Yield spreads on EMU government bonds

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1. INTRODUCTION

By eliminating exchange rate risk between the currencies of participating member states, the inception of economic and monetary union (EMU) in January 1999 created the conditions for a substantially more integrated public debt market in the euro area. However, interest rates on euro-denominated bonds issued by different governments have not fully converged. Spreads between them may reflect differences in liquidity, as bonds that can be traded immediately with low transaction costs and minimum price changes can offer lower yields in equilibrium,[1] and/or differences in the creditworthiness of sovereign issuers.

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[1] Gómez-Puig (2003) finds an important role for liquidity as measured by bid-ask spreads in a static panel where credit ratings identify default risk and relative levels of debt are taken as a proxy for market depth.

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Government bond spreads

SUMMARY

We provide evidence that the movements in yield differentials between euro zone government bonds explained by changes in international risk factors – as measured by banking and corporate risk premiums in the United States – are more pronounced for bonds issued by Italy and Spain. Liquidity factors play a smaller role, so policies meant to increase financial market efficiency do not appear sufficient to deliver a 'seamless' bond market in the euro area. The risk of default is a small but important component of yield differentials movements, which signal market perceptions of fiscal vulnerability, impose market discipline on national fiscal policies, and may be reduced only by further convergence in debt ratios.

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The aim of this paper is to study the determinants of observed yield differentials in the euro zone government bond markets. New evidence is provided on the relative importance of credit risk and liquidity by examining the role of macroeconomic fiscal fundamentals and liquidity indicators in explaining movements in yield differentials. Following Blanco (2001), we build on findings of the empirical literature on sovereign bond spreads of emerging markets, according to which spreads are sensitive to US risk factors and interest rates (see e.g. Arora and Cerisola, 2001; Barnes and Cline, 1997; Eichengreen and Mody, 2000; Kamin and Von Kleist, 1999). Then, we assess the importance of credit risk by testing whether the impact of exogenous international factors depends on local fiscal fundamentals, which are represented by the debt-to-GDP ratios.

Distinguishing between the credit risk and liquidity components of interest rate spreads has important implications for policy-making and for financial markets.

To the extent that yield spreads reflect differences in credit standings, the Stability and Growth Pact (SGP) and the European fiscal framework appear insufficient to ensure that all member states have the same creditworthiness from the market point of view. Yield differentials are important indicators of market perceptions of fiscal vulnerability and, since higher bond yields imply higher debt service costs, impose market discipline on national governments' fiscal policies. The impact of even small differentials can of course be substantial in countries like Belgium and Italy, where the debt exceeds GDP, and even a tenth of a percent spread (10 basis points) increases government outlays by more than 0.1% of GDP. The kind of runaway fiscal policies that the SGP tries to rule out and its consequent market reaction has not been recorded over the past few years. However, if even limited changes in fiscal positions as those recently observed affect yield differentials, it is sensible to expect that the impact of lax fiscal policies would be much stronger. This has important policy implications: it suggests that expansionary fiscal policies could lead to substantially higher debt service costs and thus that the scope would be limited even in the post-EMU environment.

To the extent that yield spreads instead depend on differences in liquidity of government bonds, they merely reflect the relative effectiveness of debt management policies in improving liquidity and differences in market microstructures. Policy implications would then depend on the sources of liquidity premiums. If yield differentials can be explained by the size of the overall debt issued by a specific member state, again only structural convergence could lead them to disappear. If instead yield differentials reflect specific features of primary markets where bonds are issued, such as the auction mechanism or the issuance calendar, as well as the degree of primary and secondary market efficiency, there is scope for policy action to narrow differentials further, and appropriate cost-minimizing debt management can lead to a full convergence of yields.

Understanding the determinants of yield spreads is also crucial in assessing the prospects for the European bonds market. If bonds issued by different member states continue to be perceived as imperfect substitutes, the goal of creating one market for the 'same bond' as large and liquid as the US bond market would be frustrated. However, whether this is a desirable aim depends on the reason for the segmentation.

If yield differentials were explained by differences in liquidity, their elimination would certainly be a sign of higher efficiency. If, instead, yield differentials reflected different default risks across states, they would be useful indicators for an efficient allocation of funds and a deterrent for irresponsible fiscal policies. And this may be considered as a more important goal than creating a market for the 'same bond'.

Market participants and member state debt managers appear to believe that EMU yield differentials are mostly due to liquidity factors. In order to reduce borrowing costs, debt managers have introduced substantial, sometimes costly, innovations that should have enhanced the liquidity of their bonds (see Favero *et al.*, 1999). In particular, with the launch of the euro in 1999, a number of governments have extended the time available for second-round non-competitive bidding, when specialists (the reference institutions in the primary market) are allowed to buy bonds at the average price of first-round competitive auctions. Governments have also launched repurchase programmes in order to buy back old illiquid issues in exchange for benchmark bonds. More recently, repo facilities (of the last resort type) at the Treasury have been provided to market makers. Distinguishing between credit risk and liquidity components could also help in assessing the merits of such policies.

Our analysis of yield differentials in the Euro area, however, suggests that market perceptions of default risk are a relatively important component of spreads.

2. YIELD DIFFERENTIALS IN THE EURO AREA

Interest rates on government bonds issued by EMU member states converged steadily in the 1990s as the introduction of the Euro approached. Figure 1 shows that

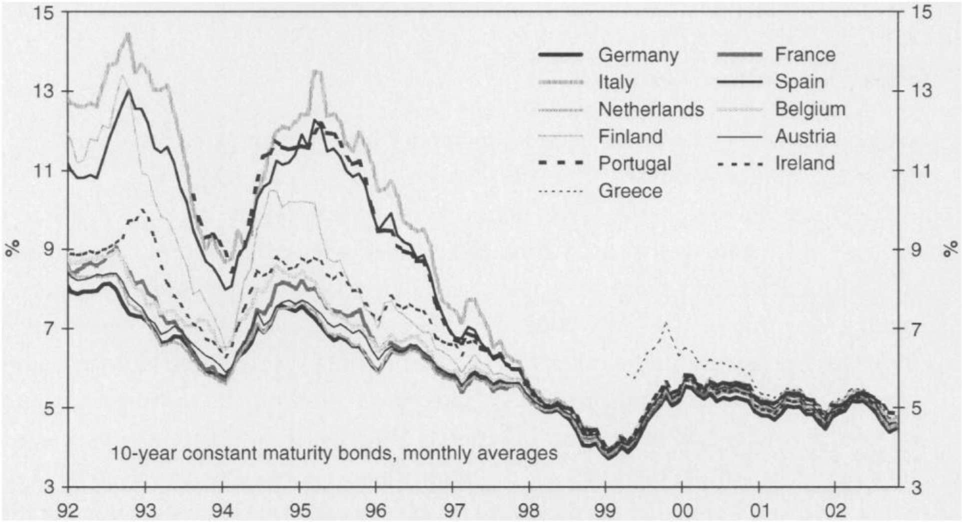

Figure 1. Government bond yields in the euro area

Note: Yields are in percentage annual terms.

Source: Datastream/Thomson Financial.

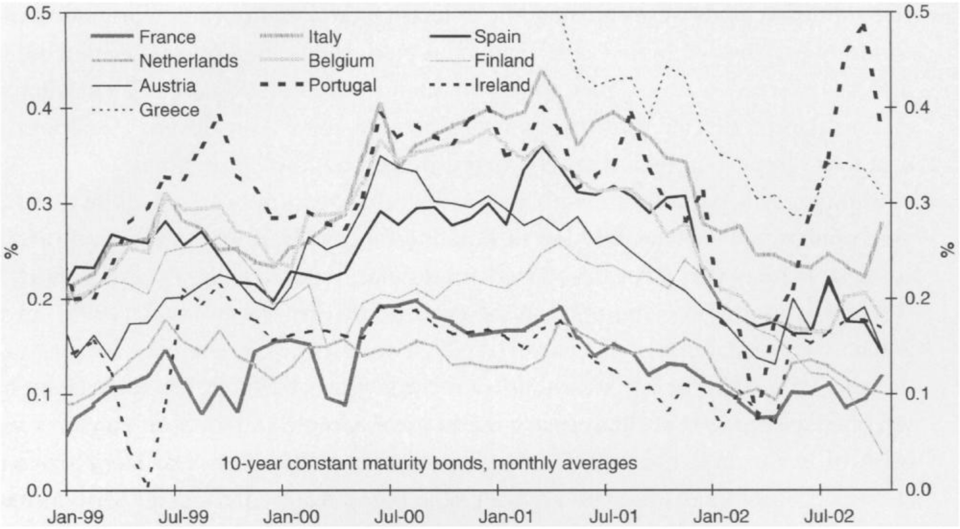

Figure 2. Post-EMU spreads of euro area versus German 10-year bond yields

Notes: Yield differentials are presented in percentage annual terms and refer to the 10-year maturity of the term structure of interest rates, hence are not affected by the small differences in the residual life to maturity of benchmark 10-year maturity bonds, the most actively traded maturity in the euro zone government securities market. German bond yields are taken as the reference rates since German bonds have maintained their benchmark status and have continued to display lower yields.

