comparability of results.

[23] Doyle (1951), "*Silver Blaze*".

the two. True, the *post-hoc* element here is weaker: market interest rate, in nominal and real terms, had already started to comove in the pre-EMU period 1995-98. But the move strengthened, and became permanent, only after 1999. Cross-country interest rate comovements in the euro area now mimic closely those that we observe among US regions. This is supporting evidence that the process of interest rate determination, in banking and in the financial markets, has moved in the direction one would expect. It is also evidence that the interest rate channel, another important co-suspect, is a contributing factor leading to both changes in the transmission process, and more cross-country homogeneity.

If all this holds true, then one would expect to also see changes in the transmission of monetary policy to asset prices post-1999. Present and expected future real rates are the discount factors that translate future income flows into current asset prices. Other things being equal, stronger interest rate co-movements across countries should tend to generate homogeneous stock price responses across countries. Unfortunately, our data did not allow this comparison across time to be made. But we observed that, post-1999, the impact of monetary policy on stock prices is broadly similar. This is compatible with – though it does not prove – the hypothesis that *both* the reaction of expected future dividends, *and* that of expected future interest rates, are similar across countries.

Is our case closed? We doubt Sherlock would conclude this quite yet. But we do think that he would consider the sequence of conjectures that we have described as *the most plausible working hypothesis given the current state of knowledge*. He would then probably depart for further investigation. We instead stop here for now, leaving the rest for future research. The transmission of monetary policy in the euro area after EMU is a new research subject. Many promising developments come to mind, especially when more data will become available. We just mention some here.

Financial integration in the euro area, in the banking as well as the non-bank financial sectors, particularly in its relation to EMU, needs analysing and monitoring closely. This should provide continuously new evidence also on the monetary transmission mechanism and its changes. Another frontier ahead seems to be the analysis of the impact of EMU on the euro area labour and product markets. Studying the origin and the nature of inflation persistence in the euro area is a crucial first step. Since extended post-EMU data series will be unavailable for long, in the interim cross-sectional data should be exploited as much as possible. The role of the exchange rate in the euro area transmission process should also be analysed; this is something we have completely set aside in this paper. One should look afresh at this, using recent theories on pass-through and pricing to market as a starting point (see e.g. Bacchetta and Van Wincoop, 2002). Furthermore, the behaviour of euro area consumers and specifically their reaction to monetary policy and to financial factors merit further research. Relevant differences in the effect of monetary policy on consumer behaviour between the euro area and the United States have been noted, and call for explanation, see Angeloni et al. (2003).

Further ahead, the major challenge seems to be the construction of comprehensive models of the euro area, with proper microfoundation and a realistic characterisation of the transmission process. There have been good steps in this direction – e.g. Smets and Wouters (2002); Christiano, Motto and Rostagno (2003) – but the goal is still very far. Like Scotland Yard in our detective's tales, model builders are condemned by the nature of their approach to always be last in accounting for new events. Surely their story, when it comes, will be more complete and systematic than the one we have told here.

Bibliography

Agresti, A. M. and B. Mojon, (2003), Some stylised facts on the Euro area business cycle, forthcoming in: Angeloni I., A. Kashyap, B. Mojon (eds.), *Monetary policy transmission in the euro area*, Cambridge University Press;

Andersen, T.G., Bollerslev, T., Diebold, F.X. and C. Vega (2003). Micro Effects of Macro Announcements: Real-Time Price Discovery in Foreign Exchange, forthcoming, *American Economic Review*;

Angeloni I., A. Kashyap, B. Mojon (ed.) (2003), *Monetary policy transmission in the Euro area*, forthcoming, Cambridge University Press*;*

Angeloni, I., A. Kashyap, B. Mojon and D. Terlizzese, (2003), The output composition puzzle: a difference in the monetary transmission mechanism in the Euro area and the U.S., forthcoming, *Journal of Money Credit and Banking*. See http://www.clev.frb.org/Research/conf2002/november/index.htm

Bacchetta, P. and E. Van Wincoop (2002), A theory of the currency denomination of international trade, *ECB Working Paper No. 177*;

Bernanke, B. and M. Gertler (1995), Inside the Black Box: The Credit Channel of Monetary Policy Transmission, *Journal of Economic Perspectives* 9, 27-48

Bernanke, B., M. Gertler and S. Gilchrist (1999), The financial accelerator in a quantitative business cycle framework, *Handbook of Macroeconomics*, Volume 1c;

BIS, (1995), Financial Structure and the Monetary Policy Transmission Mechanism, *Bank for International Settlements;*

Bomfim, A.N., (2000), Pre-announcement effects, news, and volatility: monetary policy and the stock market, *Board of Governors Finance and Economics Discussion Paper No. 2000-50*;

Bomfim, A.N. and V. Reinhart, (2000), Making news: financial market effects of Federal Reserve disclosure practices, *Board of Governors Finance and Economics Discussion Paper No. 2000-14*;

De Bondt, G., Mojon, B. and N. Valla (2003), The adjustment of retail rates in the euro area: is it (really) sluggish?, mimeo, ECB, presented at the CEPR seminar "Will Universal Banking Dominate or Disappear?, January 2003

Borio, C.E.V. (1995), The Structure of Credit to the Non-Government Sector and the Transmission Mechanism of Monetary Policy: A Cross-Country Comparison. BIS Working Paper No. 24

Cecchetti, S., (2001), Legal structure, financial structure and the monetary policy transmission mechanism, in: Deutsche Bundesbank (ed.), *The Monetary Transmission Process*, Palgrave;

Christiano, L., R. Motto and M. Rostagno, (2002), Banking and financial frictions in a dynamic, general equilibrium model, mimeo;

Ciccarelli, M. and A. Rebucci (2002), The Transmission Mechanism of European Monetary Policy: Is there Heterogeneity? Is it Changing over Time?, IMF Working Paper No. 02/54

Croux, C., M. Forni and L. Reichlin, (2001), A measure of comovement for economic variables: theory and empirics, *Review of Economics and Statistics* 83(2), 232-241;

Danthine, J.-P., F. Giavazzi, X. Vives and E.-L. von Thadden, (1999), The future of European banking. Monitoring European integration 9, *CEPR;*

Dedola, L. and F. Lippi, (2000), The monetary transmission mechanism: evidence from the industries of five OECD countries, *Banca d'Italia Temi di Discussione, No. 389*;

Dermine, J., (2002) European banking: past, present and future, mimeo, prepared for the Second ECB Central Banking Conference on the Transformation of the European Financial System;

Dornbusch, R., Favero, C.A. and F. Giavazzi (1998), The immediate challenges for the European Central Bank, *Economic Policy,* 26, 17-64

Doyle, A. C., "*Sherlock Holmes, Selected Stories*" Oxford University Press, 1951.

Van Els, P., Locarno, A., Morgan, J. and J.P Villetelle (2003), Monetary Policy Transmission in the Euro Area: What do Aggregate and National Structural Models Tell Us?, forthcoming in: Angeloni I., A. Kashyap, B. Mojon (eds.), *Monetary policy transmission in the euro area*, Cambridge University Press;

Ehrmann, M. and M. Fratzscher, (2002), Interdependence between the euro area and the US: What role for EMU?, ECB Working Paper No. 200

Ehrmann, M., Gambacorta, L., Martinez-Pages, J., Sevestre, P. and A. Worms (2003). Financial Systems and the Role of Banks in Monetary Policy Transmission in the Euro Area, forthcoming in: Angeloni I., A. Kashyap, B. Mojon (eds.), *Monetary policy transmission in the euro area*, Cambridge University Press;

European Central Bank (2000), Mergers and Acquisitions involving the EU Banking Industry – Facts and Implications; see www.ecb.int;

European Central Bank (2002), Structural Analysis of the EU Banking Sector;

Fagan, G., J. Henry and R. Mestre, (2001), An Area-Wide Model for the Euro Area, *ECB Working Paper No. 42*;

Favero, C.A., Giavazzi, F. and L. Flabbi (1999), The Transmission Mechanism of Monetary Policy in Europe: Evidence from Banks' Balance Sheets, NBER Working Paper No. 7231

Guiso, L., A. Kashyap, F. Panetta and D. Terlizzese, (1999), Will a common European monetary policy have asymmetric effects?, *Federal Reserve Bank of Chicago Economic Perspectives,* 23(4), 56-75;

Hamilton, J. D. (1994). *Time Series Analysis*. Princeton: Princeton University Press;

Hofmann, B. (2003), EMU and the Transmission of Monetary Policy: Evidence from Business Lending Rates, mimeo, University of Bonn;

Kashyap, A.K. and J.C. Stein (1997), The Role of Banks in Monetary Policy: A Survey with Implications for the European Monetary Union, *Federal Reserve Bank of Chicago Economic Perspectives, Sept.-Oct. 1997*, 2-18;

Kieler, M and T. Saarenheimo, (1998), Differences in monetary policy transmission? A case not closed, *European Commission Economic Papers* No. 132;

Leamer, E., (1978), *Specification Searches: Ad Hoc Inference with Nonexperimental Data*, J. Wiley & Sons;

