THE EURO-AREA GOVERNMENT SECURITIES MARKETS. RECENT DEVELOPMENTS AND IMPLICATIONS FOR MARKET FUNCTIONING

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Banco de España — Servicio de Estudios
Documento de Trabajo n.º 0120

THE EURO-AREA GOVERNMENT SECURITIES MARKETS. RECENT DEVELOPMENTS AND IMPLICATIONS FOR MARKET FUNCTIONING*

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* Paper prepared for the BIS Autumn Central Bank Economist's Meeting, October 2001. I thank Francisco Alonso, Eva del Barrio and Alicia Sanchís for helpful research assistance. I also thank Juan Ayuso, Fernando Restoy, Javier Santillán and participants in the seminar held at the Banco de España and in the BIS meeting for helpful comments.

Abstract

This paper analyses recent key developments in euro-area government bond markets and their main implications for central banks and for market functioning. The introduction of the euro is found to have significantly affected the relative pricing of securities. The spreads over German bonds of previously high-yield debt have narrowed significantly whereas the spreads of all other euro-area sovereign debt have widened following the introduction of the euro. Market microstructure factors, such as relative market liquidity and the cheapest-to-deliver status of bonds, are also found to play a part in determining relative prices in addition to differences in credit risk. Finally, the evidence suggests that the reduction in the relative supply of government bonds has hitherto had a limited effect in the euro area, in contrast to the evidence in the US market.

1. INTRODUCTION

Government securities markets have traditionally played an important role for both central banks and private agents. From the standpoint of central banks, certain indicators for assessing the inflation and output outlook have normally been derived from pricing data collected in these markets. From the point of view of private agents, these securities are used as a risk-free investment, as collateral, as a benchmark for pricing fixed-income securities and for hedging interest rate risks. The important role played by government securities is the result of a number of characteristics that distinguish them from other securities. These include minimal credit risk, high market liquidity, a wide range of maturities and well-developed market infrastructure.

In the euro area, recent developments in and the functioning of government securities markets have been affected by a number of factors including the introduction of the euro and the reduction in the relative supply of government bonds. The removal of foreign exchange risk within the euro area since the start of Monetary Union has eliminated one of the elements that previously differentiated existing securities and, consequently, should have altered trading strategies and relative prices. The reduction in the relative supply of bonds as a consequence of the improvement of public finances raises the question about how the functions performed by these markets are going to change.

Against this background, the goal of this paper is to describe recent developments in euro-area government bond markets and to discuss their implications for both the information content of prices and market functioning. It is found that the introduction of the euro has significantly affected the relative pricing of securities. In particular, the 10-year spreads over German bonds of previous high-yield debt have dropped whereas the spreads of all other euro-area sovereign debt have widened. Market microstructure factors, such as relative market liquidity and the cheapest-to-deliver status of bonds, are also found to play a part in determining relative prices in addition to differences in credit risk. Finally, the reduction in the relative supply of government bonds is seen hitherto to have had a limited effect on the euro area, in contrast to the evidence in the US market.

The rest of the paper is structured as follows. Section 2 describes the main factors driving market developments and Section 3 discusses their impact on portfolio composition and trading activity. Section 4 is the core of the paper and analyses pricing developments and their implications. Section 5 discusses the outlook for euro-area government bond markets and, finally, the last section draws the main conclusions.

2. MAIN FACTORS DRIVING MARKET DEVELOPMENTS

The introduction of the euro

The elimination of foreign exchange risk within the euro area since the start of Monetary Union has eliminated one of the elements that previously differentiated existing bonds. This has resulted in an increase in the degree of substitutability among securities issued by different treasuries. At the same time, other elements such as credit risk and market liquidity may have gained in importance. These changes may have affected both pricing and trading activity. As regards pricing, the level and the dynamics of yield spreads between different national issuers will no longer reflect foreign exchange factors. The portfolio composition and trading strategies of investors have been affected through different channels. Firstly, currency-driven strategies are no longer feasible. Secondly, the scope for risk diversification among national securities has been reduced. And, finally, the introduction of the euro has removed certain legal barriers to cross-border investment such as currency matching rules, which traditionally limited the possibilities of certain investors – especially pension funds and insurance companies- investing in foreign currency.

Besides the aforementioned effects, the introduction of the euro has had other more indirect effects. In particular, the search for market liquidity has fostered competition between issuers to attract investors and has prompted some reorganisation of the market structure. On the side of the issuers, some significant changes have been observed since the start of Monetary Union. In this respect, mention may be made of the efforts by national treasuries to increase market transparency through different means such as the introduction of pre-announced auction calendars. Additionally, issue sizes have generally tended to increase. In some countries, the creation of large issues was facilitated by the introduction of programmes to exchange old illiquid bonds for new bonds and by the concentration of issuance activity in a smaller number of benchmark securities. Some of the smaller issuers, such as Austria, Belgium, the Netherlands and Portugal, have resorted to syndication procedures instead of traditional auctions with the aim of reaching a larger set of investors. Others, such as the French Treasury have introduced new instruments such as constant maturity and inflation-indexed bonds to attract more investors. Other institutional changes introduced were the harmonisation of market conventions such as the computation of yields, and the existence of a single trading calendar.

As regards the organisation of the markets, one notable development has been the creation of electronic pan-European exchanges for debt securities. So far, the most successful trading platform has been EuroMTS, a screen-based exchange owned by a number of the largest banks active in the European market. Currently, issues of the major euro-area treasuries and some large highly rated private bonds are listed on this trading platform. Both spot and repo transactions are admitted. BrokerTec is another example of a

recently created electronic trading platform. However, its market share is considerably lower. At the national level, there have been initiatives aimed at concentrating trading activity in a limited number of platforms.[1] In the futures markets, some small and medium exchanges have established alliances to better cope with competition from the biggest exchanges.

In the case of settlement systems, there have been initiatives geared to achieving a higher degree of integration. In this regard, the introduction of links between national central securities depositories and the merger of the two international central securities depositories with existing national central depositories should be highlighted.[2]

To sum up, the introduction of the euro has increased the degree of substitutability of securities and has contributed to reducing the extent of fragmentation among euro-area government bond markets. Advances in market integration are also explained by other factors such as the implementation of the Single Market for financial services and technological changes. The euro-area government bond markets are increasingly seen as one single market that is comparable in terms of size to the US or Japanese markets (Table 1). However, the multiplicity of issuers and differences in credit rating distinguishes the euro-area government market from its corresponding US and Japanese counterparts. In spite of the advances in integration, euro-area government bond markets are currently far from being completely integrated. Some factors frequently mentioned as contributing to some degree of fragmentation are the lack of integration of the settlement system and the different tax regimes and market conventions.[3]

The reduction in the relative supply of government bonds

Over the last few years the share of the stock of government paper has trended downwards in the euro-denominated fixed-income markets. More specifically, between end-1996 and mid-2001, the share of the stock of government paper has decreased by more than five percentage points (Table 2). This process is the result of both a slowdown in government issuing activity, due to the improvement in fiscal deficits, and the surge in the stock of private paper.

The shrinking supply of government securities may have three different effects on their pricing. Firstly, since lower debt obligations mean an improvement in the credit standing, the yield demanded by investors will be lower. Secondly, scarcity of risk-free securities may further reduce the yield demanded by investors in comparison with other securities. This effect, which is sometimes called the *scarcity premium*, might arise if there

[1] See ECB (2001) for more details of recent changes in market infrastructure in the euro-area bond markets.

[2] Cedel merged with Deutsche Börse Clearing to form Clearstream International. Euroclear merged with CBISSO and Sicovam to the Euroclear group.

[3] See IMF(2001b), Santillán et al. (2000) and ECB (2001).

are no substitute securities with similar characteristics. Finally, the reduction in size may negatively affect market liquidity and, as a consequence, investors would demand an extra yield –*liquidity premium*- to compensate for the lower market liquidity. Thus, from a theoretical standpoint, the impact on the yield level of the reduction in the relative supply is ambiguous.

The existence of the aforementioned idiosyncratic elements in the prices of government securities may have some implications for the information content of the interest rates and for market functioning. More specifically, certain indicators frequently used by central banks to extract information on the output and inflation outlook, such as the quality spread (the yield differential between corporate bonds and government bonds) and the term spread (the differential between long-term and short-term yields) might be distorted. Similarly, the usefulness of government securities as a benchmark for pricing other fixed-income assets may also be affected. Finally, the presence of these idiosyncratic elements will reduce the effectiveness to hedge interest rate risk with government securities, provided that they are time-varying.