Source: Datastream/Thomson Financial.

Table 1. Average 10-year government bond yield spread versus Germany

Basis points, period Jan. 1999/Dec. 2002	AUS	BEL	FIN	FRA	GRE	IRE	ITA	NET	POR	SPA
Yield differential	24.3	28.1	19.0	13.8	54.9	14.6	32.5	13.6	32.2	25.4

Source: Datastream/Thomson Financial.

by January 1999 differences across benchmark government bond yields had largely, but not completely, vanished.[2]

Yield differentials for the EMU period are shown in Figure 2, and Table 1 reports average yield spreads for that period. Four years after EMU inception, differentials are still positive, and point to non-trivial differences in credit and/or liquidity premiums. Over the period 1999–2002, the differences between 10-year government bond yields of Germany and the other EMU member states were about 14 basis points on average in the case of France and the Netherlands, and ranged up to 32 basis points on average in the case of Italy and Portugal. Although these differences appear small, they have non-trivial consequences for public finances. For instance, if applied to the whole stock of Italian debt, the recorded yield spreads would account for additional government outlays in excess of 0.3% of GDP.

[2] For a detailed discussion on benchmark status see Dunne *et al.* (2002).

Before EMU, yield differentials within Europe were determined by four main factors:

(1) expected exchange rate movements and exchange rate risk,
(2) different tax treatments and controls on capital movements,
(3) liquidity, and
(4) default (or credit) risk.

Exchange rate factors were eliminated in January 1999 for EMU countries, and tax treatments were harmonized before monetary union, while controls on capital movements had been removed long before that. The other two factors, however, remain relevant.

As regards liquidity, bonds that can be traded immediately at low transaction costs and with minimum price changes, even in adverse market conditions, can offer lower yields to investors in equilibrium. Liquidity may vary across sovereign issues depending on trading volumes, the amounts of bonds outstanding, the trading activity of market makers, and the efficiency of the secondary market. Bonds, especially in the 10-year maturity segment, are highly standardized products, but outstanding amounts vary considerably across sovereign borrowers depending on country and debt dimensions. Therefore, issuing policies may play an important role. Secondary market characteristics such as admission and trading rules or clearing and settlement procedures may equally be critical for liquidity, and especially the willingness of market makers to quote two-way prices and stand ready to satisfy buying and selling orders. The incentives to trade and invest in specific bonds may also depend on the availability of hedging and financing instruments, such as liquid and efficient future contracts and efficient repurchase agreement markets.

As regards credit (or default) risk, namely the risk that the country may not honour, in part or in full, its obligations, it depends crucially on current and future stated and hidden debt, and debt sustainability. Debt sustainability depends on expected budget surpluses/deficits, as well as future economic activity and interest rates, which in turn are affected by domestic and international factors and policies. EMU member states have lost the option of printing money to pay for their debts, so credit risk may have become even more important even as the exchange risk disappeared. Moreover, fiscal rules such as the Stability and Growth Pact may change the market perception of default risk, and thus have an impact on interest rates (see, for example, Poterba and Reuben, 2001).

3. EMPIRICAL MODELS OF YIELD SPREADS BEFORE AND AFTER EMU

Some aspects of both credit risk and liquidity do not change over the period considered, and this makes it difficult to identify the determinants of average yield differentials. Hence, the goal of our analysis is to identify the relative importance of liquidity and default premiums in explaining fluctuations, rather than levels of yield differentials. This is accomplished by estimating the impact of macroeconomic fiscal fundamentals

Table 2. Asset swap spreads and swap differentials

	AUS	BEL	FIN	FRA	GRE	IRE	ITA	NET	POR	SPA
Sample June 1991–December 1995										
Total yield differential	n.a.	0.787	n.a.	0.536	n.a.	n.a.	4.821	0.107	n.a.	3.744
Relative asset swap spread	n.a.	0.199	n.a.	–0.053	n.a.	n.a.	0.966	0.005	n.a.	0.133
Swap differential	n.a.	0.588	n.a.	0.589	n.a.	n.a.	3.855	0.102	n.a.	3.610
Sample January 1996–December 1998										
Total yield differential	0.090	0.189	0.436	0.029	n.a.	n.a.	1.577	–0.027	1.107	1.180
Relative asset swap spread	0.094	0.147	0.022	0.061	n.a.	n.a.	0.246	0.008	0.192	0.200
Swap differential	–0.004	0.042	0.413	–0.031	n.a.	n.a.	1.331	–0.035	0.914	0.980
Sample January 1999–December 2002										
Total yield differential	0.243	0.281	0.190	0.138	0.549	0.146	0.325	0.136	0.322	0.254
Relative asset swap spread	0.243	0.281	0.190	0.138	0.469	0.146	0.325	0.136	0.322	0.254
Swap differential	0.000	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	0.000

Source: Datastream/Thomson Financial.

and international risk factors on yield differentials, and by testing whether the impact of international factors depends on local fiscal fundamentals. In fact, liquidity factors should be, by their nature, local and not directly related to changes in either international factors or macroeconomic fundamentals.

The analysis is complicated by the fact that liquidity-related variables affect yields at high frequencies, while risk-related variables reflect slow-moving economic fundamentals. The latter are only observed at low frequencies, and their effect may only be detected in long time series. Moreover, bond yield differentials are affected by different factors in the pre-EMU and post-EMU sample, and data on liquidity-related variables are only available for 2002.

We deal with these difficulties by focusing first on the effect of fundamentals using monthly series, and then considering the effect of liquidity factors in daily data. Importantly, we make an attempt towards keeping consistency between our two specifications.

3.1. Monthly data

Since the sample of monthly data includes pre-EMU and post-EMU observations, we need to remove from the former the component reflecting expected exchange rate fluctuations and exchange rate risk. To this end, we use the difference in 10-year fixed interest rates from the term structure estimated on swap contracts denominated in different currencies. Interest rates on swaps are virtually free from the risk of default of sovereign issuers. Swap contracts are private agreements between financial institutions (typically investment banks) to exchange a flow of interest payments at a fixed rate for one at a floating rate, usually the six-month LIBOR. The risk of swap contracts differs from that associated with a position in government bonds. An interest rate swap does not involve any principal to be potentially lost by any of the two counterparts in case of default of the other. The cost borne by a bank if the counterpart does not honour the contract, is the loss represented by the current market value of the net flow of future interest payments which could be very different from the initial one. The counterpart risk for swap rates denominated in different currencies should be the same, since the investment banks who deal in swaps operate in all markets relevant to us. Thus, the counterpart risk component of swap rates should net out in swap rate differentials. Indeed, Figure 3 shows that differentials between fixed interest rates on swaps converged towards zero as the probability of EMU increased from 1996 to 1999. Table 2 shows summary statistics on yield spreads, which separates the exchange risk components from the total yield differentials.

Hence, as in Favero *et al.* (1997), we measure the component of yield differentials not related to exchange rate factors as:

$$RAS_t^i = \left(R_t^i - R_t^{GER}\right) - \left(RSW_t^i - RSW_t^{GER}\right) \tag{1}$$

where RAS_t^i denotes the relative asset swap spread of country i, R_t^i and R_t^{GER} are the yields to maturity of 10-year bonds issued by country i and by Germany respectively,

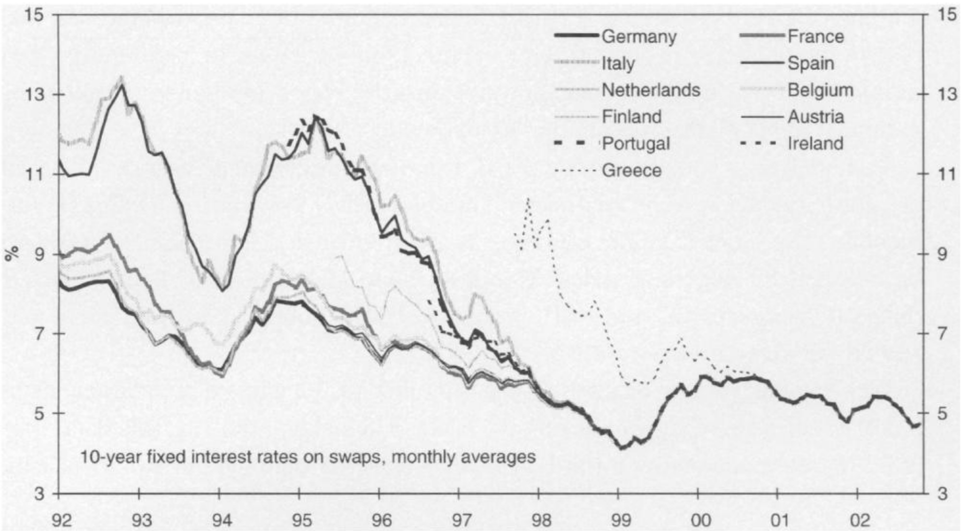

Figure 3. Fixed interest rate on interest rate swaps in the euro area

Note: Swap rates are in percentage annual terms.