Mihov, I., (2001), Monetary policy implementation and the transmission in the European Monetary Union, *Economic Policy*, 33, 369-402;

Mishkin, F., ed. (1995), Symposium on the Monetary Transmission Mechanism, *Journal of Economic Perspectives* 9.4, Fall, 3-10;

Mojon, B. and G. Peersman (2003), A VAR description of the effects of monetary policy in the individual countries of the euro area, forthcoming in: Angeloni I., A. Kashyap, B. Mojon (eds.), *Monetary policy transmission in the euro area*, Cambridge University Press;

Morgan, D., Rime, B. and P. Strahan (2002). Bank Integration and State Business Cycles. Mimeo, Boston College

Pearce, D.K. and V.V. Roley (1983). The Reaction of Stock Prices to Unanticipated Changes in Money: A Note, *Journal of Finance* 38(4), 1323-1333

Peersman, G. and F. Smets, (2002), The industry effects of monetary policy in the euro area. *ECB Working Paper No. 165*

Peersman, G. and F. Smets (2003), The monetary transmission mechanism in the euro area: more evidence from VAR analysis, forthcoming in: Angeloni I., A. Kashyap, B. Mojon (eds.), *Monetary policy transmission in the euro area*, Cambridge University Press;

Reifschneider, D, Tetlow, R., and J. Williams (1999), Aggregate Disturbances, Monetary Policy, and the Macroeconomy: The FRB/US Perspective, *Federal Reserve Bulletin* (January), 1-19

Roley, V. V. and G.H. Sellon, (1998), Market reaction to monetary policy non-announcements, *Federal Reserve Bank of Kansas City Working Paper No. 98-06*;

Sellin, P., (2001), Monetary Policy and the Stock Market: Theory and Empirical Evidence, *Journal of Economic Surveys* 15(4), 491-541;

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

Smets, F. and R. Wouters (2003), Shocks and Frictions in US and Euro Area Business Cycles: a Bayesian DSGE Approach, EABCN Workshop in Madrid (ECB, mimeo), March 2003

Worms, A. (2003). The Reaction of Bank Lending to Monetary Policy Measures in Germany, , forthcoming in: Angeloni I., A. Kashyap, B. Mojon (eds.), *Monetary policy transmission in the euro area*, Cambridge University Press.

Appendix: Data Sources

- Bank balance sheet data (Table 6, Charts1-4): ECB (unpublished)
- Assets of domestic credit institutions and subsidiaries and branches of credit institutions from EEA countries, 1997-2001 (Table 1): ECB (2002)
- US bank assets: Federal Reserve Bank of Chicago Commercial Bank and Bank Holding Database (Table 2)
- Number of M&A's, 1995-2001 (Table 3): SDC Thomson Financial
- Herfindahl index, 2000 (UK: 2001) (Table 3): ECB (2002), Bankscope
- Bank lending and deposit rates for euro area and euro area countries, 1990-2002 (Tables 4 and 5, Charts 5-6, A1, A2): ECB, available at http://www.ecb.int/
- Money market rates, bank lending and deposit rates for non-euro area countries, 1990-2002 (Tables 4 and 5, Charts 5-6, A1, A2): BIS
- CPI, 3 month money market rates, 10 year government bond rates, 1990-2002 (Tables 7 and 8, Chart 7): BIS
- Stock market indices (DAX, CAC40, MIB30, IBEX, AEX, FTSE100), intraday data November 7th, 2002, 11:00-16:30 (Chart A3): Bloomberg
- Stock market indices (DAX, CAC40, MIB, SMSI, AEX, ATX, BEL20, HEX, ISEQ, PSI20, Euro Stoxx Sectoral indices, daily data recorded at 12:30 and 15:30, January 1st, 1999-November 8th, 2002 (Table 9): ECB collection of Reuters data
- Monetary policy surprise (Table 9): Ehrmann and Fratzscher (2002)

Tables and Charts

Table 1: Percent of bank assets in a country held by subsidiaries and branches of credit institutions from other EEA countries

	1997	1998	1999	2000	2001
Belgium	18.47	17.46	16.97	18.12	18.47
Germany	2.30	2.58	2.47	2.48	3.12
Spain	8.27	8.18	6.81	6.83	7.44
France	6.97	6.54	5.87	10.60	.
Ireland	.	.	33.54	29.82	28.01
Italy	5.21	7.37	7.16	6.50	6.28
Luxembourg	45.51	46.74	46.91	46.23	46.65
Netherlands	4.70	4.49	3.41	8.61	8.94
Austria	2.33	1.78	1.96	1.89	15.99
Portugal	11.58	15.87	11.00	17.49	19.08
Finland	7.21	7.06	8.14	6.82	5.35
Euro area (excl. GR, IE)	8.29	8.56	8.15	9.55	.
Sweden	1.39	3.49	3.43	.	.
United Kingdom	19.57	21.76	20.53	20.58	19.98
Denmark	.	5.95	4.09	5.04	14.32

Source: ECB (2002); authors' calculations; the number for Austria in 2001 is explained by the take-over of Bank Austria by the German HypoVereinsbank

Table 2: Percent of bank assets in a state held by out-of state bank holding companies

	1980	1984	1990	1994
Alaska	0.00	24.96	49.55	45.92
Alabama	0.00	0.00	0.32	1.24
Arkansas	0.00	0.00	0.00	0.45
Arizona	27.64	26.56	45.76	66.14
California	1.00	1.16	0.43	1.32
Colorado	5.49	14.19	4.04	28.60
Connecticut	0.22	0.18	16.28	19.74
District of Columbia	0.00	0.00	14.54	41.90
Delaware	0.00	20.12	55.69	44.92
Florida	0.02	0.08	2.45	17.96
Georgia	0.00	0.00	0.16	29.51
Hawaii	0.39	0.00	0.00	0.00
Iowa	20.28	22.72	24.49	34.23
Idaho	37.98	37.83	39.73	44.92
Illinois	0.67	1.49	4.59	12.99
Indiana	0.09	0.37	5.23	22.68
Kansas	1.31	2.92	2.95	12.44
Kentucky	0.00	0.00	5.19	34.80
Louisiana	0.00	0.00	1.95	7.20
Massachusetts	0.04	0.08	2.23	18.49
Maryland	2.59	3.68	27.96	69.20
Maine	0.00	11.58	15.71	7.38
Michigan	20.46	21.88	24.91	28.26
Minnesota	25.99	23.18	28.52	33.91
Missouri	0.16	0.34	0.89	0.92
Mississippi	0.00	0.00	2.40	10.29
Montana	42.32	42.53	37.19	31.82
North Carolina	0.00	0.00	0.61	0.68
North Dakota	32.69	36.46	39.30	37.24
Nebraska	10.07	11.96	15.86	16.69
New Hampshire	0.00	0.77	12.43	12.78
New Jersey	0.00	0.08	2.00	2.40
New Mexico	19.79	22.29	24.18	46.02
Nevada	47.67	48.67	65.47	63.14
New York	0.07	0.14	2.01	1.25
Ohio	5.17	13.13	2.12	4.35
Oklahoma	0.30	0.43	5.61	16.49
Oregon	29.21	28.73	31.90	40.39
Pennsylvania	0.00	0.00	19.67	32.08
Rhode Island	35.24	51.37	51.56	63.71
South Carolina	0.00	0.01	4.57	44.92
South Dakota	37.28	72.69	74.98	74.51
Tennessee	1.72	2.40	8.12	15.17
Texas	1.40	13.04	59.96	66.43
Utah	39.60	37.22	45.36	48.73
Virginia	0.00	0.19	1.42	16.58
Vermont	0.00	0.00	21.62	23.09
Washington	6.27	7.44	17.51	22.41
Wisconsin	4.07	4.24	8.41	6.51
West Virginia	0.00	0.00	7.62	16.21
Wyoming	20.66	19.78	10.72	17.95
USA	2.92	4.67	10.07	15.90

Source: Federal Reserve Bank of Chicago Commercial Bank and Bank Holding Database; authors' calculations