Other effect of the reduction in the supply of government securities is the lesser availability of a risk-free asset for investment and for use as collateral in monetary policy operations, intraday credit or in private transactions. For example, during the last quarter of 2000, these types of securities accounted for 56% of collateral used by Eurosystem counterparties for monetary policy and for intraday credit.

3. DEVELOPMENTS IN PORTFOLIO COMPOSITION AND TRADING ACTIVITY

The information available clearly shows that the process of geographical diversification initiated in the mid-1990s in the euro-area government debt markets has continued at a more rapid pace since the start of the Monetary Union. According to the figures of Table 3, the share of the stock of euro-area government securities held by non-residents has increased by 7 percentage points between 1998 and 2000. This evidence suggests that the introduction of the euro has contributed to a geographical reallocation of portfolios. The removal of certain legal barriers, such as currency matching rules, and greater market integration after the introduction of the euro may have played a part in this process.

As regards trading activity, the most significant development has been in the bond futures markets. Since the last quarter of 1998 trading activity has increasingly been concentrated in the futures based on German bonds and traded in Eurex (Table 4). This process was driven by the high substitutability of existing contracts after the removal of

foreign exchange risk within the euro area countries. Turnover of futures based on French, Italian and Spanish bonds decreased to very low historical levels and, as a consequence, their liquidity was seriously damaged. This situation changed slightly in 2000 when Euronext introduced a number of measures to improve the attractiveness of its contracts, including the extension of the list of deliverable bonds to some euro-area non-French bonds – German and Dutch bonds. Thereafter, turnover in bond futures traded in MATIF recovered to pre-EMU levels, but continued to be relatively low when compared with the contracts traded in Eurex.

The increasing trading activity in the futures based on German bonds was also reflected in the open interest of the contracts to the point that it frequently exceeded the outstanding amount of deliverable bonds. This has sometimes favoured situations, known as squeezes, under which a small number of participants acquire a large proportion of the stock of deliverable bonds before the maturity of the contract with the aim of obtaining a profit. If the strategy succeeds, the short position holders in the futures contract are obliged to borrow deliverable bonds and lend money at below market rates in the repo market. The latest squeeze is reported to have involved the 5-year contract maturing in March 2001. Other squeezes occurred in September 1998 and June 1999. The existence of squeezes may introduce potential efficiency-reducing distortions in the pricing of securities traded in the spot, derivative and repo markets.[4]

Another relevant development recently observed in Eurex is the growing importance of contracts based on 2- and 5-year bonds. The cumulative trading volumes of these two contracts are currently similar to those observed with the 10-year contract. These movements probably reflect a change in investor trading strategies, which are more balanced along the yield curve.

In the spot markets, recent changes in trading patterns seem to have been less dramatic. In some small markets, such as the Irish market, a drop in trading figures has been observed. Similarly, trading with Italian government bonds in the MTS market has continued declining since the start of Monetary Union, a trend initiated in 1998. However, this process seems to reflect, at least partially, a shift to the Euro MTS platform rather than a lower trading volume with Italian securities. In the Spanish market, trading has increased slightly after the introduction of the euro but the turnover ratio has dropped. By contrast, trading figures for French government bonds show a robust increase as compared with pre-EMU levels –the monthly average volume during 1999-2001 was 37% higher than that in 1996-1998. Similarly, there is some evidence of growing trading activity with German government bonds.[5] However, the lack of more detailed data in some markets and the

[4] The pricing effects due to the existence of the futures market are studied in Section 4.

[5] BIS (2001b) reports a significant increase in trading volumes with German bonds using data on the most actively traded bonds that are settled through Euroclear.

absence of information in others do not allow us to know to what extent a process of concentration towards the most liquid markets has also occurred in this market segment.

Trading conducted through EuroMTS has risen significantly since its creation in 1999. It is estimated that in 2000 about 40% of bond transactions were traded through this platform.[6]

The evidence in this Section suggests that overall trading activity and, as a result, liquidity, has not been significantly affected by the reduction in the relative supply of bonds, which contrasts with the evidence in the US market, where liquidity seems to have deteriorated recently.[7] At the same time, some concentration of liquidity towards the main markets at the expense of others has occurred since the introduction of the euro.

4. PRICING DEVELOPMENTS

4.1. The relative pricing of euro-area government bonds after the introduction of the euro

Determinants of yield spreads

The removal of foreign exchange risk since the start of Monetary Union eliminated one of the determinants of the yield spreads between euro-area government bonds. To approximate the importance of this effect, the average 10-year yield spreads over German bonds of euro-area government bonds in the pre-EMU period (1996-1998) are broken down into two components: i) the foreign exchange factor, and ii) other factors, which mainly include differences in credit risk and market liquidity. The first component is estimated as the spread between the swap rate in the currency of denomination of the bond and the swap rate in DM.[8] Given that most of the participants present in the different currency segments of the underlying swap market (the eurodeposit market) are the same, differences in swap rates should mainly capture foreign exchange factors.[9]

Table 5 shows the results of the exercise, together with the average yield spreads over German bonds after the introduction of the euro (1999-June 2001). It can be seen that the foreign exchange factor was the main component of the spread in those countries with wider spreads, such as Italy, Spain and, to a lesser extent, Finland and Ireland. In these countries the introduction of the euro has meant a significant reduction in their debt' yield

[6] See Galati and Tsatsaronis (2001).

[7] See Fleming (2000).

[8] All pricing data used in this paper are taken from Bloomberg, unless otherwise stated.

[9] Part of the differences in swap rates may also reflect differences in liquidity.

spread over German bonds. The removal of foreign exchange risk has also been reflected in a reduction in the yield volatility for debt issued by these countries (Chart 1). Conversely, the yield volatility of the other countries' debt has shown minor changes between both periods and their yield spreads over German bonds have increased (Table 5).

Interestingly, on removing the foreign exchange factor from yield spreads in the pre-EMU period, it can be seen that all yield spreads over German bonds have widened. A number of factors may account for this evidence. First, the concentration of trading activity in the German market, at least in the futures segment, and the fact that the credit and liquidity component has risen more intensively for debt issued by smaller countries such as Austria, Belgium and Finland, denote that liquidity differences vis-à-vis German bonds may have widened since the introduction of the euro. Second, observed changes might partly reflect a change in the price assigned by the market to these factors, perhaps as a consequence of the higher degree of market integration – i.e. before Monetary Union differences in liquidity and credit risk were not completely priced due to market segmentation. Finally, it cannot be ruled out that part of the change in the credit risk and liquidity component is upward biased due to the following two factors. First, before EMU differences in credit standing were partly captured in the foreign exchange factor since governments had the possibility of monetising debt denominated in local currency to prevent default, which ultimately would be reflected as a devaluation of the local currency. Since the start of Monetary Union this option is no longer feasible given the no bail-out clause in the EU Treaty.[10] Second, if swap spreads between currencies partly reflected differences in liquidity, the estimated foreign exchange component would be biased upward and, consequently, the credit and liquidity component would be downward biased. In any case, the increase in the yield spread for countries in which the foreign exchange component was not significant indicates that these biases do not fully explain the rise in the price of liquidity and credit risk.

To better understand the determinants of the yield spreads between euro-area government debts, Chart 2 depicts the 10-year yields for the 12 euro-area countries government debt by risk category in June 2001. These categories have been created combining the ratings assigned to sovereign debt by S&P and Moody's.[11] Seven different categories are considered. The first category is made up of highest-rated debts whereas the

[10] Notwithstanding, the fact that the liquidity and credit risk component was relatively high in countries with the lowest ratings such as Italy, Belgium and Spain indicates that not all of the differences in credit standing were reflected in the foreign exchange factor.

[11] S&P and Moody's rate debt using different codes, but their rating categories can be ordered in comparable levels of risk. For instance, the AAA and AA+ ratings of S&P are equivalent, respectively, to the Moody's Aaa and Aa1 ratings. In practice, these rating agencies either give equivalent ratings to the same issuer or have them differ by just one level. Taking into account this fact, debt has been included in categories 1, 3, and 5 that is equivalently rated by both agencies corresponding, respectively, to the first, second, and third-best rate levels. Categories 2, 4 and 6 include debt that is not equivalently rated by these agencies. For instance, category 2 includes debt rated in the first level by one agency and in the second level by the other. And, finally, category 7 includes debt having rates below the third- best level.

seventh includes the lowest-rated debts. A positive correlation between risk and yield clearly emerge from the Chart, suggesting that credit risk plays an important role in explaining yield spreads in the euro-area government bond markets. However, significant differences in yields among some debts having a similar risk are observed, particularly within highly rated debt. For instance, it is worth noting that the yield spread between the Austrian and German bonds is even higher than that of the Austrian and lower-rated securities such as Greek debt. This indicates that credit risk alone is not sufficient to explain yield spreads, which means that other factors such as market liquidity must also play an important role.