Source: Datastream/Thomson Financial.

and RSW_t^i and RSW_t^{GER} are the 10-year fixed interest rates on swaps denominated in currency i and in deutschemarks respectively. It is worth noting that the relative asset swap, RAS_t^i, coincides with the yield differential in the EMU period.[3] We use RAS_t^i as the dependent variable in an empirical model aimed at identifying the relevance of liquidity and credit-risk related factors.

Total yield differentials and relative asset swap spreads are plotted in Figure 4, and show that the exchange rate factor did heavily affect yield differentials in the pre-EMU era, as observed by Favero *et al.* (1997) and Blanco (2001). Relative asset swap spreads show a much more homogenous time series behaviour. This is consistent with the hypothesis that netting out the exchange rate factor from yield differentials allows data coming from the pre-1999 and the post-1999 regimes to be pooled sensibly. We then implement the following empirical model on monthly data:

$$RAS_t^i = \lambda RAS_{t-1}^i + (1-\lambda)[d_t^i(\beta_1 + \beta_2 Z_t) + \beta_3 Z_t] + (1-\lambda)\beta_0 + u_t^i \qquad (2)$$

[3] As discussed by Favero *et al.* (1997) a direct measure of the default factor can be obtained by comparing the yields of bonds issued in the *same currency* by a country i and by a different sovereign issuer. In this vein, Giovannini and Piga (1994) used the yield differential between two dollar-denominated bonds: one issued by the Republic of Italy and one, of roughly the same maturity, issued by the World Bank (or by the US Treasury). This measure is, however, unsatisfactory for both empirical and technical reasons. Just as supranational issues, the bonds issued by the Republic of Italy on the global or on the Euro-syndicated market are not very liquid, as they are held by long-term investors, including central banks, are not the object of short-term arbitrage trading, are intermittent in time and do not cover all relevant maturities. The latter factor is crucial for international comparisons because, when issues are sparse, term structure effects could contaminate the data. Furthermore, unlike domestic bonds, foreign issues, and especially issues in the 'global' market, have legal guarantees for creditors (in the case of global issues in the United States, for instance, a US court is competent in the case of litigation).

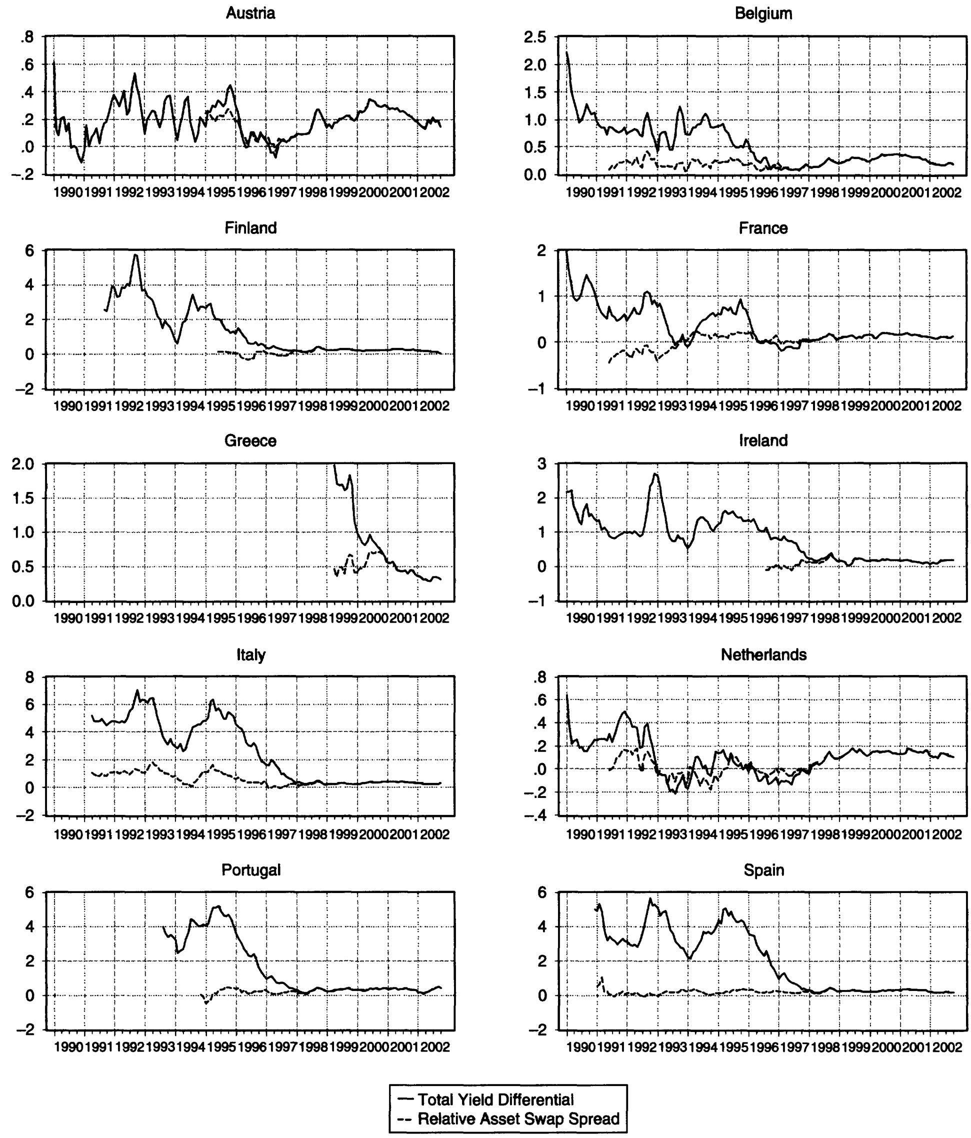

Figure 4. Yield differentials and relative asset swap spreads in the euro area

Sources: Datastream/Thomson Financial and our calculations.

where RAS_t^i is the relative asset swap spread for country i, d_t^i is the (log) deviation of country i debt-to-GDP ratio from Germany's debt-to-GDP ratio, and $\mathcal{Z}_t$ is a vector containing exogenous variables measuring or approximating risk premiums.[4] Our baseline specification for $\mathcal{Z}_t$ includes $(R_t^{SP,US} - R_t^{US})$, the spread between 10-year fixed interest rates on US swaps and the yield on 10-year US government bonds and

[4] We have considered other local fiscal fundamentals besides debt ratios, and in particular relative budget deficits and relative amounts of total government securities outstanding, but they were not significant once we accounted for debt ratios. We have not included future expected liabilities arising from pension systems since we have been unable to find time series of such obligations.

$(R_t^{C,US} - R_t^{US})$, the spread between the yield on Moody's Seasoned AAA US corporate bonds and the yield on 10-year US government bonds.

The model allows for slow dynamic adjustment to a long-term equilibrium value of RAS_t^i, and explains relative asset swaps in terms of exogenous factors which capture risk premiums (specifically, banking and corporate sector risk premiums in the United States). This specification is not motivated by a theoretical model, but by empirical evidence that risk tends to affect bond yields proportionally rather than additively. As international risk increases, all yield differentials generally widen. In particular, the empirical literature on sovereign bond spreads in emerging markets shows that the yield on US government bonds and/or the slope of the US yield curve are main determinants of sovereign spreads (e.g. Eichengreen and Mody, 2000; Barnes and Cline, 1997; Kamin and Von Kleist, 1999). Blanco (2001) also uses yields on US corporate bonds as a proxy for global credit risk in modelling yields on euro zone government securities. Our choice of proxies is also consistent with the evidence produced by Arora and Cerisola (2001), who document that tightening of US monetary policy and increasing uncertainty on the future stance significantly widens bond spreads of emerging markets. The dependence of yield differentials on proxies for international risk would be consistent with the results by Dungey *et al.* (2000), who show strong evidence in favour of the presence of a common international factor in many yield differentials.