Table 3: Number of M&As involving credit institutions

	1995	1996	1997	1998	1999	2000	2001	avg p.a. 95-98	avg p.a. 99-01	Herfin-dahl
Domestic										
EA	80	63	70	62	70	68	49	68.8	62.3	89.7
Of which:										
FR	10	10	17	9	8	11	11	11.5	10.0	58.9
GE	11	11	16	12	22	10	8	12.5	13.3	15.1
IT	40	19	17	16	24	29	21	23.0	24.7	19.0
NL	0	0	3	1	1	0	1	1.0	0.7	169.4
ES	6	4	8	13	9	7	4	7.8	6.7	87.4
other										
EU	3	6	5	0	3	1	2	3.5	2.0	.
JP	1	3	1	2	26	16	31	1.8	24.3	28.7
US	670	562	409	459	292	239	220	525.0	250.3	12.8
Cross-border, target in the euro area										
EA	14	6	5	11	25	17	11	9.0	17.7	89.7
Of which:										
FR	5	1	0	0	3	3	0	1.5	2.0	58.9
GE	3	3	1	5	7	4	2	3.0	4.3	15.1
IT	0	1	0	1	3	2	0	0.5	1.7	19.0
NL	1	0	1	0	3	1	2	0.5	2.0	169.4
ES	2	1	0	1	3	3	2	1.0	2.7	87.4
other										
EU	2	2	1	0	3	2	2	1.3	2.3	.
JP	0	0	0	0	1	0	0	0.0	0.3	28.7
US	1	0	2	1	0	0	1	1.0	0.3	12.8
Other										
EA	38	25	37	36	45	49	44	34.0	46.0	89.7
Of which:										
FR	4	6	7	7	7	4	9	6.0	6.7	58.9
GE	10	3	6	6	15	14	8	6.3	12.3	15.1
IT	1	0	1	2	2	4	4	1.0	3.3	19.0
NL	6	2	4	4	2	1	5	4.0	2.7	169.4
ES	6	8	8	12	5	9	6	8.5	6.7	87.4
other										
EU	6	2	9	6	22	12	11	5.8	15.0	.
JP	3	2	2	1	3		1	2.0	2.0	28.7
US	4	6	13	15	6	6	10	9.5	7.3	12.8

Source: SDC Thomson Financial; Herfindahl index for Europe: ECB (2002); US and Japan: Bankscope; Herfindahl is computed for 2000 (UK: 2001)

Table 4: Effect of Money Market Rates on Lending and Deposit Rates (country averages)

Country (no. of rates)	Impact Coefficient			Maximum Response			Time to max		
	1990-1998	1999-2002	No. up	1990-1998	1999-2002	No. up	1990-1998	1999-2002	No. down
Germany (8)	0.441	0.387	4 (0)	0.852	0.765	4	6.875	4.750	4
France (2)	0.017	0.621	2 (2)	0.325	1.158	2	6.000	5.000	1
Italy (7)	0.153	0.396	7 (3)	0.541	0.931	6	4.714	6.286	1
Spain (9)	0.404	0.470	6 (2)	0.717	1.184	9	5.111	5.444	1
Netherlands (4)	0.389	0.468	4 (0)	0.800	0.850	3	4.750	3.000	3
Euro area (10)	0.241	0.380	9 (5)	0.475	0.744	9	14.600	5.000	3
UK (10)	0.422	0.423	4 (1)	1.481	0.810	2	6.700	6.100	5
Sweden (2)	0.395	0.581	1 (0)	0.609	0.455	1	1.500	1.000	1
Japan (10)	0.524	0.239	0 (0)	0.882	0.323	0	5.100	2.000	10
US (5)	0.838	0.744	1 (0)	1.367	1.304	3	4.400	3.800	2
Coeff. of Var. of EA countries	0.663	0.200		0.332	0.191		0.170	0.247	

Source: authors' calculations; the coefficients are averages from models for various retail rates. OLS regression equation for the impact coefficient: $\Delta r_t^{bank} = \alpha + \beta \Delta r_t^{mmkt} + \varepsilon_t$. Maximum response and time to max are computed from VAR responses of retail rates to a unitary shock to money market rates (obtained from a Choleski decomposition). Regression equation:

$x_t = \alpha + \sum_{l=1}^{2} \beta_l x_{t-l} + \varepsilon_t$, where $x_t = [r_t^{bank} \quad r_t^{mmkt}]'$. The last column for each statistic reports the number of cases where this statistic has increased ("up") or decreased ("down") in the second subperiod relative to the first (of which significant at the 5% level in brackets). Sample size: 1990:1 (or later) - 2002:7

Table 5a: Effect of Money Market Rates on Lending and Deposit Rates (averages by instrument)

Type of business (no. of rates)	Impact Coefficient			Maximum Response			Time to max		
	1990-1998	1999-2002	No. up	1990-1998	1999-2002	No. up	1990-1998	1999-2002	No. down
Euro Area									
Mortgage loans (5)	0.249	0.394	5 (1)	0.517	0.840	4	3.200	4.000	1
Loans to consumers (5)	0.299	0.298	3 (0)	0.684	0.832	4	7.400	6.200	2
Loans to corporations (11)	0.35	0.534	8 (3)	0.811	1.110	9	14.636	5.000	4
Deposits (19)	0.297	0.404	16 (8)	0.565	0.836	16	5.105	5.105	6
UK, Sweden, Japan, US									
Mortgage loans (5)	0.289	0.458	4 (1)	0.711	0.609	2	3.200	2.400	4
Loans to consumers (6)	0.336	0.203	1 (0)	0.872	0.424	1	9.000	6.167	4
Loans to corporations (5)	0.554	0.478	1 (0)	1.132	0.810	1	5.000	3.800	3
Deposits (11)	0.746	0.510	0 (0)	1.567	0.830	2	4.364	3.091	7

Source: authors' calculations; see table 4

Table 5b: Tests for homogeneity of the impact effect of changes in money market rates to bank rates across euro area countries, grouped by instrument

Type of business (no. of rates)	1990-1998		1999-2002	
	χ^2	significance	χ^2	significance
Mortgage loans (4)	5.702	0.223	1.069	0.899
Loans to consumers (4)	16.395	0.003	21.596	0.000
Long-term loans to corp. (4)	4.681	0.322	3.714	0.446
Short-term loans to corp. (5)	106.504	0.000	20.167	0.001
Savings deposits (6)	48.035	0.000	39.936	0.000
Long-term time deposits (4)	20.091	0.000	6.053	0.195
Short-term time deposits + CA (4)	135.865	0.000	47.887	0.000

Source: authors' calculations; SUR models comprising national rates only (i.e., excluding euro area rates), where each equation is estimated as $\Delta r_t^{bank} = \alpha + \beta \Delta r_t^{mmkt} + \varepsilon_t$; further explanations: see table 4.

Table 6: Share of loans with original maturity over 5 years, euro area

a) Non-financial corporations

		1997	1998	1999	2000	2001	2002Q2
Euro Area		49.76	50.63	49.25	47.96	48.05	48.52
Of which:	France	53.67	56.01	57.01	54.89	56.22	55.33
	Germany	64.29	65.12	61.45	60.80	60.78	61.60
	Italy	24.37	25.23	26.85	26.95	27.77	29.39
	Spain	36.80	38.08	39.26	38.71	41.42	42.99
	Netherlands	60.21	60.05	61.40	58.24	58.50	56.95
Coeff. of Var. of EA countries		0.35	0.34	0.31	0.30	0.29	0.27

b) Households - consumer credit

		1997	1998	1999	2000	2001	2002Q2
Euro Area		48.61	48.37	44.47	44.76	45.37	45.59
Of which:	France	22.21	22.23	23.96	25.00	27.25	27.61
	Germany	66.84	66.87	58.78	58.17	59.38	59.99
	Italy	17.90	17.88	18.02	20.99	24.28	25.08
	Spain	36.23	40.47	42.12	43.46	45.10	44.69
	Netherlands	21.12	22.28	19.29	18.90	20.20	18.92
Coeff. of Var. of EA countries		0.62	0.60	0.54	0.51	0.47	0.48

c) Households - other lending

		1997	1998	1999	2000	2001	2002Q2
Euro Area		66.14	65.81	58.27	57.76	58.23	58.03
Of which:	France	76.75	76.65	76.20	74.85	72.50	72.97
	Germany	81.61	82.54	70.70	70.45	70.59	70.15
	Italy	25.70	25.56	28.83	30.45	34.40	35.31
	Spain	56.98	55.76	56.51	59.63	57.65	55.12
	Netherlands	44.98	44.95	45.58	41.10	43.27	41.88
Coeff. of Var. of EA countries		0.40	0.41	0.35	0.34	0.30	0.30

Source: ECB; authors' calculations; the coefficient of variation is calculated for GE, FR, IT, SP and NL.

Table 7: Variance of interest rate differentials: measures of cohesion

a) Interest rate levels

	Nominal rates			Real rates		
	1990-1994	1995-1998	1999-2002	1990-1994	1995-1998	1999-2002
			Euro Area			
short rate	1.82	1.84	0.00	2.66	2.09	0.39
long rate	0.73	1.75	0.00	1.92	1.67	0.39
			Euro Area and other EU			
short rate	6.79	2.42	0.62	4.46	2.31	1.31
long rate	0.77	1.01	0.05	1.87	0.98	0.43
			Euro Area, Japan and US			
short rate	4.20	1.14	2.51	3.88	1.99	1.19
long rate	0.59	1.25	0.21	1.04	2.07	0.42
			US Regions			
Short/long	--	--	--	0.23	0.15	0.32

b) Interest rate changes

	Nominal rates			Real rates		
	1990-1994	1995-1998	1999-2002	1990-1994	1995-1998	1999-2002
			Euro Area			
short rate	0.53	0.12	0.00	0.66	0.20	0.10
long rate	0.10	0.04	0.00	0.23	0.13	0.10
			Euro Area and other EU			
short rate	0.81	0.10	0.02	0.99	0.18	0.12
long rate	0.11	0.04	0.01	0.34	0.12	0.10
			Euro Area, Japan and US			
short rate	0.27	0.07	0.04	0.40	0.24	0.12
long rate	0.10	0.07	0.05	0.22	0.24	0.15
			US Regions			
Short/long	--	--	--	0.07	0.05	0.19