An in-depth analysis is now made of the importance of market microstructure factors, such as liquidity, in the relative pricing of euro-area government bonds. To do this, zero-coupon yield curves from January 1999 to May 2001 are first estimated for the two markets considered as having the highest liquidity, the German and French markets.[12] Initial analysis of the results of this exercise reveals some significant changes after May 2000. Given this evidence, the analysis below considers two sub-periods (1/1/99-30/4/00 and 1/05/00-28/5/01). Chart 3 shows the average difference between both curves in these two sub-periods. In the first, French bonds appear to have on average a lower yield for horizons between 2 and 12 years whereas for longer horizons German bonds display a lower yield. These results denote that, during this period, the benchmark yield curve for euro interest rates was made up of more than one issuer. This evidence seems to indicate that, in the German market, liquidity tends to be more concentrated than in the other two exchanges.

In the second sub-period, a widening of spreads in favour of German bonds is observed to the point that these securities display a lower yield for all horizons. This result probably reflects an improvement in the relative liquidity of German bonds, especially in the medium-term sector. The increasing turnover observed in the 2- and 5-year futures contracts based on German bonds (see Section 3) seems to support this view. Thus, it is apparent from this evidence that over the last few months the German market has achieved benchmark status for all maturities. Nonetheless, it cannot be ruled out that part of the widening is attributable to other factors such as credit risk considerations, although that does not seem plausible.

With the aim of confirming these findings, the liquidity effects for certain groups of bonds are now studied. More specifically, a comparison is made of the yield errors –i.e. the difference between observed and estimated yields- for certain groups of bonds within a range of maturities. In this case, a single zero-coupon yield curve using German and French bonds is estimated. Note that this approach, unlike the simple comparison of yields, allows

[12] More specifically, the zero-coupon yield curve is estimated using the Nelson and Siegel model and minimising the squared errors in prices adjusted by the inverse of the duration. This procedure normally estimates with relatively low error the medium and long-term sector of the curve.

us to control for differences in cash flow structures. Table 6 shows some descriptive statistics of the differences in yield errors for different groups of securities between January 1999 and May 2001. Results are shown for the whole sample and for two sub-periods (1/1/99-30/4/00 and 1/05/00-28/5/01).

Regarding on-the-run issues for typical maturities (newly issued bonds with 2-, 5-10-, and 30-year maturities[13]), three main results emerge from Table 6. Firstly, German bonds appear to have, on average, a lower yield in both sub-periods, suggesting that the German market is the most liquid for on-the-run issues. Secondly, liquidity differences seem to be relatively more important for 10-year bonds. And, finally, a widening of spreads is observed in the second sub-sample, denoting an increasing preference of investors for German bonds.

The evidence for off-the-run issues is slightly different, especially for bonds with a term-to-maturity lower than 10 years. More specifically, it is found that, in the first sub-period, French bonds with a term to maturity lower than 10 years used to trade at a lower yield than comparable German bonds. This implies a higher degree of liquidity in the French market in this maturity sector. However, in the second sub-period, German bonds appear to have a lower yield in the same maturity sector, indicating an improvement in their degree of liquidity. In the 10- to 30-year sector, the German market appears in both sub-periods as having the lowest yields. And, again, a widening of spreads in favour of German bonds is found in this sector. These results seem to confirm that the German market has finally achieved benchmark status for all maturity ranges.

Let us now examine in depth the impact on pricing of market microstructure factors. To do this, the focus is placed on the German market and the estimated yield errors from 1999 to May 2001 are analysed using the securities issued by the German Treasury. Of particular interest here are liquidity effects and the impact on yields of the futures market. Observation of these errors shows that newly issued bonds normally display a negative yield error –i.e. the observed yield is below the estimated curve- that is sometimes very significant (up to about 20 basis points), especially in the 10-year sector. Yield errors of the bonds with cheapest-to-deliver status in the futures market also tend to be negative, but they are normally much closer to zero. These results imply that liquidity factors play an important role in determining relative yields in the German market, whereas the impact of the futures market seems much more limited.

To test more formally for these effects, the zero-coupon yield curve is re-estimated introducing a dummy variable that takes the value 1 for the last two on-the-run issues and 0

[13] These are the only maturities issued by the German Treasury during the sample period. Over the same period, the French Treasury has been issuing mainly at these maturities. However, it has sometimes issued at other maturities such as 7-8 years and 15 years.

otherwise. Table 7 shows the main results of the exercise. The parameter of this variable is negative and statistically significant for most of the sample and its average value is –6.4 basis points. The results by sub-period show no significant changes. This evidence points to the existence of significant liquidity premia in the relative pricing of German bonds. The same exercise is replicated for both the French and the Spanish markets in order to make comparisons. Table 7 shows the results. Liquidity premia in these markets appear, on average, to be less significant than in the case of the German market.

Analysis now turns to the impact on yields of the cheapest-to-deliver status in the German market. Given the small sample of securities affected by this status –a maximum of three- the yield errors of these bonds are compared with those of a similar security, instead of introducing a dummy variable. More specifically a match is made, for every futures contract and maturity, between the cheapest-to-deliver bond and another security with a similar duration and age.[14] The difference of yield errors between these two bonds is then regressed on a constant and a dummy variable that takes the value 1 during the period in which the bond has cheapest-to-deliver status. For each case, the period considered runs from the delivery day of the previous maturity up to three months after the delivery day of the current maturity. The parameter of the dummy variable captures the relative impact on pricing caused by the futures market on cheapest-to-deliver bonds. However, this parameter does not capture other possible general effects caused by the futures market on all securities within a maturity sector. The parameter of the dummy variable turns out to be negative (-2.8 basis points) and statistically significant, suggesting that cheapest-to-deliver bonds tend to have a yield below otherwise similar bonds. However, this effect is quantitatively less significant than the impact on yields associated with benchmark status.

To check the robustness of this result and to analyse the effect for the different maturities and contracts, the regression is repeated separately for every maturity and contract. In the individual regressions the parameter that captures the impact of the futures market turns out to be negative and statistically significant in 12 out of 13 cases. The minimum value of the parameter (-8.8 basis points) corresponds to the 2-year cheapest-to-deliver bond of the June 1999 contract, which was affected by a squeeze.

Implications for the information content of the yield curve and for market functioning

The multiplicity of sovereign issuers in the euro area and the impact on pricing of market microstructure effects have implications for both the information content of the yield curve derived from government bond markets and for market functioning. From the point of view of the information content of interest rates, these factors complicate the estimation of a benchmark yield curve for euro interest rates using government debt markets. In fact, the previously reported evidence indicates that, for some of the period analysed, the benchmark

[14] The cheapest-to-deliver bond is approximated as the bond whose amount delivered was the maximum.

yield curve was made up of more than one issuer. In addition, the existence of market microstructure effects may distort the information content of certain indicators frequently used by central banks, such as the term and the quality spreads. From the point of view of market functioning, the usefulness of government bonds for pricing private debt and for hedging interest rate risk may be affected, especially if the market microstructure effects are time-varying.

4.2. The reduction in the relative supply of government bonds

Impact on yields

In Section 2 it was argued that the reduction in the relative supply of government bonds may have three different effects on yield levels: it may reduce the yield due to the improvement in the credit standing of treasuries, increase (or introduce) a scarcity premium and increase the liquidity premium. The first two imply a reduction in the yield level whereas the latter has the opposite effect. This section tests for these effects in both the euro-area and in the US markets. The focus will be on yield spreads over other securities rather than yield levels in order to control for general movements in interest rates caused, for example, by changes in expectations about future interest rates or inflation. More specifically, the swap spread (the differential between swap rates and government bond yields) will be used, given the high liquidity of the swap market. Notwithstanding, part of the movement of the swap spreads may reflect changes in credit risk. [15] To control for this effect a credit-risk-adjusted swap spread will be computed.

Chart 4 shows 10-year swap spreads in the US and in the euro-area markets. The latter series is proxied using German bonds and, in the pre-EMU period, DM swap rates. As is apparent from Chart 4, in the US market the swap spread has changed significantly over the last 2 to 3 years, in contrast to its relative stability between 1992 and 1997. The widening of the spread during the autumn of 1998 possibly reflected the flight to quality resulting from the financial crisis and events such as the LTCM hedge fund crisis. Between mid-1999 and 2000 Q2 the swap spread widened again, coinciding with the announcement and the implementation of the buyback programme by the US Treasury. During this latter period the swap spread reached record levels (more than 135 basis points), about 95 basis points above the average level of 1991-1997 and significantly above the level observed during the autumn 1998 events. Since 2000 Q3 the swap spread has trended downwards. Notwithstanding, as at mid-2001 it stood above average historical levels.