The Z_t variables appear in the regression both linearly, and interacted with the deviation of country i debt-to-GDP ratio from Germany's debt-to-GDP ratio. This captures the idea that international risk affects yield differentials because euro zone government bonds are imperfect substitutes, either because of liquidity or because of different default risk.

The linear terms are necessary, as international factors might affect the relative asset swap spread either because of 'structural' differences in liquidity or differences in non-varying unobservable fundamentals, such as the reputation of the issuing governments. Hence, the coefficients capture changes in yield spreads that can be attributed to non-varying differences in either liquidity or credit risk. In addition, such terms might capture unobservable variations in fiscal vulnerability. This would be the case if, for example, banking and corporate sector risk premiums were a leading indicator of deteriorated economic conditions and thus lower expected budget surpluses.

Interactions between international risk variables, Z_t and relative debt ratios are relevant only to the extent that the impact of global risk on yield differentials depend on differences between country i fiscal fundamentals and Germany's fundamentals. Therefore, the interaction term identifies changes in yield spreads that can be entirely attributed to default risk.

Finally, we control for an independent effect of fiscal fundamentals by entering debt ratios linearly in the regressions for the relative asset swap spread.[5] As we control

[5] We controlled for a linear effect of fiscal variables other than debt ratios in model (2), but they were not significant.

for time-varying fiscal variables, the constant can be interpreted as measuring the 'structural' component of relative asset swap spreads due to differences in liquidity that do not interact with international risk factors. The null hypothesis that this constant is zero thus provides a weak test of independent liquidity effects on yield differentials.

This specification makes it possible to test for parameter stability in the pre- and post-EMU periods, and allows us to identify movements in yield differentials which depend on local fiscal fundamentals and are robust to the modelling strategy of liquidity and credit-risk components. The solution of the identification problem through the interaction between international risk variables and debt indicators is based on the testable hypothesis that international risk-related factors affect yield differentials because of differences in macroeconomic fundamentals. And, very importantly for our purposes, the specification can be adapted into a model for daily data in Section 5 below, where direct measures of liquidity factors are available and slow-moving fundamentals may be taken to be constant.

4. THE EVIDENCE FROM MONTHLY DATA

The use of monthly data allows us to evaluate the effect of fiscal fundamentals on credit risk at the cost of the unavailability of measures of liquidity over the sample period. Following the discussion in the previous section, we report in Table 3 the results from the estimation of the dynamic model (2) linking the relative asset swap spread for each country to its own lag, to international exogenous measures of risk such as the spread between 10-year fixed interest rates on US swaps and the yield on 10-year US government bonds and the spread between the yield on Moody's Seasoned AAA US corporate bonds and the yield on 10-year US government bonds, and to the interaction of these measures of risk with fiscal fundamentals, measured by the (log) deviation of country i's debt-to-GDP ratio from Germany's debt-to-GDP ratio.[6] The time series behaviour of all regressors is reported in Figures 5 and 6. Table 3 contains the most parsimonious specification for each country. Such specification is obtained by omitting from a general model all coefficients not significant at the 5% level, with the exceptions of constants, which are always kept in the specification.

Table 3 shows that, for most countries, differences in debt-to-GDP ratios have no significant effects on relative asset swap spreads when considered separately. However, debt-to-GDP differentials are significant for Austria, Italy and Spain in the specification that considers their interaction with international risk variables. They are not statistically different from zero for all other countries. This evidence points to the

[6] We started from a more general specification for Z, including also the slope of the US yield curve as measured by the difference between the yield of 10-year US government bonds and a 3-month interest rate, and some measures of stock market volatility. We excluded these variables because they were never significant in addition to our proxies for corporate and banking sector risk.

Table 3. Model estimates on monthly data

	AUS	BEL	FIN	FRA	IRE	ITA	NET	POR	SPA
Sample	1995:12 2002:10	1995:12 2002:10	1995:12 2002:10	1995:12 2002:10	1996:09 2002:10	1995:12 2002:10	1995:12 2002:10	1995:12 2002:10	1995:12 2002:10
λ	0.60 (0.067)	0.74 (0.045)	0.87 (0.045)	0.64 (0.050)	0.68 (0.068)	0.78 (0.036)	0.88 (0.045)	0.64 (0.060)	0.61 (0.057)
β_1	−0.90 (0.407)	–	–	–	–	–	–	–	−0.33 (0.12)
β_2	–	–	–	–	–	0.41 (0.195)	–	–	–
β_3	0.83 (0.425)	–	–	–	–	–	–	–	0.81 (0.12)
β_4	0.25 (0.036)	0.28 (0.034)	0.32 (0.169)	0.13 (0.030)	0.18 (0.064)	–	0.16 (0.077)	0.15 (0.063)	–
β_5	–	–	–	–	–	–	–	0.08 (0.036)	–
β_0	−0.01 (0.028)	0.02 (0.025)	−0.10 (0.125)	0.008 (0.023)	−0.004 (0.049)	0.08 (0.090)	−0.02 (0.058)	0.047 (0.052)	0.067 (0.032)
Chow Test P-value	0.38	0.16	0.29	0.70	0.00	0.84	0.10	0.70	0.94
SE of Regression	0.03	0.02	0.06	0.03	0.05	0.07	0.02	0.06	0.03
Mean Dep. Variable	0.17	0.22	0.12	0.10	0.12	0.28	0.08	0.26	0.23

Notes: Estimation method: SURE. Standard errors in parentheses. The estimated model is:

$$RAS_t^i = \lambda RAS_{t-1}^i + (1-\lambda)d_t^i[\beta_1 + \beta_2(R_t^{SP,US} - R_t^{US}) + \beta_3(R_t^{C,US} - R_t^{US})] + (1-\lambda)[\beta_4(R_t^{SP,US} - R_t^{US}) + \beta_5(R_t^{C,US} - R_t^{US})] + (1-\lambda)\beta_0 + u_t^i$$

where RAS_t^i is the relative asset swap spread for country i, d_t^i is the (log) deviation of country i's debt-to-GDP ratio from Germany's debt-to-GDP ratio, $(R_t^{SP,US} - R_t^{US})$ is the spread between 10-year fixed interest rates on US swaps and the yield on 10-year US government bonds and $(RAS_t^{C,US} - R_t^{US})$ is the spread between the yield on Moody's Seasoned AAA US corporate bonds and the yield on 10-year US government bonds.

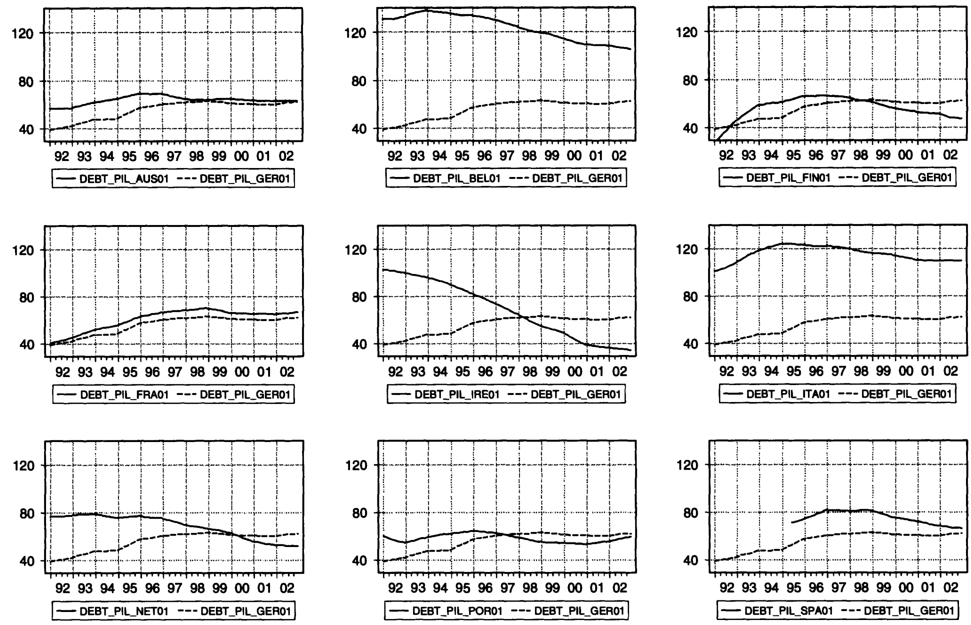

Figure 5. Debt to GDP ratios in EMU countries and Germany

Sources: EU Commission, Datastream/Thomson Financial.