Source: authors' calculations. The cohesion index is calculated as $\Sigma w_i w_j Z_{i,j} / \Sigma w_i w_j$, where $Z_{i,j}$ are bilateral variances and w_i weights proportional to GDP; euro area countries without Luxembourg and Greece. Short rate: 3-month money market/interbank rates. Long rate: 10-year government bond rates. Real rates are constructed by subtracting one-year ahead inflation rates. Sample size: 1990:1-2002:2

Table 8: Variance of interest rate differentials: number of decreases (of which significant)

a) Interest rate levels

	Nominal rates			Real rates		
	90-94 vs. 95-98	95-98 vs. 99-02	90-94 vs. 99-02	90-94 vs. 95-98	95-98 vs. 99-02	90-94 vs. 99-02
	Euro area (over a total of 45 bilateral variances)					
short rate	29 (25)	45 (45)	45 (45)	29 (26)	38 (33)	43 (42)
long rate	24 (19)	45 (45)	45 (45)	29 (17)	34 (29)	39 (33)
	Euro area and other EU (over a total of 33 bilateral variances)					
short rate	31 (25)	28 (27)	33 (33)	30 (22)	21 (16)	33 (30)
long rate	21 (17)	33 (33)	33 (33)	29 (22)	21 (16)	32 (27)
	Euro area, Japan and US (over a total of 21 bilateral variances)					
short rate	19 (18)	8 (4)	20 (17)	17 (14)	13 (10)	21 (17)
long rate	10 (5)	16 (11)	13 (12)	4 (2)	21 (16)	16 (16)
	US Regions (over a total of 6 bilateral variances)					
Short/long	--	--	--	5 (2)	0 (0)	1 (1)

b) Interest rate changes

	Nominal rates			Real rates		
	90-94 vs. 95-98	95-98 vs. 99-02	90-94 vs. 99-02	90-94 vs. 95-98	95-98 vs. 99-02	90-94 vs. 99-02
	Euro area (over a total of 45 bilateral variances)					
short rate	45 (44)	45 (45)	45 (45)	45 (42)	43 (27)	45 (43)
long rate	45 (42)	44 (44)	45 (44)	38 (25)	32 (12)	41 (29)
	Euro area and other EU (over a total of 33 bilateral variances)					
short rate	33 (33)	33 (31)	33 (33)	33 (32)	27 (12)	33 (31)
long rate	33 (33)	33 (33)	33 (33)	32 (25)	25 (6)	33 (26)
	Euro area, Japan and US (over a total of 21 bilateral variances)					
short rate	21 (20)	14 (12)	21 (20)	17 (13)	17 (12)	21 (18)
long rate	20 (12)	16 (5)	21 (13)	9 (4)	15 (10)	17 (10)
	US Regions (over a total of 6 bilateral variances)					
Short/long	--	--	--	6 (1)	0 (0)	1 (0)

Source: authors' calculations. euro area countries without Luxembourg and Greece; significance is measured by a χ^2-test at the 5% level; further explanations: see table 7.

Table 9a: Stock market responses to ECB monetary policy surprises: 1999-2002

	Intercept	t-stat	Beta	t-stat
Eurostoxx	-0.014	-0.720	-1.938**	-2.786
Austria (ATX)	-0.001	-0.068	-0.517	-1.248
Belgium (BEL20)	-0.033*	-1.984	-1.318*	-2.252
Finland (HEX)	-0.042	-1.052	-2.585	-1.842
France (CAC40)	-0.006	-0.288	-1.775*	-2.263
Germany (DAX)	-0.029	-1.182	-2.66**	-3.112
Ireland (ISEQ)	-0.007	-0.471	0.551	1.056
Italy (MIB)	0.005	0.239	-1.812**	-2.648
Netherlands (AEX)	-0.028	-1.323	-1.845*	-2.488
Portugal (PSI20)	-0.04*	-2.538	-2.32**	-4.231
Spain (SMSI)	-0.02	-1.355	-0.665	-1.288
Euro Stoxx: Basic Materials	-0.04*	-2.025	-1.983**	-2.86
Euro Stoxx: Consumer Cyclical	-0.037	-1.444	-2.434**	-2.676
Euro Stoxx: Consumer Non Cyclical	-0.04*	-2.058	-2.937**	-4.231
Euro Stoxx: Energy	0.007	0.332	-1.26	-1.641
Euro Stoxx: Financial	-0.035	-1.713	-2.912**	-4.065
Euro Stoxx: Industrial	-0.017	-0.825	-1.04	-1.439
Euro Stoxx: Media	-0.037	-1.365	-1.517	-1.583
Euro Stoxx: Technology	-0.035	-0.871	-2.953*	-2.064
Euro Stoxx: Telecom	-0.01	-0.335	-3.13**	-2.841
Euro Stoxx: Utilities	-0.024	-1.376	-2.293**	-3.651

Source: authors' calculations; derived in seemingly unrelated regression models of Ehrmann/Fratzscher (2002) monetary policy surprises on intraday stock market returns; */** indicates significance at the 5/1% level. Regression equation: $\ln\left(x_t^{15:30}\right) - \ln\left(x_t^{12:30}\right) = \alpha + \beta surp_t + \varepsilon_t$, following Pearce and Roley (1983). Sample size: January 1st, 1999- November 14th, 2002

Table 9b: Sectoral composition of national stock market indices

Industry Sector	AT	BE	FI	FR	GE	IE	IT	NL	PT	ES	Avg.
Basic Materials	10.7	8.3	16.3	2.2	11.3	0.2	0.0	4.8	1.1	3.3	5.8
Consumer, Cyclical	1.0	0.6	2.7	7.7	17.2	13.9	1.3	2.8	3.1	7.5	5.8
Consumer, Non-cyclical	3.0	15.2	4.9	24.8	6.3	12.1	4.0	17.1	13.1	7.0	10.8
Energy	12.6	0.0	4.5	15.2	0.0	0.2	16.7	10.4	0.0	8.2	6.8
Financial	23.9	47.6	6.0	21.6	21.2	53.1	34.8	35.5	34.4	31.5	31.0
Industrial	17.9	4.5	7.3	8.4	15.0	14.2	1.1	12.3	4.1	8.2	9.3
Media	0.0	0.0	1.7	3.7	0.0	1.9	4.3	8.4	0.3	1.0	2.1
Technology	0.0	0.0	1.5	3.2	6.8	0.8	4.4	2.3	0.6	0.4	2.0
Telecom	21.2	0.9	54.9	6.5	9.6	0.2	22.0	6.4	29.5	17.5	16.9
Utilities	9.6	18.4	0.0	3.3	12.7	2.0	11.4	0.0	13.2	14.6	8.5

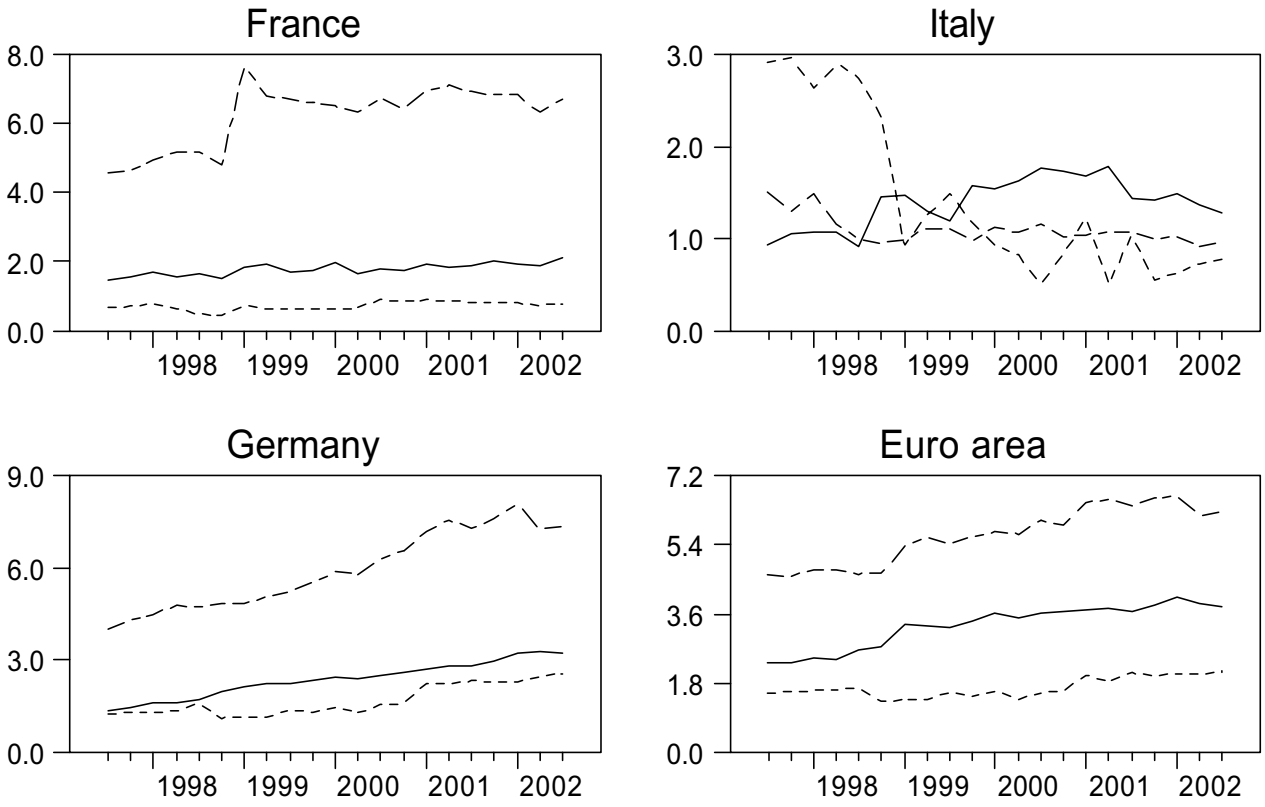
Source: Bloomberg, authors' calculations; the weights depend on the market capitalisation of stocks, and thus change with stock prices. Weights as on March 5, 2003.