In the euro-area markets, a similar pattern to that followed by the corresponding swap spread in the US market was observed, although some notable differences appear. Firstly, the spread showed a much more stable pattern as from 1999. For example, the

[15] Most of the banks in the LIBOR contributor are rated AA (see BIS (2001b)).

peak level during this period was around 70 basis points, i.e. 40 basis points above the average level in 1991-1997. Secondly, the spread peaked later (August 2000), coinciding with the auction of UMTS licences in Europe, which provided high revenues to some European governments. Thirdly, the level observed at mid-2001 was closer to average historical levels.

To analyse to what extent recent patterns in swap spreads are driven or not by credit risk factors, resort is had to the following regression:

$$sp_{i,t} = a_i + bcred_t + e_{i,t}$$

where $sp_{i,t}$ is the 10-year swap spread in market i (i=dollar, euro) at time t, and $cred_t$ is the yield spread between 10-year B and AAA-rated corporate bonds in the US market. This variable proxies global credit risks. It is implicitly assumed that credit risk shocks proportionately affect lower rated bonds more and, as a consequence, the yield spread between risk categories should proxy credit risk. It is also assumed that the coefficient of this variable is the same for both currencies given that most of the counterparties present in the underlying market for swaps are the same (eurodeposit market).[16] Use is made of weekly data computed as an average of daily rates to limit the impact of measurement errors such as the lack of synchronous rates. As expected, the estimated coefficient β is positive and significant, meaning that swap spreads are partly driven by changes in credit risk.

Chart 5 shows 10-year swap spreads adjusted for credit risk, which are computed as the sum of the constant and residuals of the regression, for both the US and euro-area markets. The adjusted spreads show, over the last three years, a similar pattern to that followed by the corresponding unadjusted spreads, although movements appear to be slightly more stable. This evidence suggests that the swap spreads have been partly driven by idiosyncratic factors affecting the treasury market.

In the US market, the adjusted swap spread peaked in April 2000 at about 100 b.p. – i.e. about 80 b.p. above the average level between 1991 and 1997. Since 2000 Q3 this spread has trended downwards and in July 2001 it stood around 30 b.p. above the average level of 1991-1997. In other words, this evidence suggests that the shrinking supply of treasury bonds in the US market has had a negative impact on the yields of treasury securities, meaning that the scarcity premium has prevailed over the liquidity premium, despite the evidence of the decreasing liquidity of the US government bond market reported by some authors.[17,18] The downward trend of the adjusted spread since 2000 Q3 may

[16] Since 1999 the euro-area swaps have been based on the Euribor instead of the Libor. The contributor panel in the Euribor is much wider than that of the Libor.

[17] See Fleming (2000).

reflect some correction of the imbalances between supply and demand. Possibly, some market participants have found highly rated private instruments as replacements for government securities, such as those issued by US agencies. In this regard, some of these agencies (Freddie Mac, Fannie Mae) have announced the regular issuance of large amounts of bonds in a range of maturities and, in March 2000, the CME, the CBOT and the Cantor Exchange launched futures and options contracts on agency bonds.

In the euro area, the adjusted swap spread peaked in August 2000 at around 30 b.p. –i.e. about 30 b.p. the average level of the period 1991-1997. In July 2001 this spread was around the average level of 1991-1997, meaning that the scarcity premium was no longer embedded in euro-area government bond prices.

All told, this evidence seems to indicate that the effects on yields of the relative reduction of government bonds have been much more limited in the euro area than in the US. This result is not surprising bearing in mind that, contrary to what has occurred in the US, in the euro area the stock of government bonds has continued growing and will foreseeably continue on this path in the coming years.

Implications for the information content of the yield curve and for market functioning

The above discussion suggests that the quality spread in the US was significantly affected by changes in the scarcity premium embedded in the government bonds yields, i.e. movements in this spread did not only reflect changes in the private credit risk premium.

Similarly, the possible different behaviour of the scarcity premium along the yield curve may have affected the information content of the term spread. Chart 6 shows the term spread computed as the difference between the 10-year and the 2-year yields using data from both the government debt and swap markets in the US. Between 1999 and 2000, large discrepancies between both indicators are observed in both the level and the intensity of changes. In this respect, it is worth noting that, during 2000, even the sign of this indicator was different depending on the data used: it was negative when using data from the government debt market, but positive in the other case. The foregoing evidence implies that the information content of the government bond yield curve for inflation and output has been significantly affected in the US due to imbalances between supply and demand.

In the euro area, the relatively higher stability of the adjusted swap spread during 1999 and 2000 means that the information content of the government bond yield curve was

[18] Note that this approach does not allow for the analysis of potential effects on yields caused by the improved credit standing of the US Treasury since this effect will probably be reflected, at least partially, in the foreign exchange risk premium demanded by investors and, therefore, will also affect other debt securities denominated in dollars.

less affected by the reduction in the relative supply of these securities. Chart 7 confirms that discrepancies in the term spread derived form the swap and the government debt market were relatively limited, although a widening between both indicators was also observed during 2000.

Apart from the impact on information content, the distortions in the US government bond yield curve caused by the shrinking supply of these securities may have affected some other functions performed by the treasury securities market. For instance, the usefulness of treasury securities for pricing private securities and the efficiency of using these assets for hedging private interest rate risk may have diminished. To test for these effects the correlation between government and private bond 10-year yields is now analysed using a weekly frequency. It is apparent from Chart 8 that these correlations dropped significantly during the autumn 1998 crisis for all rating categories. More recently, these have dropped again, although less dramatically. Chart 9 shows that a similar pattern is found when computing these correlations using swap rates instead of government securities yields. This evidence seems to indicate that, at least at a weekly frequency, the decreasing efficiency of using treasury securities to hedge interest rate risk has not been driven by idiosyncratic factors of the treasury market.

Table 8 reports correlations of treasuries and swaps with corporate bonds, using different frequencies (1 week, 4 weeks and 8 weeks) and for two sub-periods: 1991-1997 and 1999-2001.[19] Three important features emerge from Table 8. First, correlations decrease between both sub-periods irrespective of the frequency and instrument (treasury bond or swap). Second, the relative performance of swaps as a hedging vehicle tends to increase with the horizon. Third, in the second sub-period swaps appear to be the best hedging instruments for horizons of 8-weeks, in contrast to the first period, in which treasuries were relatively superior.

Thus, this evidence indicates that idiosyncratic factors affecting the pricing of US government securities have contributed somewhat to lowering the efficiency of using treasury securities to hedge interest rate risk in horizons of 8-weeks or more. However, other factors, such as credit risk, have also contributed to this phenomenon.

In the euro area, a similar process of decreasing correlations between the yields on private and government securities has also been observed recently (Chart 10), likewise implying the decreasing efficiency of hedging private interest risk using government bond yields.[20] A similar result is also obtained when using swaps instead of government bond securities (Chart 11), which means that credit risk factors possibly account for this development. Table 9 shows correlations of treasuries and swaps with corporate bonds

[19] The year 1998 is not considered given the anomalous behaviour of markets during the autumn crisis.

[20] Data on corporate bond yields in the euro area are taken from Merrill Lynch.

between 1999 and 2001.[21] Like in the US, the relative superiority of swaps tends to increase with the horizon. But, in contrast to the US evidence, swaps appear to be the best hedging vehicle for all horizons.

5. OUTLOOK

Market integration and changes in market structure

The introduction of the euro has contributed, among other factors, to a reduction in the degree of fragmentation among euro-area government bond markets. However, at present these markets are not fully integrated due to remaining barriers such as the heterogeneous tax regime within the euro area and the lack of integration of its clearing and settlement systems.

The lack of co-ordination between issuers is sometimes cited as another element hampering market integration. However, a higher homogeneity of products is neither a sufficient nor a necessary condition for market integration.

Progress in market integration will involve obvious gains for both investors and issuers due to the reduction in trading costs. This, in turn, would positively affect the market liquidity of traded securities. All these developments would ultimately improve some of the functions performed by government bond markets.

Another area in which changes in market structure can improve market functioning is in the futures contracts. As was discussed in Section 3, the futures contracts based on German bonds are currently used for managing euro interest rate risks and not only German bond interest rate risks. As a result, the size of the futures market is large as compared with the underlying market. This has created ideal conditions for squeezes. The existence of squeezes may introduce distortions into the pricing of securities traded in the cash, derivative and repo markets that negatively affect the market functioning. In IMF (2001b), some measures are proposed to reduce the chance of squeezes, such as the increasing issue sizes, reopening issues when a squeeze is likely, introducing of cash settlement for futures contracts and enlarging the basket of deliverable bonds.