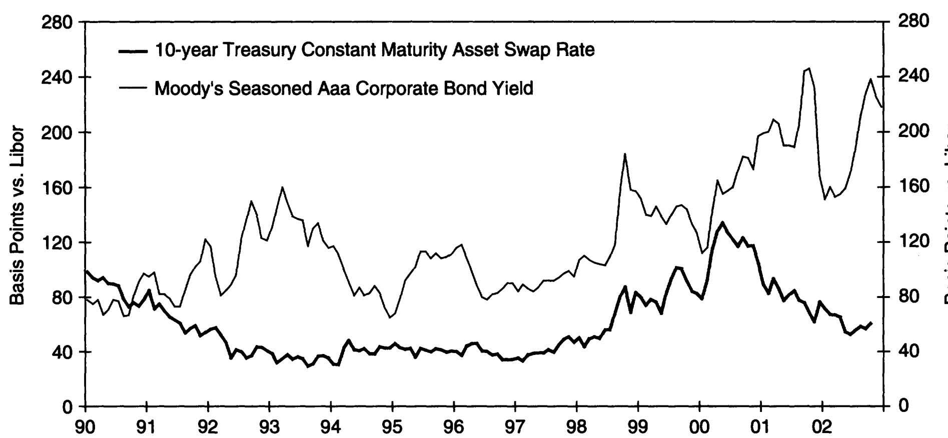

Figure 6. Exogenous measures of risk premium

Sources: US Federal Reserve St Louis and Datastream/Thomson Financial.

importance of credit risk in explaining movements in yield differentials. To assess the statistical and economic importance of the credit risk component, Figure 7 plots yield differentials and our estimate of the component explained by the interaction of fiscal fundamentals (default risk) with international risk factors linked along with its 95% confidence interval. Only in the case of Spain and Italy can a substantial part of the

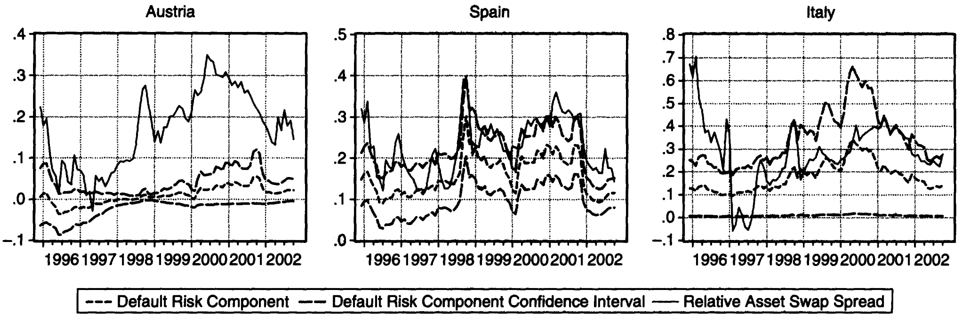

Figure 7. Estimates of yield differentials attributable to default risk

Sources: Our calculations.

total yield differential be attributed to the default risk factor, and reaches almost 20 basis points in 2002. In the case of Austria the significant response of yield differentials to risk variables does not map into a sizeable default risk component.

The international risk factors enter significantly in the linear specification for all countries except Italy and Spain. In particular, all European yield differentials (but Italy and Spain) react significantly to fluctuations in the US asset swap spread. This suggests that bonds issued by different governments are viewed as imperfect substitutes for other reasons than differences in debt ratios. International risk may have an impact because of differences in liquidity but also because of unobservable fundamentals, such as the reputation of the issuing government, or because of greater uncertainty of future budget surpluses. Finally, the constant, which captures residual liquidity factors, is significant only for Spain.

To sum up, the results from estimation on monthly data show that EU countries can be grouped according to their response to fluctuations in exogenous risk factors. At one extreme are Italy and Spain, where we have evidence that fluctuations in yield differentials can be almost entirely attributed to fluctuations in default premiums related to domestic fiscal fundamentals. At the other extreme we have Belgium, France, Finland, Ireland, the Netherlands and Portugal, where fluctuations in yield differentials respond to international risk-related factors, although independently from debt ratios. Austria is an intermediate case in that its yield differentials do respond both linearly and in an interacted fashion to international risk factors, but the response associated to local fiscal fundamentals is neither as strong nor as statistically significant as that for Italy and Spain.

4.1. Evidence from credit default swaps

A credit default swap (CDS) is a derivative contract that allows the investor to hedge against the default of a borrower. The protection buyer agrees to make periodic payments (the swap spread or premium) to the protection seller over the life of the

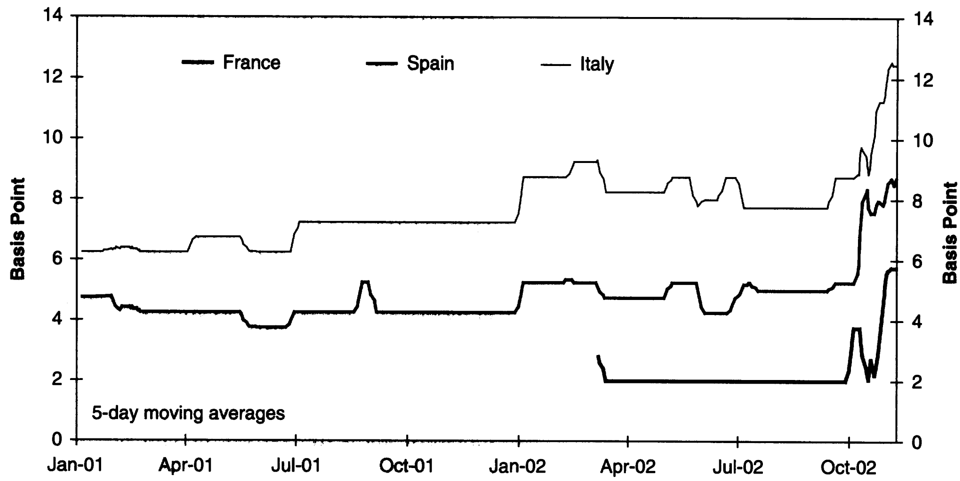

Figure 8. Credit default swap differentials versus Germany

Sources: CreditTrade and our calculations.

contract. This is in exchange for a payment in the event of default by a third party – in our case an EMU member state. The premium is usually a percentage of the face value of the government bond. Should a default event occur, the protection seller becomes liable for the difference between the face value and the recovery value of the bond. Data for such contracts are not available before 2001.

Figure 8 displays the cost of hedging against default in basis points, derived from CDS differentials for Spanish, Italian and French government bonds relative to German bonds. This provides a market-based measure of the credit-risk premium. Pricing of credit risk in CDS spreads differ from relative asset swap spreads for at least two reasons: (1) there is an optionality feature in CDSs versus asset swap spreads, as CDS spreads cannot decrease below zero while asset swap spreads may go deeply negative; and (2) CDSs have an embedded delivery option, because in case of default the protection buyer has the option to deliver a basket of bonds.

Liquidity of credit default swaps has increased, but remains extremely low compared to volumes traded in the government bond market. Therefore, this information must be taken with caution. Still, CDS spreads indicate that the credit risk that investors perceive is significant. Developments in CDS spreads seem to broadly support our findings about the importance of credit risk in the case of Spain and Italy and their relative ranking.

4.2. Does EMU generate a structural break?

Investigating if EMU generated a structural break is very important to our objective of identifying the source of fluctuations of yield differentials. In particular, January 1999 marked the introduction of important reforms of primary markets in many EMU member states. Common euro denomination would have penalized small countries, which have been forced to compete with major markets in terms of liquidity, having to offer only bond issues of a smaller size. Therefore, evidence of a structural break, possibly related to market reforms, could shed light on the importance of liquidity factors in determining yield differentials.

We address the issue of a shift in regime by a direct test for parameters stability reported as 'Chow test' in Table 3. The results of the test indicate that the null hypothesis of no structural break in January 1999 cannot be rejected at the 5% level for all countries in our sample, with the only exception of Ireland.

We also simulate our model on the basis of the parameters estimated with pre-EMU data and of the international risk factors realization in the 1999–2002 period.