Table 9c: Tests for equality of beta coefficients from table 9a

	Test statistic	Significance level
Equality of coefficients		
All countries	$\chi^2(9) = 22.054$	0.009
excluding IE and PT	$\chi^2(7) = 8.953$	0.256
5 large countries	$\chi^2(4) = 8.093$	0.088
All sectors	$\chi^2(9) = 18.606$	0.029
Equality of beta coefficients of national indices with prior from sectoral weights		
All countries	$\chi^2(9) = 21.206$	0.012
excluding IE and PT	$\chi^2(7) = 8.667$	0.277
5 large countries	$\chi^2(4) = 7.886$	0.096

Source: authors' calculations

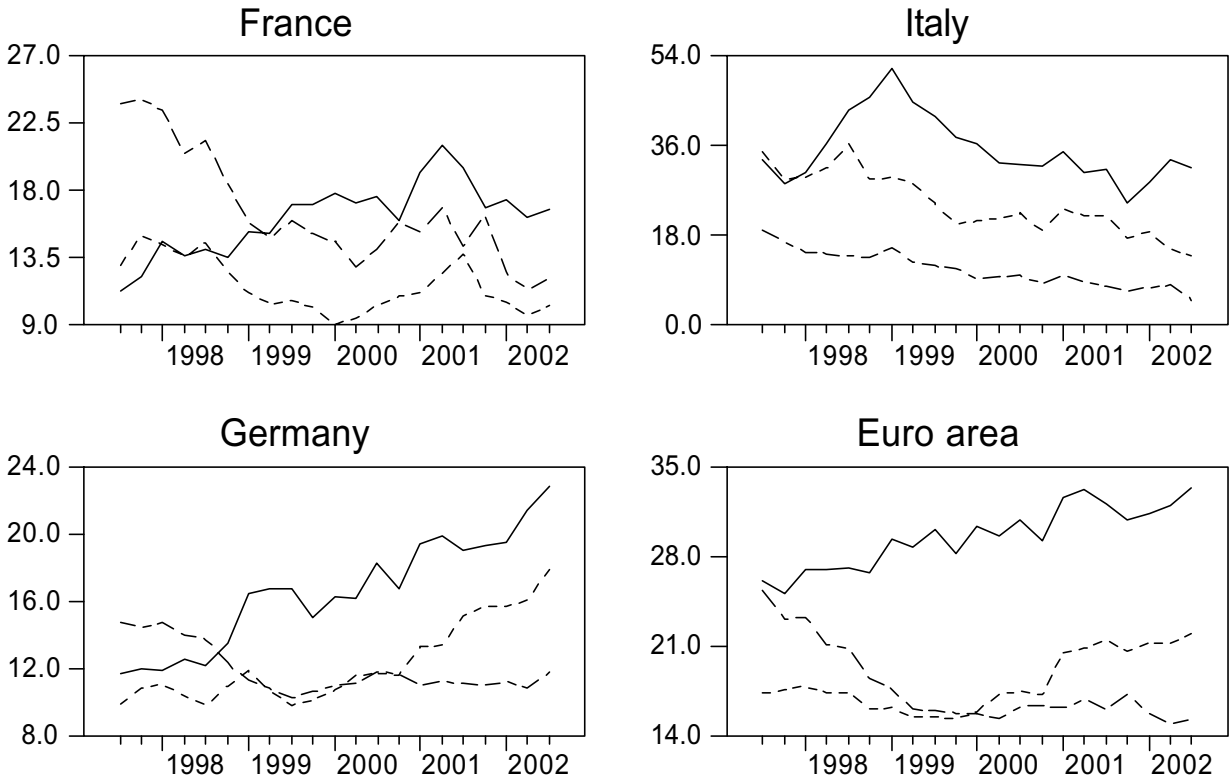
Chart 1: Cross-Border Loans (in Percent of Domestic Loans)*



solid line: euro area; short dashed: rest of the European Union; long dashed: rest of world.

* The ECB will start the regular publication of these data in September 2003.

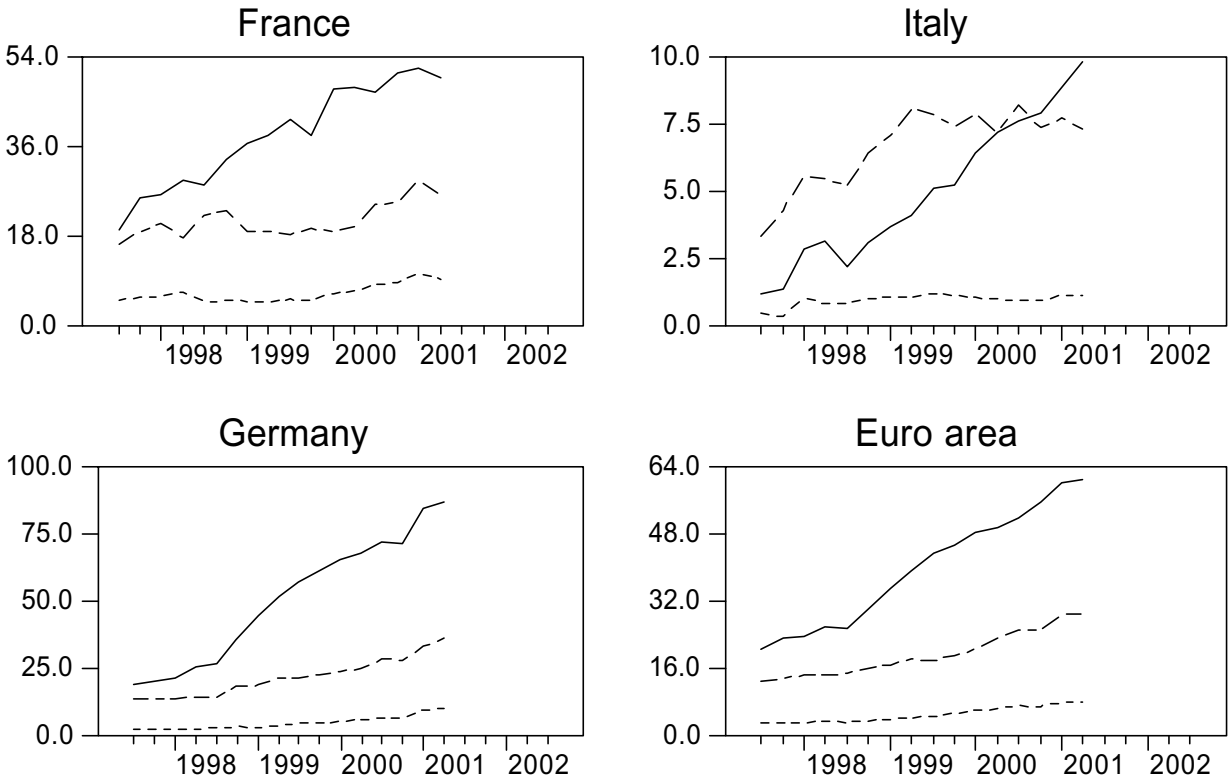
Chart 2: Cross-Border Interbank Loans (in Percent of Domestic Interbank Loans)*



solid line: euro area; short dashed: rest of the European Union; long dashed: rest of world.

* The ECB will start the regular publication of these data in September 2003.