[21] Unfortunately, no data are available on corporate bond yields denominated in euro-area currencies before 1998.

The search for substitute securities for treasury securities

As argued in Section 4, a number of factors including the multiplicity of issuers, the existence of market microstructure factors and, to some extent, the reduction in the relative supply of bonds, have affected some of the functions traditionally performed by government bond markets. The effects of the reduction in the relative supply of bonds have hitherto been limited in the euro area compared with what has occurred in the US. However, the evidence in the US markets shows that an acceleration of the reduction in the relative supply of bonds in the euro area may have important effects for market functioning. The appearance of such effects would largely depend on the existence of substitute instruments.

Against this background, an analysis is made of what securities could replace treasury securities in their functions, and their relative advantages and shortcomings compared with government bonds. More specifically, the focus is on the following functions: i) benchmark status to extract information on inflation and output outlook, ii) use as risk-free securities for investment and for use as collateral, iii) benchmark status for pricing of other fixed-income securities, and iv) instruments used for hedging of interest-rate risks.

Interest rate swaps are frequently cited as instruments that can stand in for some of these functions.[22] In this regard, swaps have a number of advantages over government securities. First, coupon-related effects do not appear in their valuation since they always reflect the rate of a par bond. Second, the relative liquidity of this market, compared with that of government bond markets, has improved significantly since the introduction of the euro.[23] This effect is mainly a consequence of the concentration of liquidity in one single instrument. Third, a single curve is observed in the swap market. Fourth, the absence of underlying fundamental assets for swaps means that there is no supply limit and no need to borrow securities to go short. And, finally, unlike government bonds, this market is completely integrated.

Another distinctive feature of the swap rates is the presence of a credit risk premium embedded in their pricing, related to the risk of highly rated financial institutions. Depending on the aim pursued and what the market circumstances are, this feature of swaps may be an advantage or a shortcoming. For the purpose of extracting information on expectations about some macroeconomic variables, the existence of credit risk premia in the swaps market will distort the information content of interest rates. Conversely, for the purpose of hedging private interest rate or pricing other private fixed-income securities, the existence of a credit risk premium embedded in swap rates will normally be an advantage since this premium tends to be highly correlated with credit risk premia of other private securities. In

[22] See BIS (2001b), IMF (2001a), IMF (2001b) and Fleming (2000).

[23] The average bid-ask spread of euro 10-year swap rates was 2.7 basis points between January 1999 and July 2001, which compares with an average of 3.4 basis points for the DM 10-year swap rate between 1996 and 1998.

this regard, the surge in the size of the swap market in the euro area suggests that an increasing number of participants are using this market to hedge interest rate risks.[24] Nonetheless, under certain circumstances – for instance, stress in the financial sector- these correlations may be low or even negative.

The existence of counterparty credit risk is another shortcoming of swaps. However, this risk is currently very low given the set of collateralisation and documentation standards recently developed by dealers and customers.

Swaps cannot be used to replace government securities in other functions such as investment and their use as collateral. At the same time, some market indicators such as those derived from inflation-indexed bonds are not currently available from swaps markets. To perform these functions an alternative highly rated instrument is needed. Recent developments in the euro area indicate that asset- and mortgage-backed securities, such as the German Pfandbriefe, may meet this need. Their increasing liquidity and the fact they are normally highly rated are the main advantages. In this respect, these securities are increasingly used as collateral by some institutions and the ECB currently accepts most of them as collateral in its monetary policy operations. But these instruments currently evidence shortcomings that limit their advantages over government bonds, namely their lower liquidity and the existence of a prepayment risk embedded in their pricing. Additionally, the fact these instruments normally have a higher credit risk than government bonds means that they cannot be perfect substitutes. More specifically, some investors might be forced to assume a level of risk above that desired. In the collateral transactions, higher risk can be easily overcome by introducing higher haircuts than those applied to comparable government bonds.

The foregoing discussion suggests there are currently certain instruments capable of performing some of the functions traditionally undertaken by government bonds. Although these instruments have some advantages over government bonds, they also have shortcomings. Thus, the optimal instrument is not easy to establish and will depend on a number of factors including the aim pursued. For the purpose of extracting information on the inflation and output outlook, the advantage of using an alternative security in the euro area is not clear. Possibly, a better alternative would be to complement the information provided by the government bond market rather than replace it. Conversely, swaps will normally be better instruments for the purpose of hedging private interest rate risk or pricing private fixed-income securities. In this regard, Section 4 reveals that, in the euro area, swaps are a better hedging vehicle than treasuries.

[24] According to BIS (BIS (2001a), the size of the market, approximated by the notional amount outstanding, has increased by 32% between 1998 and 2000.

6. CONCLUSIONS

This paper has analysed recent key developments in euro-area government bond markets and their main implications for central banks and for market functioning. The introduction of the euro and the relative reduction in the supply of bonds have been identified as the two main driving forces.

The introduction of the euro has affected the trading strategies of investors and has prompted some reorganisation of the markets ultimately reflected in greater market integration. However, euro-area government bond markets are at present far from being fully integrated. Given the advantages associated with greater integration, it would be desirable to continue efforts to eliminate obstacles that currently seem to contribute to fragmentation.

The introduction of the euro has also affected the relative pricing of securities. To see this the determinants of yield spreads before and after Monetary Union have been analysed. The spreads over German bonds of previously high-yield debt have narrowed significantly. By contrast, the spreads of all other euro-area sovereign debt have widened after the introduction of the euro. It was argued that this evidence might reflect an increase in differences in both liquidity and genuine credit risk between the German securities and the other euro-area sovereign debt. A change in pricing due to greater market integration is not ruled out. It has also been shown that market microstructure factors, such as relative market liquidity and the cheapest-to-deliver status of bonds, play a part in determining relative prices in addition to differences in credit risk.

It was argued that the existence of these market microstructure effects together with the multiplicity of sovereign issuers in the euro area limits some of the functions traditionally performed by government bond markets, such as their status as a benchmark for pricing other fixed-income securities, their usefulness for hedging interest rate risks or the extraction of relevant information for the inflation and output outlook.

The reduction in the relative supply of government bonds has hitherto had a limited effect in the euro area, contrasting with the evidence in the US market. The experience in the US shows that the continuation of this process in the euro area may have relevant effects and implications for market functioning. The appearance of such effects would largely depend on the existence of substitute instruments.

Against this background, interest rate swaps appear to be instruments capable of replacing government securities in some of their functions. However, the existence of a time-varying credit risk premium embedded in swap rates means that, depending on the aim pursued and under certain market circumstances, the relative advantages of these instruments might be offset by their costs. For the purpose of hedging private interest rate

risk or pricing private fixed-income securities, swaps are probably better instruments. Conversely, for the purpose of extracting information on the inflation and output outlook, the advantage of using an alternative security to government bonds is not clear. Possibly, a better alternative would be to complement the information provided by the government bond market rather than replace it.

Finally, swaps cannot be used to replace government securities in certain other functions such as investment and use as collateral. To perform these functions, highly rated private paper is needed, but the higher credit risk of these alternative instruments as compared with government bonds means that they are not perfect substitutes.

TABLE 1

Size of government securities markets. Outstanding amounts. July 2001

EUR billions

Austria	106
Belgium	243
Germany	700
Spain	281
Finland	53
France	661
Ireland	22
Italy	1102
Luxemburg	1
Netherlands	186
Portugal	49
Greece	106
Euro Area	**3510**
United States (a)	3217
Japan (a)	3897

Sources: ECB, BIS.
(a) December 2000.

TABLE 2

Stock of euro-denominated fixed-income securities (a)

EUR billions

	1996	1997	1998	1999	2000	2001
Euro area goverment	2855	2977	3112	3239	3317	3508
Other public debt	93	95	96	100	109	115
Financial institutions	1836	1975	2146	2467	2680	2825
Non-financial corporations	261	258	271	319	374	416
Non-residents	-	-	441	631	793	889
TOTAL	**-**	**-**	**6067**	**6756**	**7273**	**7754**
Memorandum item:						
Euro area gov / TOTAL (%)	-	-	51.30	47.95	45.61	45.24
Euro area gov / Resid. sectors (%)	56.58	56.12	55.32	52.89	51.19	51.10

Source: ECB.
(a) End of period, June for 2001.