The results from the dynamic simulation of our model over the period 1999–2002 are reported in Figure 9. We report the dynamics implied by the estimated coefficients applied to each series' initial condition, and do not introduce confidence intervals as the actual series always lies in the 95% confidence intervals of the simulation. Figure 9

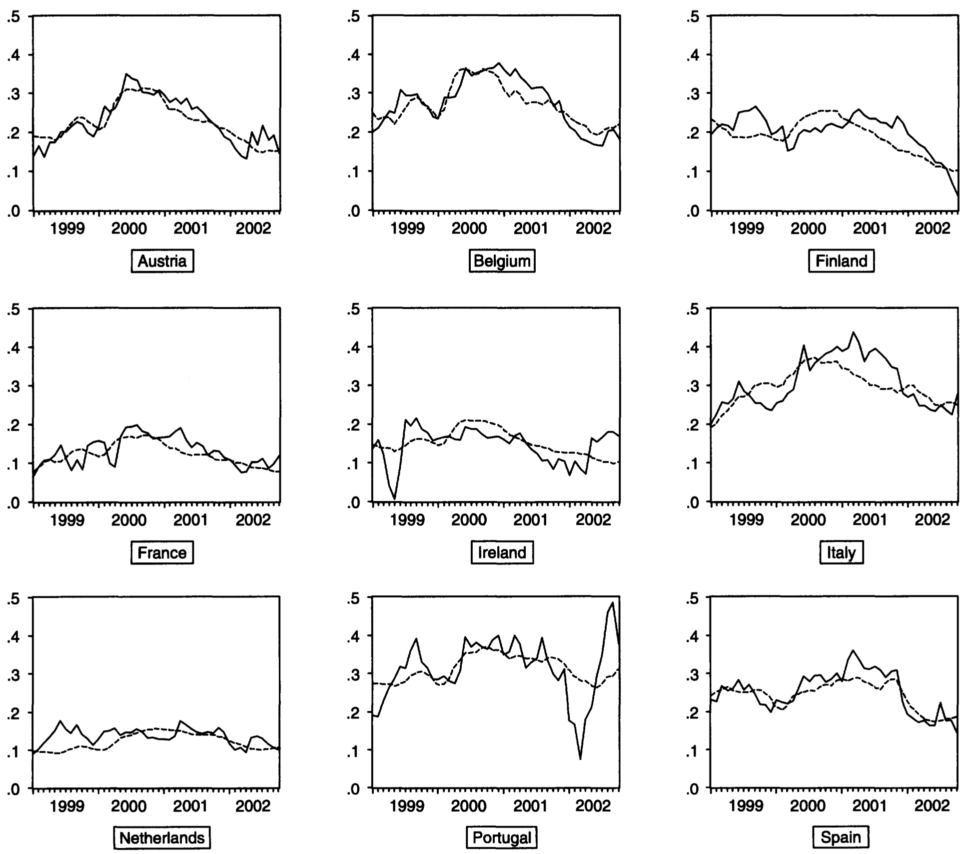

Figure 9. Actual and dynamically simulated yield differentials versus Germany

Sources: Datastream/Thomson Financial and our calculations.

shows that yield differentials in the EMU area are very well predicted given the parameters estimated with pre-EMU data and the knowledge of the international risk factors.

The only notable exception is the Portuguese yield differential in spring 2002. The sharp swing in that differential was probably related to rumours that the EU Commission might issue an 'early warning' for excessive deficit to Portugal. Rumours of an early warning on Germany and Portugal spread in January 2002. But the EU Council refused to issue the warning against Portugal (and Germany) on 12 February. This ended the discussion. Then, after the Portuguese election, it turned out that the actual Portuguese deficit in 2001 might have been wrongly reported by the previous government and might have actually been higher than 3% of GDP. This would have directly triggered an excessive deficit procedure. On 26 June the Portuguese Prime Minister made a reference to an ECB document in Parliament saying that the deficit was 3.9% of GDP. The official deficit figure, which had to be released by a commission founded for that purpose under the leadership of the Bank of Portugal, was released only at a later date. On 26 July the Portuguese government officially submitted the final deficit figure of 4.1% of GDP to the European Commission. Then, on 16 October, the European Commission adopted a report and a recommendation arguing that the Council should declare Portugal to be in excessive deficit. That is what the ECOFIN Council did on 5 November.[7] Interestingly, the Portuguese spread appears to have been the only one in Europe affected by rumours of warnings, although Germany and more recently France have experienced similar budget problems.

5. EVIDENCE FROM DAILY DATA

The econometric evidence of our baseline model points towards the importance of differences in debt ratios for the impact of international risk factors on yield spreads in highly indebted countries. Can liquidity-related factors increase the explanatory power of international factors?

To gauge liquidity conditions the following measures are usually considered:[8] (1) bid/ask spread; (2) trading volume; (3) turnover ratios (total trading volume divided by the stock of securities outstanding, i.e. the number of times the market 'turns over' in the period); and (4) trading intensity (number of transactions that take place over a set period).

We have available one year of daily observations of yields on benchmark bonds from EuroMTS data. This database records for each benchmark bond[9] the bid-ask

[7] The dating for all fiscal announcements in 2002 was kindly provided by Rolf Strauch and Antonio Afonso, who have recently produced a thorough event-study of all fiscal announcements in 2002 (Afonso and Strauch, 2003).

[8] See Gravelle (1999a, b) for a formal definition of liquidity.

[9] Our data come from a snapshot of the market taken daily at 11 am. There are some recent interesting developments in the literature on how a benchmark should be defined (see, e.g., Dunne *et al.*, 2002). We somewhat arbitrarily define benchmarks by considering the introduction of a new 10-year bond in the EuroMTS market.

Table 4. Model estimates on daily data

	AUS	BEL	FIN	FRA	GRE	IRE	ITA	NET	POR	SPA	Wald(b)	Wald(c)
λ	0.733	0.946	0.932	0.909	0.939	0.976	0.875	0.777	0.915	0.930	–	31.28
	(0.031)	(0.012)	(0.018)	(0.021)	(0.013)	(0.023)	(0.021)	(0.028)	(0.014)	(0.015)	–	(0.000)
β_0	0.064	0.036	0.215	0.039	0.200	–0.159	0.079	–0.024	0.059	0.037	82.86	–
	(0.022)	(0.043)	(0.092)	(0.023)	(0.037)	(0.344)	(0.028)	(0.028)	(0.047)	(0.048)	(0.000)	–
μ	1.168	0.305	0.097	0.258	0.231	–0.283	0.266	0.459	0.822	0.701	40.77	263.19
	(0.419)	(0.128)	(0.079)	(0.056)	(0.094)	(0.490)	(0.043)	(0.033)	(0.129)	(0.226)	(0.000)	(0.000)
β_1	0.195	0.247	–0.133	0.075	0.283	0.647	0.186	0.253	0.330	0.206	20.70	56.98
	(0.041)	(0.070)	(0.148)	(0.041)	(0.067)	(0.440)	(0.047)	(0.051)	(0.083)	(0.087)	(0.014)	(0.000)
β_2	–0.010	–0.018	–0.025	–0.012	–0.043	0.072	–0.001	–0.018	0.004	–0.034	12.78	16.44
	(0.007)	(0.018)	(0.031)	(0.005)	(0.019)	(0.095)	(0.003)	(0.009)	(0.017)	(0.018)	(0.172)	(0.087)
β_3	–0.003	0.005	–0.199	0.224	0.079	1.036	0.162	0.000	–0.048	0.119	4.98	7.03
	(0.123)	(0.196)	(0.312)	(0.104)	(0.232)	(1.161)	(0.138)	(0.098)	(0.204)	(0.224)	(0.836)	(0.722)
β_4	0.168	–0.079	1.208	0.084	–1.053	3.187	0.236	0.526	0.240	1.306	7.43	9.13
	(0.274)	(0.872)	(1.098)	(0.451)	(0.617)	(2.911)	(0.593)	(0.449)	(0.646)	(0.805)	(0.592)	(0.519)
Dum 30 Jan	0.001	0.001	–0.002	0.002	0.004	–	0.005	0.006	0.001	0.001		
	(0.010)	(0.004)	(0.006)	(0.003)	(0.004)	–	(0.006)	(0.007)	(0.006)	(0.005)		
Dum 12 Feb	–0.001	–0.005	–0.006	0.002	–0.011	–	–0.006	–0.003	–0.008	–0.007		
	(0.010)	(0.004)	(0.006)	(0.003)	(0.004)	–	(0.006)	(0.007)	(0.006)	(0.006)		
Dum 26 Jul	0.007	0.007	0.002	0.001	0.010	–0.002	0.014	0.005	0.034	0.007		
	(0.010)	(0.004)	(0.006)	(0.003)	(0.004)	(0.003)	(0.007)	(0.007)	(0.006)	(0.006)		
Dum 16 Oct	–0.008	–0.006	–0.002	–0.003	–0.008	–0.002	–0.007	0.001	–0.007	–0.002		
	(0.010)	(0.004)	(0.006)	(0.004)	(0.004)	(0.003)	(0.006)	(0.007)	(0.006)	(0.006)		
Dun 5 Nov	–0.004	–0.0003	0.002	0.002	–0.006	0.005	–0.001	–0.005	–0.002	–0.001		
	(0.010)	(0.004)	(0.006)	(0.003)	(0.004)	(0.003)	(0.006)	(0.007)	(0.006)	(0.006)		
SE of Regression	0.011	0.005	0.006	0.007	0.004	0.005	0.003	0.007	0.008	0.007		
Mean Dep. Variable	0.172	0.202	0.168	0.190	0.077	0.334	0.221	0.188	0.096	0.228		