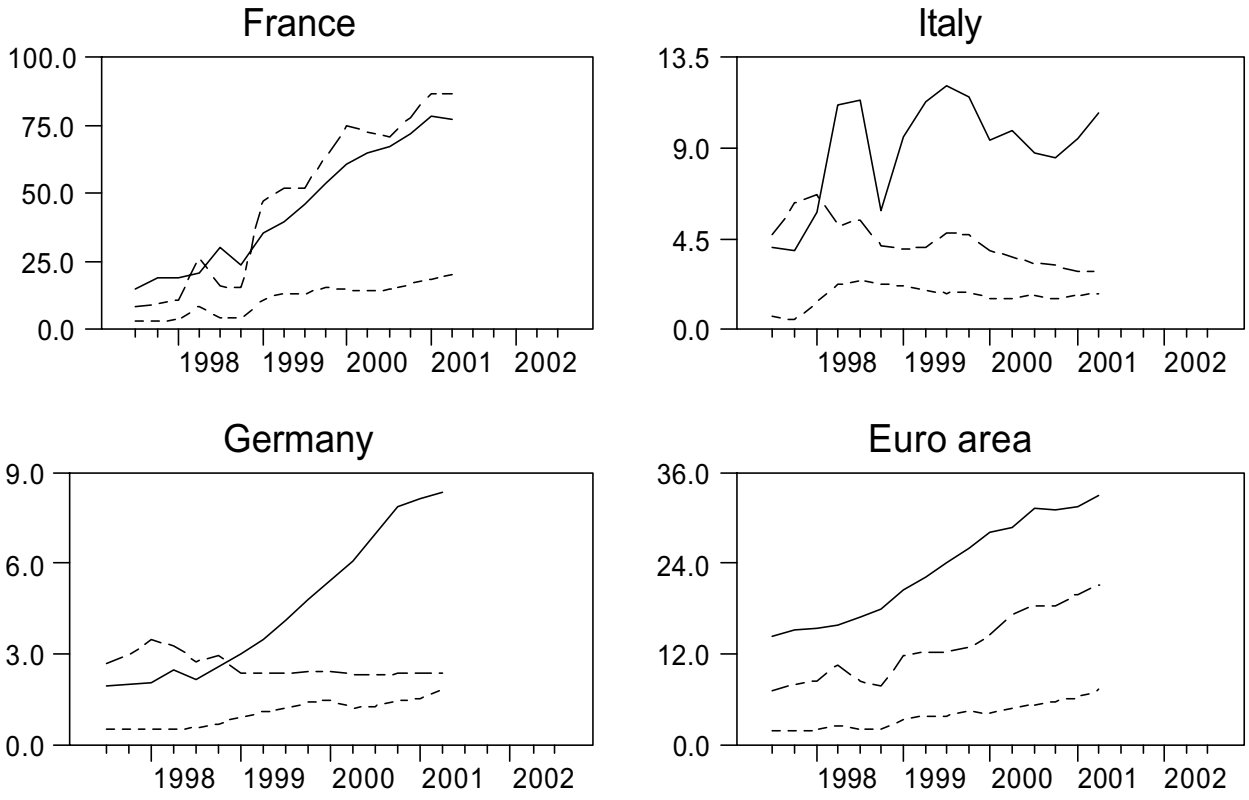
Chart 3: Cross-Border Holdings of Non-Bank Securities*
(in Percent of Domestic Holdings)



solid line: euro area; short dashed: rest of the European Union; long dashed: rest of world.

* The ECB will start the regular publication of these data in September 2003.

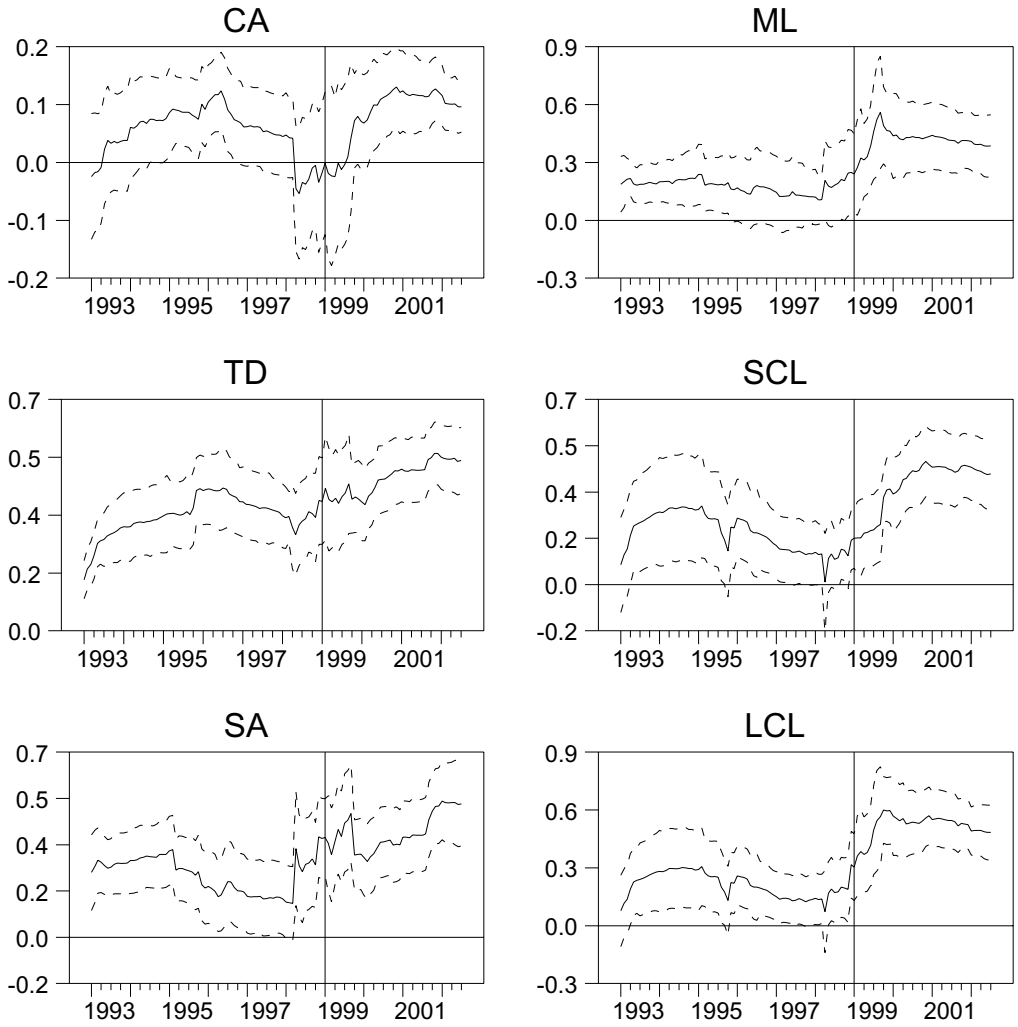
Chart 4: Cross-Border Holdings of Bank Securities (in Percent of Domestic Holdings)*



solid line: euro area; short dashed: rest of the European Union; long dashed: rest of world.

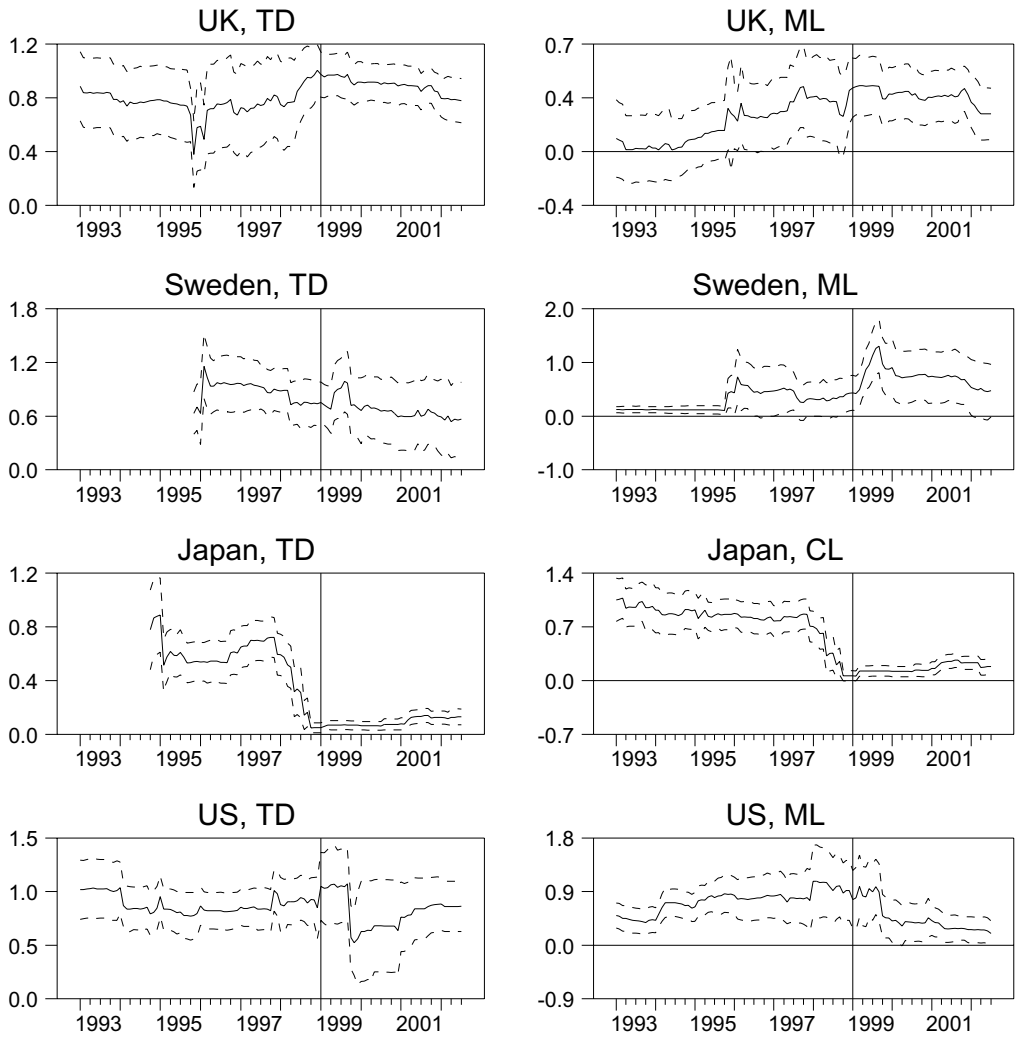
* The ECB will start the regular publication of these data in September 2003.