TABLE 3

Ownership of euro-area government securities

%

	Resident sector				Non-residents
	TOTAL	MFI	Other fin. Corporations	Other	
1991	83.8	43.0	12.5	28.2	16.0
1992	82.4	43.3	12.3	26.9	17.6
1993	78.1	41.1	12.6	24.3	22.0
1994	80.3	42.7	14.1	23.4	19.7
1995	79.0	41.1	14.7	23.0	21.0
1996	78.5	40.2	17.5	21.0	21.5
1997	76.5	38.9	19.3	18.3	23.7
1998	73.2	36.9	22.2	14.2	26.8
1999	69.5	35.1	20.7	13.7	30.5
2000	66.5	33.8	19.4	13.4	33.5

Source: ECB.

TABLE 4

10-year euro-area bond futures trading in selected markets

Monthly average, EUR millions

	1996	1997	1998	1999	2000	2001 (a)
German bonds	596,390	827,981	1,211,089	1,402,122	1,323,842	1,639,148
EUREX (b)	172,424	341,019	1,055,158	1,402,122	1,323,842	1,639,148
LIFFE	423,967	486,962	155,931	0	0	0
French bonds (MATIF)	224,366	214,397	145,910	51,092	360,975	301,000
Spanish bonds (MEFF)	93,337	104,848	78,386	29,810	9,121	3,772
Italian bonds	130,507	150,527	74,506	11,404	123	0
LIFFE	106,191	125,097	63,379	9,835	109	0
MIF	24,315	25,430	11,127	1,569	14	0
TOTAL	1,044,599	1,297,754	1,509,891	1,494,427	1,694,061	1,943,921

Sources: FIBV, Banca d'Italia, LIFFE, EUREX, MEFF, EURONEXT

(a) To June.

(b) Formerly DTB

TABLE 5

10-year yield spreads before and after EMU. Breakdown by factors (a)

Basis points

	Before EMU (1996-1998)			After EMU (1999-2001)
	Spread	Foreign exchange factor (b)	Other	Spread
Austria	9.7	1.3	8.4	26.2
Belgium	19.0	4.5	14.5	31.0
Finland	46.2	40.9	5.3	22.8
France	3.8	-2.9	6.8	13.1
Ireland	45.4	36.6	8.9	23.1
Italy	154.4	132.2	22.2	31.5
Netherlands	-2.2	-3.8	1.6	14.8
Spain	114.9	96.4	18.6	27.0

(a) Spread over German bonds.

(b) Approximated as the spread beween the swap rate in the currency of denomination of the bond and the swap rate in DM.

TABLE 6

Yield discrepancies between French and German government bonds, adjusted for different cash flow structure

Basis points

	1/1/99 - 28/5/01		1/1/99 - 30/4/00		1/5/00 - 28/5/01	
	Mean	(5%;95%)	Mean	(5%;95%)	Mean	(5%;95%)
On-the-run issues						
2 years	4.0	(-0.5;9.0)	3.3	(-1.4;9.0)	5.0	(1.7;9.0)
5 years	4.6	(-3.3;10.4)	2.6	(-6.6;9.1)	7.2	(3.5;11.2)
10 years	11.6	(6.3;16.3)	9.3	(5.9;12.8)	14.7	(11.9;17.0)
30 years	8.5	(2.4;13.7)	5.9	(1.9;9.9)	11.8	(9.3;14.8)
Other issues						
2-5 years	0.1	(-2.7;3.3)	-1.0	(-3.2;1.5)	1.6	(-1.4;4.0)
5-10 years	-0.4	(-8.1;9.5)	-5.2	(-8.5;-0.9)	6.0	(1.1;10.8)
10-30 years	6.6	(-1.0;13.0)	3.3	(-2.7;7.6)	11.0	(7.7;13.4)

In brackets: 5th and 95th percentiles.

Yield discrepancies are computed as the differences in yield errors in order to control for differences in cash flow structure. Yield errors are the difference between observed and estimated yields. The latter were estimated using the Nelson and Siegel model.

TABLE 7

Relative liquidity premia in selected euro-area government securities markets

Basis points

	1/1/99 - 28/5/01 Mean (5%;95%)		1/1/99 - 30/4/00 Mean (5%;95%)		1/5/00 - 28/5/01 Mean (5%;95%)	
German Market	-6.4	(-9.3;-3.3)	-6.5	(-9.5;-2.8)	-6.2	(-8.5;-4.8)
French Market	-2.8	(-5.0;-1.0)	-2.3	(-3.8;-0.7)	-3.5	(-5.3;-1.4)
Spanish Market	-4.6	(-8.3;-1.1)	-6.1	(-8.5;-3.6)	-2.8	(-4.7;-0.7)

In brackets: 5th and 95th percentiles.
A dummy variable that takes value 1 for the last two on-the-run issues is introduced in the Nelson and Siegel model. Liquidity premia are approximated as the estimates of the dummy parameter.

TABLE 8

Correlations with corporate bond yields. US market. 10-year yields

%

		1991-1997		1999-2001	
		Treasury	Swap	Treasury	Swap
Weekly					
	AAA	0.982	0.939	0.941	0.891
	AA	0.980	0.936	0.959	0.920
	A	0.978	0.936	0.953	0.914
	B	0.972	0.928	0.946	0.906
4-weekly					
	AAA	0.990	0.979	0.944	0.920
	AA	0.986	0.975	0.953	0.942
	A	0.984	0.975	0.947	0.939
	B	0.975	0.968	0.925	0.923
8-weekly					
	AAA	0.994	0.985	0.947	0.952
	AA	0.994	0.986	0.939	0.952
	A	0.989	0.983	0.921	0.951
	B	0.980	0.975	0.892	0.942

Weekly changes. Data computed as weekly average of daily rates. All data are taken from Bloomberg.

TABLE 9

Correlations with corporate bond yields. Euro-area market. 10-year yields

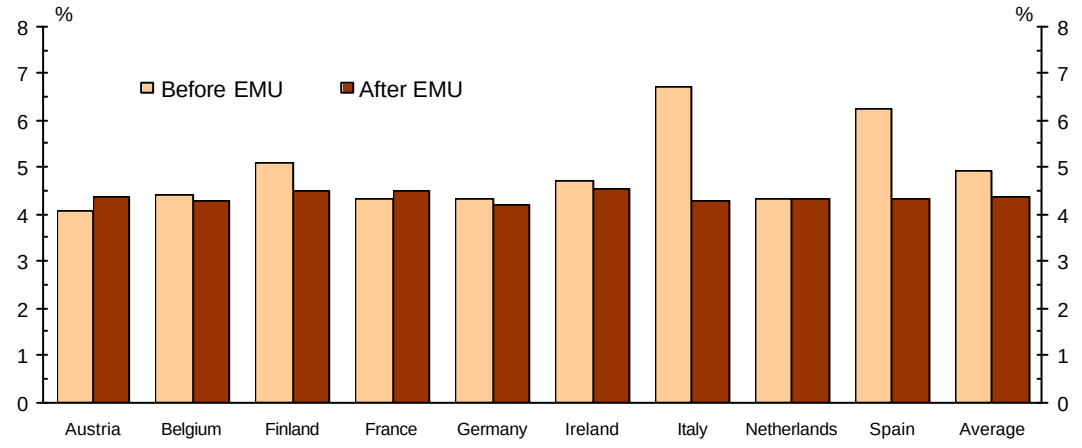
%

		1999-2001	
		Treasury	Swap
Weekly			
	AAA	0.951	0.956
	AA	0.959	0.960
	A	0.943	0.949
	BBB	0.754	0.773
4-weekly			
	AAA	0.943	0.976
	AA	0.936	0.981
	A	0.875	0.943
	BBB	0.517	0.654
8-weekly			
	AAA	0.976	0.990
	AA	0.970	0.991
	A	0.948	0.978
	BBB	0.860	0.870

Weekly changes. Data computed as weekly average of daily rates. Data on treasury yields and swap rates are taken from Bloomberg. Data on corporate bond yields are taken from Merrill Lynch.