Notes: Estimation Method: SURE. Sample 1 October 2002–12 March 2002. Standard errors in parentheses. The estimated model is:

$$R_t^i - R_t^{GER} = \lambda(R_{t-1}^i - R_{t-1}^{GER}) + (1-\lambda)[\beta_0 + \mu(RMAT_t^i - RMAT_t^{GER})SL_t + \beta_1(R_t^{SP,US} - R_t^{US}) + \beta_2(VOL_t^i - VOL_t^{GER}) + \beta_3(DEPTH_t^i - DEPTH_t^{GER}) + \beta_4(BASP_t^i - BASP_t^{GER})] + u_t^i$$

where $R_t^i - R_t^{GER}$ is the yield differential for country i, $R_t^{SP,US} - R_t^{US}$ is the spread between 10-year fixed interest rates on US swaps and the yield on 10-year US government bonds, *RMAT* is the residual maturity of each bond, *SL* is the slope of the German yield curve between the 10-year and the 7-year maturities, *VOL* is the trading volume on the EuroMTS France, *DEPTH* is the average quantity available at the bid and ask prices for each bond, and *BASP* is the bid-ask spread relative to each benchmark bond. The column labelled Wald(b) reports the results of a Wald test for the null that all the coefficients in the corresponding row are zero, while in the column labelled Wald(c) we report the results of a Wald test for the null that all the coefficients in the corresponding row are equal.

spread, the trading volume, and a direct measure of market depth, i.e. the quantities available at the bid and at the ask price. To study liquidity effects, we specify a dynamic model similar to that of monthly data. Over the sample of daily observations for the year 2002 we estimate

$$(R_t^i - R_t^{GER}) = \lambda(R_{t-1}^i - R_{t-1}^{GER}) + (1 - \lambda)(\beta_0 + \beta_1 Z_t + \beta_2 X_t^i) + u_t^i \tag{3}$$

which is the equivalent on daily data of model (2). We do not need to use relative asset swap spreads, which coincide with total yield differentials as the fixed interest rates on swaps have fully converged. We consider macroeconomic and fiscal fundamentals as constant, include an international factor measured by the spread between 10-year fixed interest rates on US swaps and the yield on 10-year US bonds, as well as the vector X_t^i of the three liquidity-related proxies mentioned above (see, for example, Fleming, 2001). We control for the difference in the residual maturities of the benchmark bonds, by interacting the differential between the residual maturity for benchmark bonds in country i and Germany with the slope of the German yield curve between the 10-year and the 7-year maturity. This correction, which is allowed to have different signs for positive and negative slopes of the long-end of the German yield curve, allows to smooth jumps in yield differentials occurring in the occasion of benchmark changes.

The results are reported in Table 4. They show that with the notable exception of France, international risk factors dominate liquidity factors in explaining yield differentials. Volumes are the best performing liquidity indicators, with a significance level close to 10% for the hypothesis of a zero impact on all countries. But the null hypothesis that all coefficients on measures of depth and bid-ask spread are zero cannot be rejected.

The null hypothesis of a zero effect of the international risk factor is strongly rejected. There are major differences across countries, but that factor is significant for all countries except France and the two countries, Finland and Ireland, where the debt ratio is substantially lower than in Germany (see Figure 5). However, in the latter countries there is also no evidence of any impact of liquidity on yield differentials. France appears to be the only country where liquidity matters more than international risk in explaining movements in yield differentials. The strongest effect of the international factor is observed for Belgium, Greece, the Netherlands, Portugal and Spain.

Overall, the results from our estimation at daily frequency suggest that international factors are more important than liquidity for the determination of yield differentials in the Euro area (except France). Several countries show a strong dependence on international factors, while evidence in favour of liquidity is weaker and limited to trading volumes. This evidence allows us to qualify the indications given by our model on monthly data. Although international risk (when not interacted with relative debt ratios) can affect yield differentials either because of differences in liquidity or in unobservable fiscal fundamentals, the fact that such effect remains when we explicitly control for liquidity indicators is – admittedly weak – evidence that differences in default risk are the main propagation mechanism.

To further assess the importance of fiscal announcements on yield differentials as indicated by the simulation of our monthly model, we have included in our daily model point dummies for five specific dates: 30 January, 12 February, 26 July, 16 October and 5 November. On 30 January the press reported a possible early warning for Germany and Portugal, the EU Council refused to issue the warning against Portugal (and Germany) on 12 February. The official deficit figures were submitted to the European Commission on 26 July, on which occasion the Portuguese government submitted the figure of 4.1% of GDP. Then, on 16 October, the European Commission adopted a report and a recommendation arguing that the Council should declare Portugal to be in excessive deficit. That is what the ECOFIN Council did on 5 November.

The coefficients on the point dummies confirm the evidence that only the Portuguese spread appears to have been affected by fiscal announcements. In particular, the dummy for 26 July is significant only for the yield spread between Portugal and Germany, showing that the submission of official figures caused an impact of 3.5 basis points in the Portuguese–German differential, with a long-run effect of about 15 basis points.

5.1. Does the presence of a liquid futures market really matter?

A potentially important variable is missing from our analysis of liquidity factors in the previous section. Anecdotal evidence from market participants attributes a great importance to the presence of an efficient and liquid future contract.[10]

A proper functioning of associated derivatives markets facilitates the active trading and management of interest rate risk. Where a well-developed futures market exists, market makers can manage their positions using futures, thereby enhancing their ability to carry out inventory-risk management in the cash market, which, in turn, promotes better liquidity. In the euro area the Bund futures contract has become predominant. It is often argued that German government bonds, which have become the *de facto* benchmark in the 10-year sector, command a sizeable premium versus other sovereign issues because of this 'derivative factor'.

In principle, our evidence in favour of the importance of international risk factors might not be robust to the inclusion of the impact of future markets in our analysis. To analyse the impact of the futures market we collected data on volumes and open interest on all futures contracts on euro zone government bonds and aggregate data

[10] We were unable to test for the presence of liquid and efficient repurchase agreement markets/facilities.

Table 5. Liquidity of future contracts on 10-year Eurozone government bonds

Volumes (€ 000)[a]	1998	1999	2000	2001	2002[b]
Eurex, Euro-Bund	176.0	509.5	581.1	681.9	762.9
Liffe, Bund	55.7	0	0	0	0
Matif, Euro-Notional	15.0	23.4	165.5	66.1	0
Liffe BTP	31.4	6.6	0	0	0
Mif, BTP	0.4	0.7	0	0	0
Meff, Bono	58.8	13.7	4.2	1.1	0.2
Germany	231.8	509.5	581.1	681.9	762.9
France	90.6	23.4	165.5	66.1	0
Italy	31.9	7.4	0	0	0
Spain	58.8	13.7	4.2	1.1	0.2
Open interest (number of contracts)	1998	1999	2000	2001	2002
Eurex, Euro-Bund	339.4	570.4	669.3	676.8	729.1
Liffe, Bund	106.6	0	0	0	0
Matif, Euro-Notional	118.9	133.0	310.8	108.6	1.0
Liffe BTP	104.3	27.6	0.7	0	0
Mif, BTP	1.6	2.6	0.1	0	0
Meff, Bono	92.9	21.8	13.5	8.0	2.5
Germany	446.0	570.4	669.3	676.8	729.1
France	118.9	133.0	310.8	108.6	1.0
Italy	105.9	30.3	0.8	0	0
Spain	92.9	21.8	13.5	8.0	2.5

Notes: Other smaller contracts are not considered as volumes and open interests were negligible.
[a] Non-euro denominated contracts are translated into euro at the fixed conversion rate.
[b] Data up to October.

Sources: Datastream/Thomson Financial and our calculations.

according to the underlying government bond.[11] Summary statistics are presented in Table 5. Arguably, the lack of a liquid futures contract in all EMU countries but Germany should command a liquidity premium on non-German bonds, depending on the risk to which investors are exposed by having an imperfect hedge. Figure 10 shows the German–French bond yield differential, the differential of volumes, and the open interest on futures contracts. Quite unexpectedly, the visual impression is for a positive correlation. In fact, yield differentials increased between early 1999 and mid-2000 as the German futures market became more and more dominant, and then decreased in

[11] Up to 1997, Liffe was the largest European futures exchange and the contracts on German and Italian 10-year government bonds were the most popular. Since mid-1998, however, trading activity has moved decidedly in favour of Eurex and Bund contracts. At the beginning of 1998, the combined volumes on Eurex and Liffe contracts on 10-year Bunds were much higher than the sum of all future contracts on other euro zone government bonds. By the launch of the single European currency the Eurex contract on 10-year Bunds was already by far the dominant contract in Europe and its volume and open interest were constantly rising. While volumes and open interest of all other contracts were waning and in some cases eventually disappearing, the contract on Matif managed to post a surprising temporary comeback, gaining more than 35% of total market share by April 2000. This was the result of an initiative by the French banking federation to boost liquidity in the market. The leap in open interest in mid-2000 was also due to a change in the method of recording (from net to gross since 23 May 2000). Still, the revival of the French contract was remarkable and offers us a wonderful opportunity to estimate the impact on asset swap spreads.