Chart 5: Rolling Window Estimates of the Impact Effect of Changes in Money Market Rates to Bank Rates; Euro Area



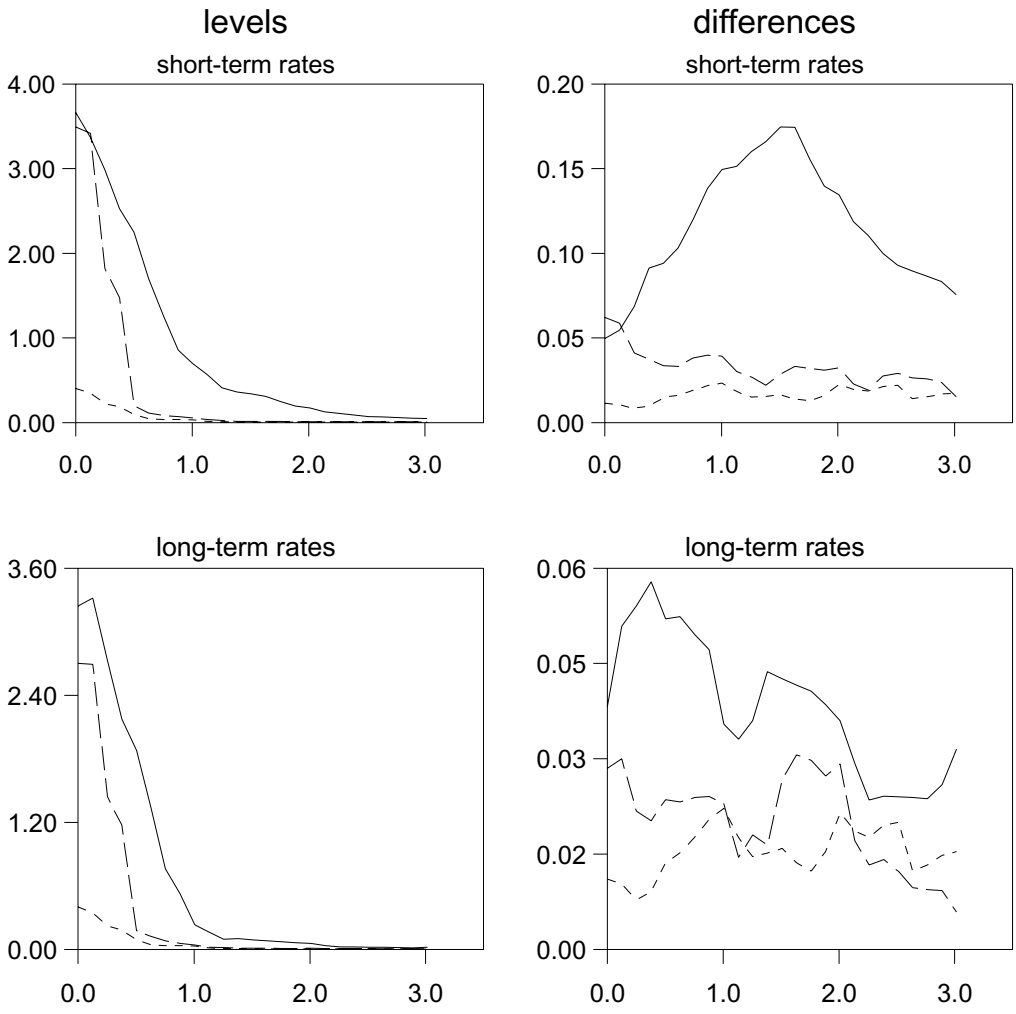
CA: current accounts; TD: time deposits; SA: savings accounts; ML: mortgage loans; SCL: short-term loans to corporations; LCL: long-term loans to corporations; solid line: rolling window coefficient estimates; dashed lines: 95% confidence bands; vertical line: first window with observation under EMU; x-axis represents the end point of the respective regression windows. Regression equation: $\Delta r_t^{bank} = \alpha + \beta \Delta r_t^{mmkt} + \varepsilon_t$; further explanations: see table 4.

Chart 6: Rolling Window Estimates of the Impact Effect of Changes in Money Market Rates to Bank Rates; Other Countries



TD: time deposits; ML: mortgage loans; CL: consumer loans; solid line: rolling window coefficient estimates; dashed lines: 95% confidence bands; vertical line: first window with observation under EMU; x-axis represents the end point of the respective regression windows. Regression equation: $\Delta r_t^{bank} = \alpha + \beta \Delta r_t^{mmkt} + \varepsilon_t$; further explanations: see table 4.

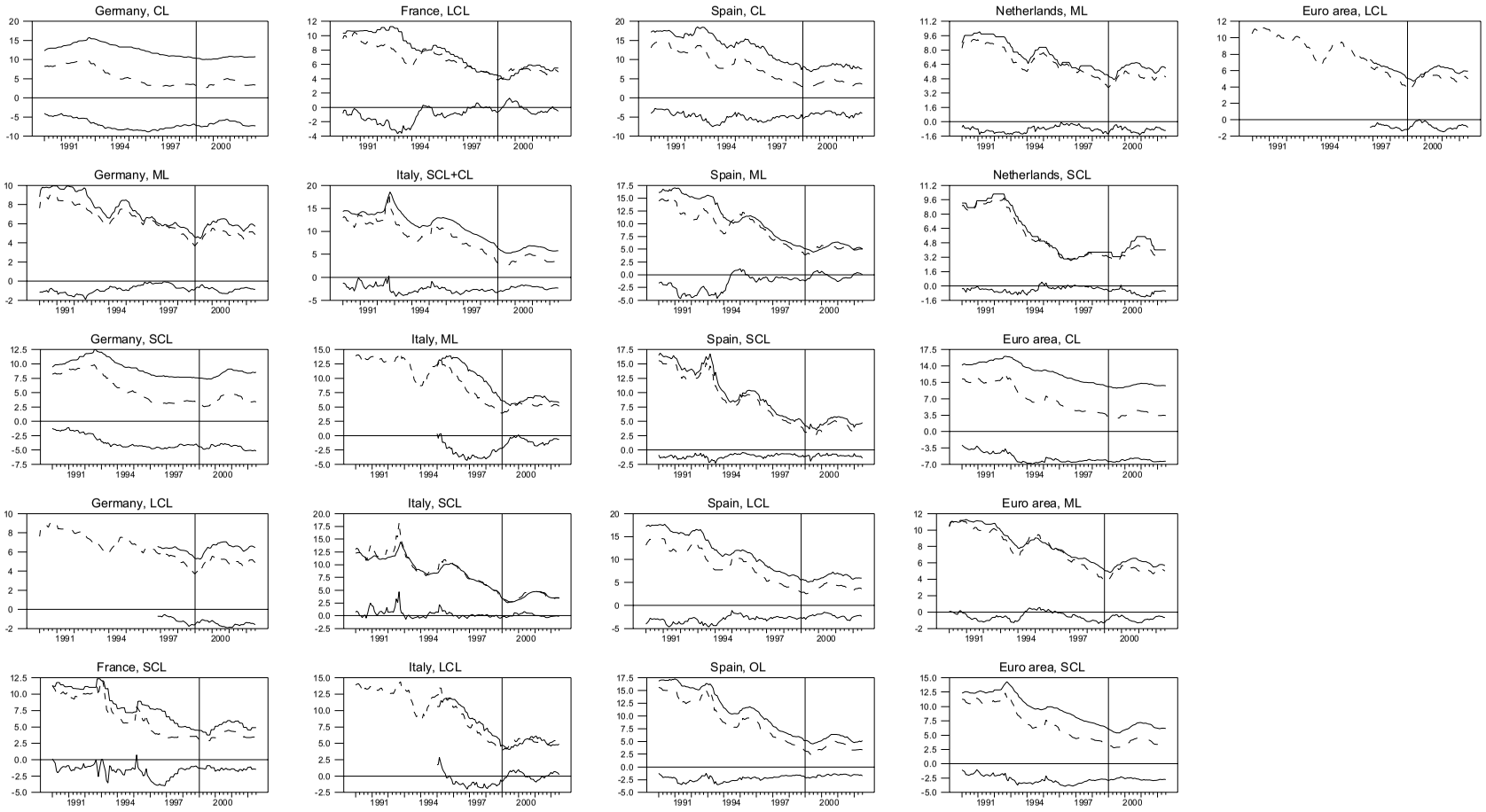
Chart 7: Spectral Density of Interest Rate Differentials Within the Euro Area



solid line: 1990-1994; long dashed: 1995-1998; short dashed: 1999-2002.