CHART 1

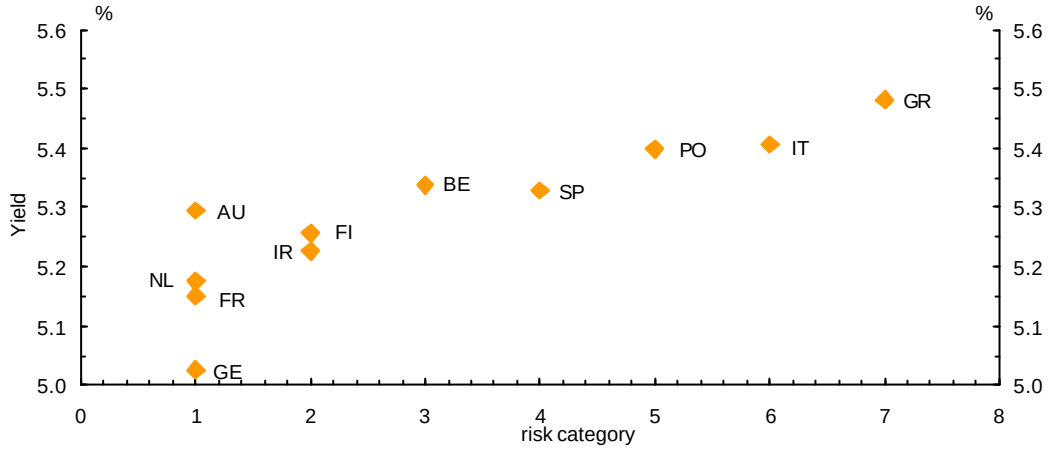
Volatility of euro-area 10-year government bond yields



Volatility computed as the standard deviation of daily changes in yields.

CHART 2

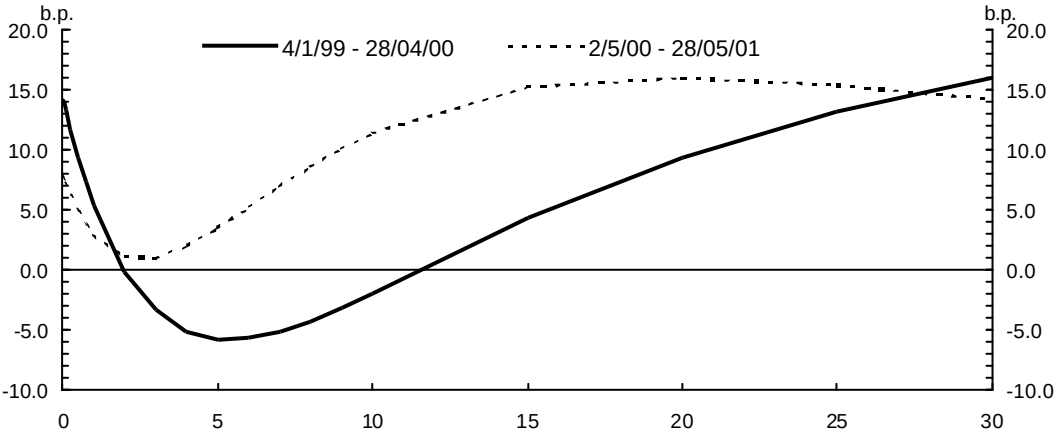
10-year government bond yields by risk category (June 2001)



Source: Bloomberg.

CHART 3

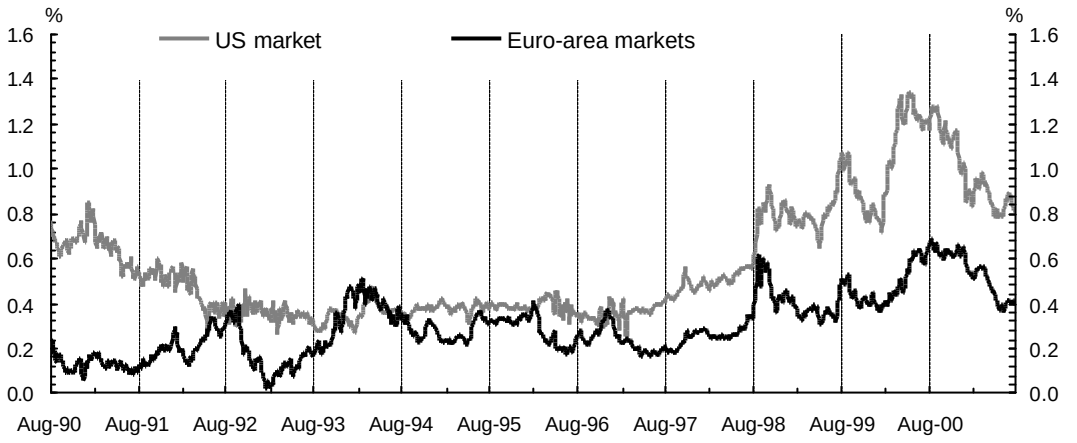
Zero-coupon yield spread between French and German government bonds



Zero-coupon yields are estimated using the Nelson Siegel model.

CHART 4

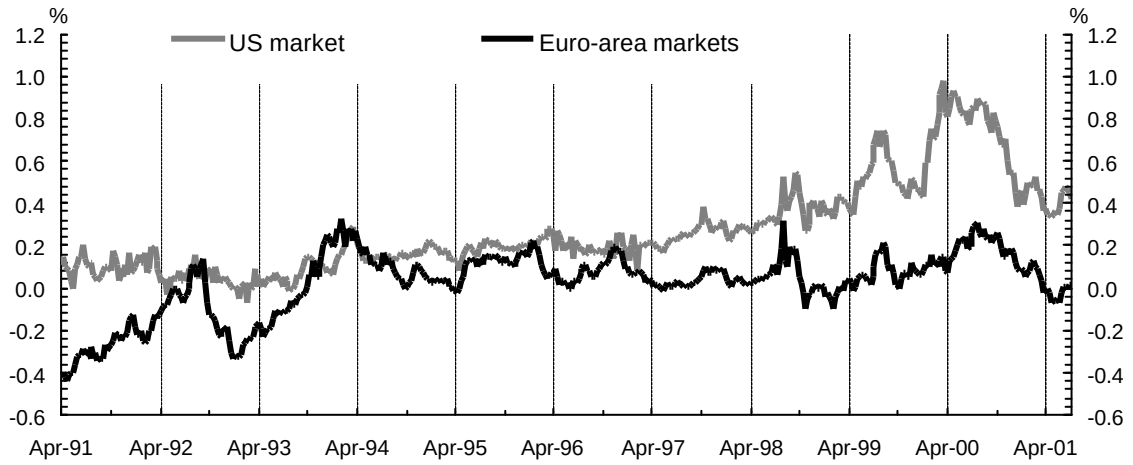
10-year swap spreads



5-day moving average. The swap spread in the euro-area market is computed using German bonds, and before 1999, swap rates in DM. All data are taken from Bloomberg.

CHART 5

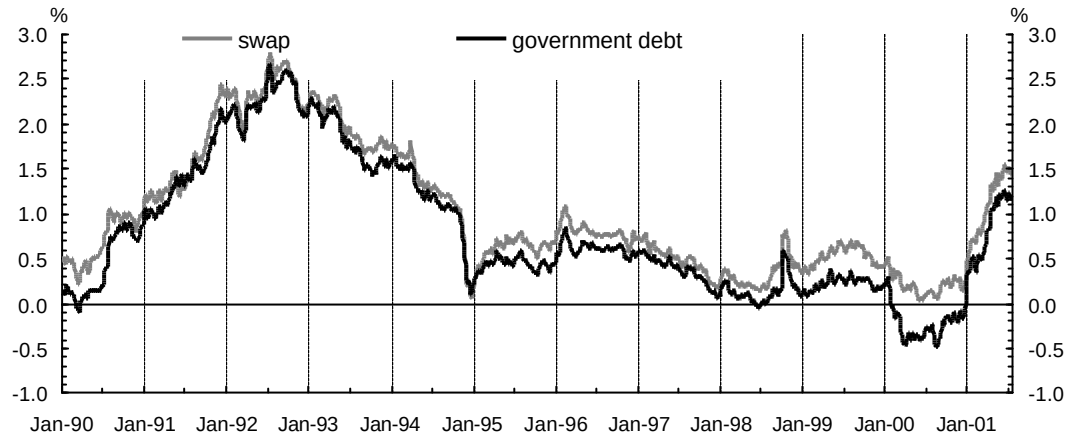
10-year swap spread adjusted for credit risk



Weekly data. To adjust swap spread for credit risk we first regress the swap on a constant and a proxy for credit risk (yield spread between B and AAA-rated corporate bonds). The adjusted spread is computed as the difference between the swap rate and the estimated credit risk term.