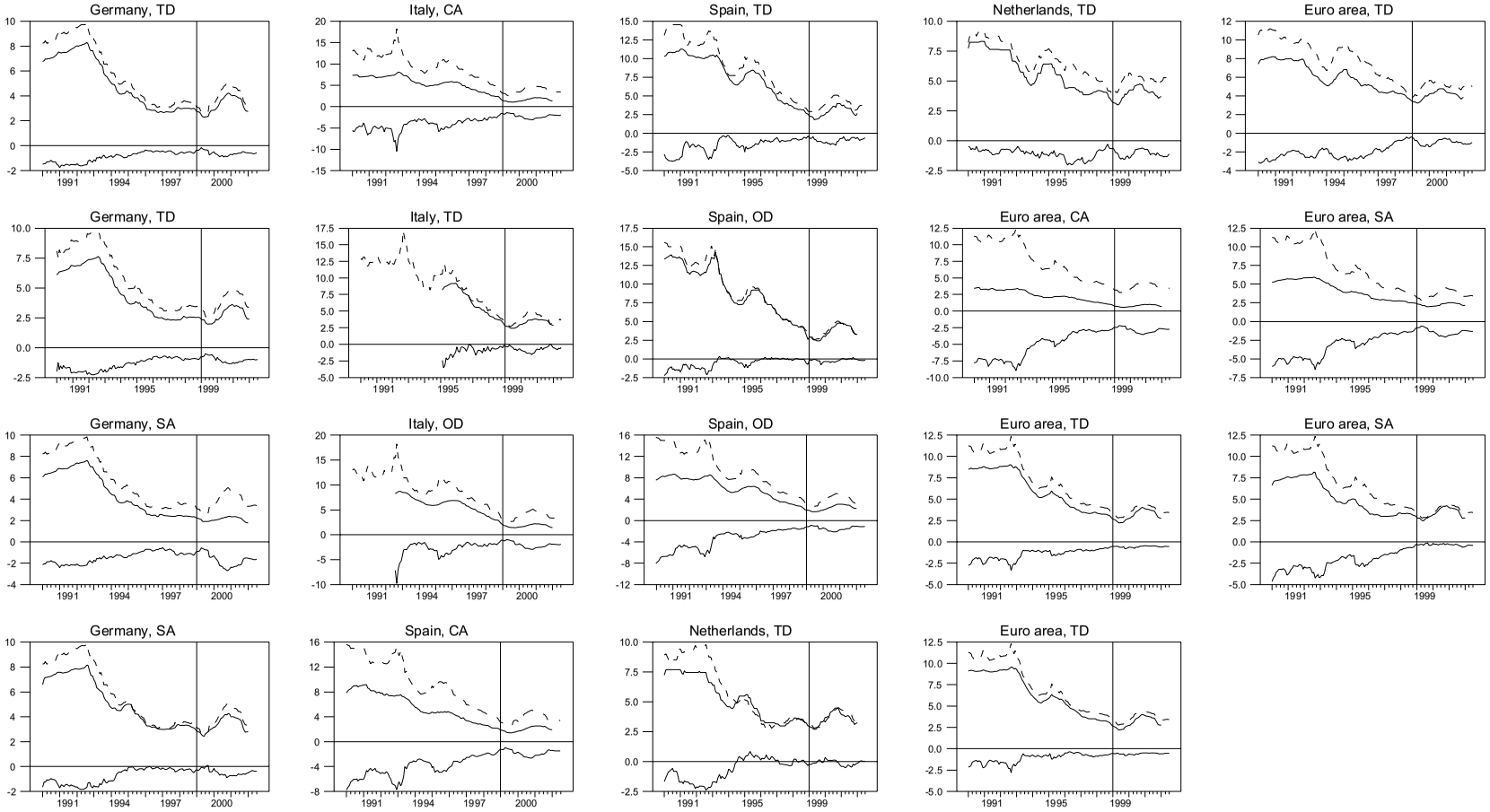
ANNEX

Chart A1: Bank Lending Rates, Money Market Rates, and Spreads: Euro Area and Euro Area Countries



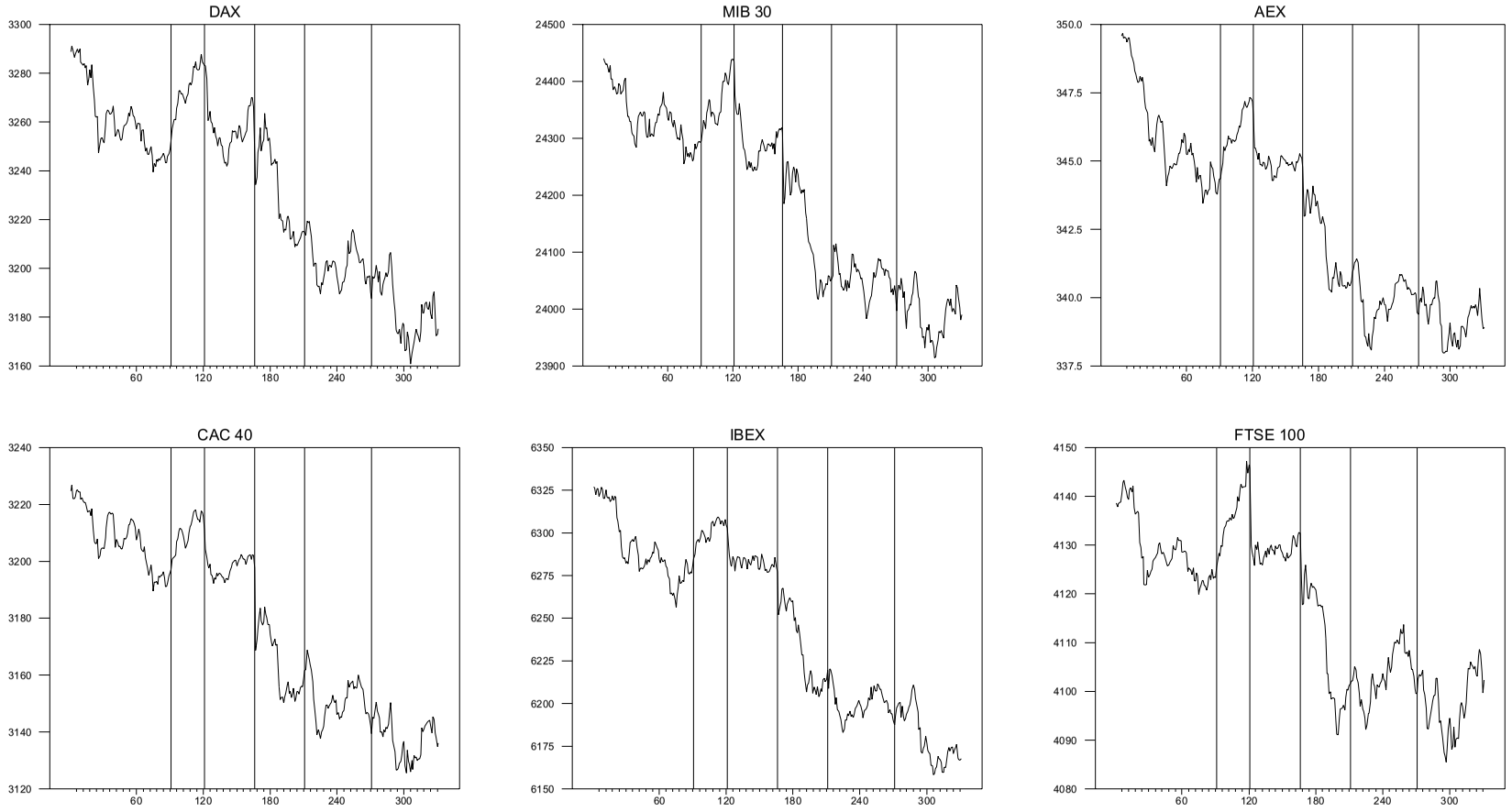
CL: consumer loans; ML: mortgage loans; SCL: short-term loans to corporations; LCL: long-term loans to corporations; OL: other loans; dashed line: money market rates; solid line: lending rates; solid line below zero: spread (lending rates – money market rates)

Chart A2: Bank Deposit Rates, Money Market Rates, and Spreads: Euro Area and Euro Area Countries



TD: time deposits; SA: savings accounts; CA: current accounts; OD: other deposits; if there are several rates of the same kind for one country, they are ordered according to maturity; dashed line: money market rates; solid line: deposit rates; solid line below zero: spread (money market rates – deposit rates)

Chart A3: Stock Market Indices on November 7th, 2002, 11:00-16.30



First vertical line: start of time window at 12:30; second vertical line: Bank of England announcement at 13:00; third vertical line: ECB announcement at 13:45; fourth vertical line: start of ECB press conference at 14:15; fifth vertical line: end of time window

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