CHART 6

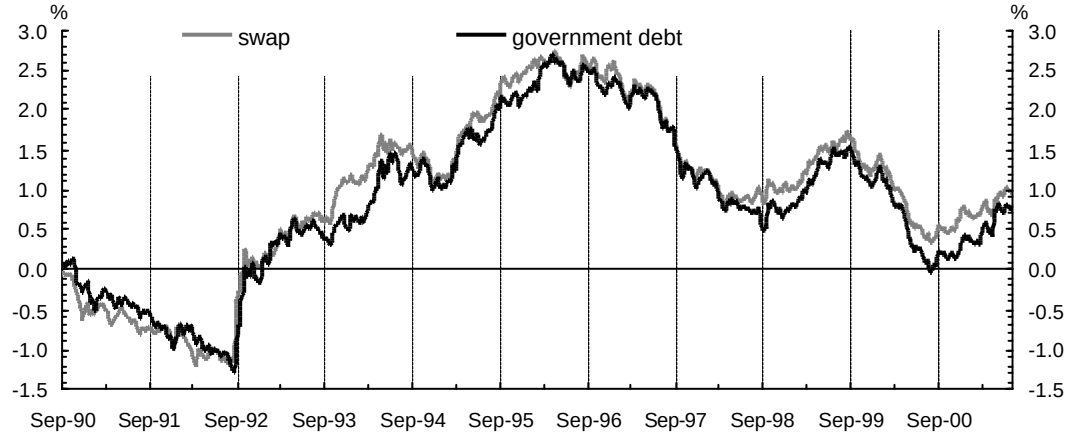
Slope of the yield curve, US markets



Slope computed as the spread between 10-year and 2-year yields. 5-day moving average. Data are taken from Bloomberg.

CHART 7

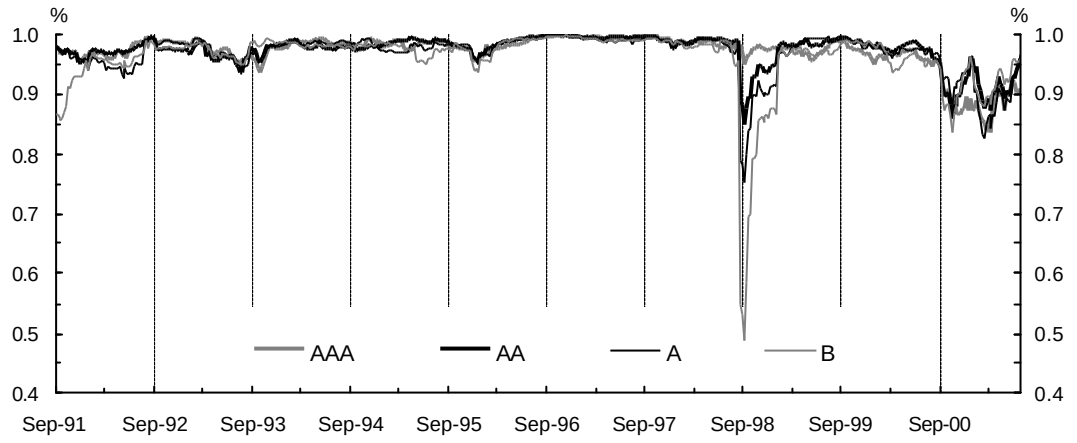
Slope of the yield curve, euro-area markets



Slope computed as the spread between 10-year and 2-year yields. 5-day moving average. German bonds for government debt. DM swap rates before 1999. Data are taken from Bloomberg.

CHART 8

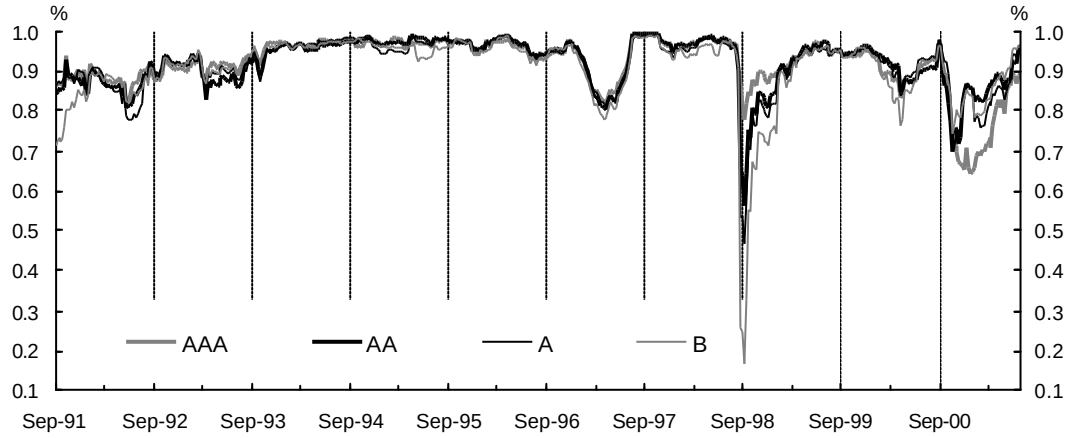
Correlation between private and government debt 10-year yields, US markets



20-week rolling correlations of weekly changes. Data computed as the average of daily rates. Data are taken from Bloomberg.

CHART 9

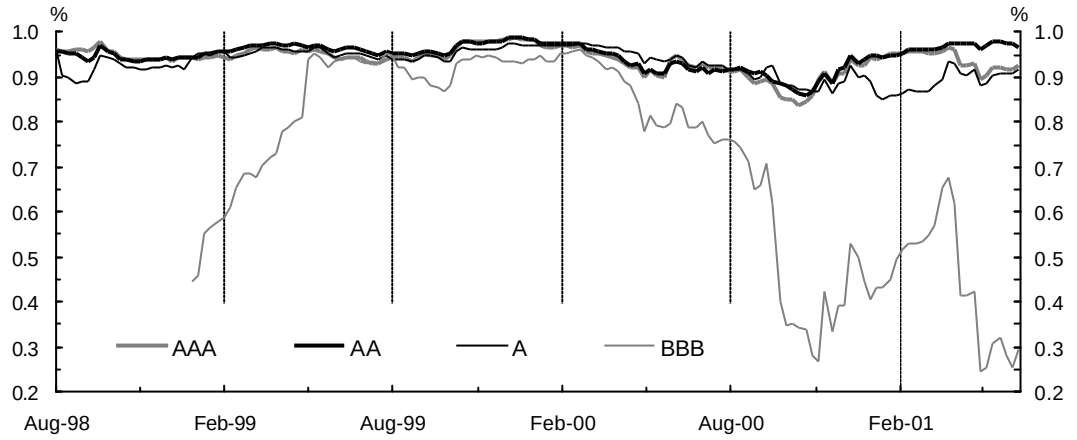
Correlation between 10-year private debt yields and 10-year swap rates, US markets



20-week rolling correlations of weekly changes. Data computed as the average of daily rates. Data are taken from Bloomberg.

CHART 10

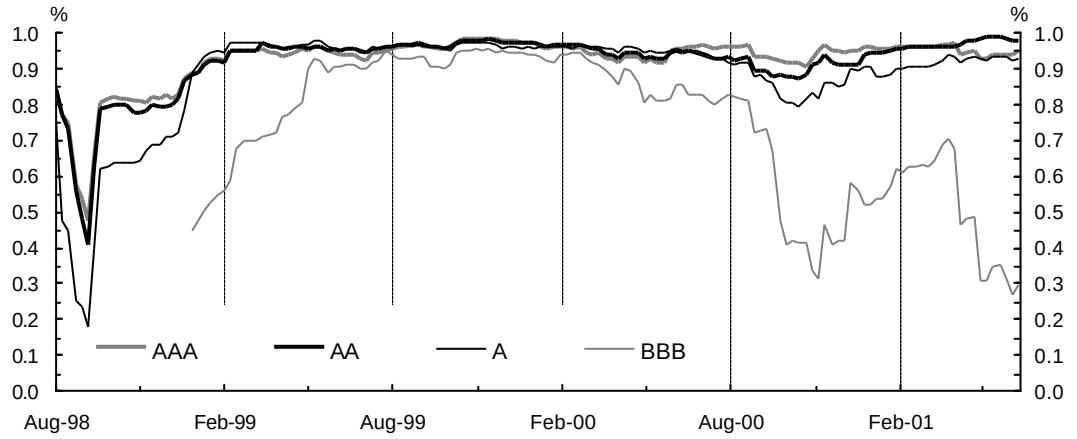
Correlation between private and government debt 10-year yields, euro-area markets



20-week rolling correlations of weekly changes. Data computed as the average of daily rates. German bonds for government debt. Data on German bonds are taken from Bloomberg and data on corporate yields are taken from Merrill Lynch.

CHART 11

Correlation between 10-year private debt yields and 10-year swap rates, euro-area markets



20-week rolling correlations of weekly changes. Data computed as the average of daily rates. Before 1999 swap rates in DM. Data on swap rates are taken from Bloomberg and data on corporate yields are taken from Merrill Lynch.

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