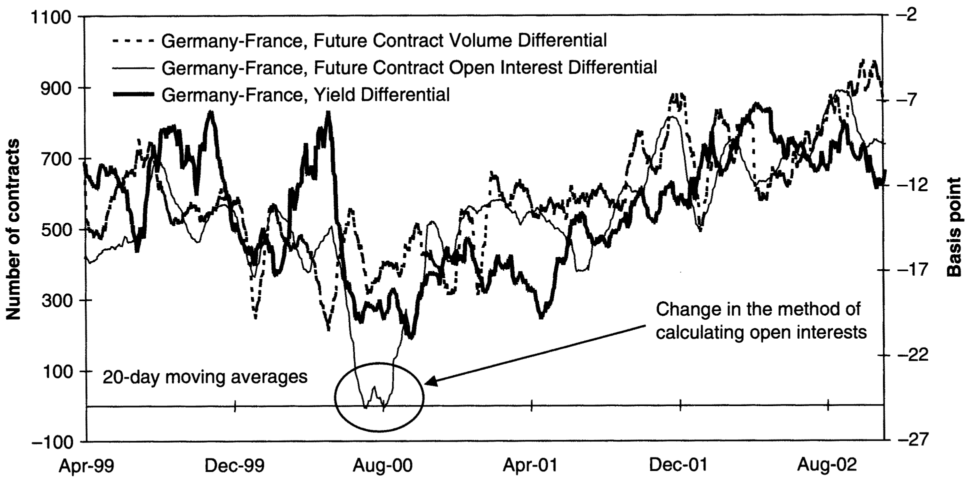

Figure 10. Germany-France yield differentials and futures contracts

Sources: Datastream/Thomson Financial and our calculations.

the course of 2001 and 2002 when the German futures market became completely dominant.

More importantly, a variable measuring relative traded volumes in futures markets is not significant when included in the equation of the French yield differential in the model estimated with daily data.

6. CONCLUDING REMARKS

Movements in yield differentials on euro zone government bonds are mostly explained by changes in international risk factors, as measured by US swap and corporate bond spreads relative to US Treasury yields. This paper provides evidence that these international factors affect spreads because they change the perceived default risk of government bonds in the euro zone. Liquidity factors play only a smaller role.

We find evidence that the impact of international risk on yield differentials in Austria, Italy and Spain, is explained by their debt-to-GDP ratios relative to Germany. Default risk explains a substantial part of changes in yield spreads in Italy and Spain. Yield differentials for all the other countries are also significantly affected by international risk factors, although independently from debt-to-GDP ratios. This suggests that bonds issued by these countries are viewed as imperfect substitutes of German bonds for reasons not related to their debt ratios. International risk may have an impact because of differences in liquidity but also because of unobservable fundamentals, such as the reputation of the issuing government, or because of greater uncertainty of future budget surpluses.

Evidence on the effects of international risk factors remains robust to the broadening of our analysis to include daily data on liquidity measures for 2002.

Greater trading volumes significantly reduce yield differentials in France, Greece, the Netherlands and Spain, while other traditional indicators, such as bid-ask spreads, have no effect. Even in such countries, however, international risk-related factors appear the main source of variation in yield differentials. France is the only country where liquidity matters more than international risk. Finland and Ireland, the two countries with the lowest debt-to-GDP ratio, also show no reaction to international risk factors.

This evidence allows us to qualify the indications given by our model on monthly data. Since international risk (when not interacted with relative debt ratios) can affect yield differentials because of differences in either liquidity or in unobservable fiscal fundamentals, we cannot conclude that liquidity has become irrelevant in the pricing of bonds in the euro area. 'Structural' liquidity factors could indeed explain the different sensitivities to international risk factors. However, the fact that international risk remains significant once we explicitly control for liquidity indicators is evidence – though weak – that international risk matters because of the different perceived creditworthiness of the sovereign issuers.

The results of our study have important policy implications. Yields on euro zone government bonds have been increasingly correlated across issuers. This is a sign of enhanced integration that is explained by the common denomination in euro. However, additional policy steps to increase financial market integration by means of increased efficiency both in primary and secondary markets, although desirable, would not deliver a 'seamless' bond market in the euro area.

The risk of default, though small, remains an important factor explaining movements in the yield differentials. This evidence points to incomplete fiscal consolidation and to the need for further convergence of debt-to-GDP ratios. In this process, yield differentials would be important policy indicators, as they would signal market perception of fiscal vulnerability. Furthermore, since higher bond yields imply higher debt service costs, yield differentials reflecting default risk impose market discipline on fiscal policies of the national governments within the euro zone. Although such a role now appears somewhat reduced compared to the pre-EMU period, also because of the limited changes currently observed in budget deficits, it is likely that the risk component of bond yields would continue to work as a deterrent for irresponsible fiscal policies if such policies were ever implemented.

Discussion

Richard Portes

London Business School, and CEPR

This paper is a significant analysis of an important issue: the integration of the euro-area government bond markets. This matters for at least three reasons:

- Governments want the lowest possible yields on their debt, both to minimize the burden of debt service and because there is a welfare loss to residents from debt interest payments to non-residents.
- An integrated government bond market is important for the monetary transmission mechanism, it underpins much financial sector activity (hedging, pricing private debt), and it supports the international role of the currency (Portes and Rey, 1998).
- Insofar as yield gaps reflect liquidity differentials, they also reflect market inefficiencies with associated costs.

But there are two meanings or measures of integration in securities markets. The authors stress the elimination of yield differentials across countries. But one might also look for unified and transparent price discovery, as exhibited in benchmarks that are valid for the entire euro area (Dunne *et al.*, 2002). Here the authors use only 10-year yields and take German yields as reference rates. In this case Germany does seem to be providing the benchmark, but that does not seem to be true for shorter maturities (*ibid.*), and it would indeed be useful to extend the analysis here to the 5-year maturity, for example.

The authors explain clearly the alternative hypotheses – default risk versus liquidity as the source of yield differentials (and hence market segmentation) – and their contrasting policy implications. If it is the fundamentals, in particular, government debt levels, then market integration requires further convergence, so the markets provide an incentive to fiscal discipline. But liquidity differentials could be eliminated by improvements in debt management and market microstructure.

There is a major difficulty, however, in viewing differences in debt-to-GDP ratios as a major source of government bond market segmentation in the euro area: the differences are just not very large, for the most part. As of end-1999, say, five of the nine countries studied here in monthly data had debt-to-GDP ratios between 59 and 64%. France and Ireland were significantly lower, Belgium and Italy were significantly higher. And indeed, of the nine, only three show a significantly and correctly signed effect of this variable on yield differentials, and only for Italy and Spain is this a substantial component of the observed differential. In particular, Belgium, France and Ireland show no default risk effect. Not surprisingly, there is only very weak evidence for the authors' preferred hypothesis.

Although Table 4 shows clear evidence for the role of international risk factors, that is not the same as country default risk, as the authors themselves carefully explain. If we then look at the liquidity variables, the key determinant is transactions volume, which is correctly signed for eight of ten countries and significant for four of these. This is not surprising. There is an extensive literature going back at least to Amihud and Mendelson (1986) showing that an asset's liquidity is valued in the market, and Amihud and Mendelson (1991) apply this to US Treasury securities. Most recently, Goldreich *et al.* (2003) find a clear (time-varying) liquidity premium in the US Treasury market; here, quoted (not effective) bid-ask spread and transactions volume have the most explanatory power.

So although I find the authors' work very interesting, I cannot accept their conclusion that default risk is primary and liquidity influences secondary in accounting for the remaining market segmentation in the euro-area government bond market. But perhaps it does not matter – if yield differentials are our criterion, the markets seem to be integrating very rapidly! As of 30 June 2003, the *Financial Times* shows '10-year constant' (adjusted for residual maturity) bond spreads relative to Germany ranging from −1 basis point for Finland to only 11 basis points for Italy, with only that country, Portugal and Greece having spreads greater than one (!) basis point. Perhaps we should focus on price discovery and benchmarks instead.

Marcel Thum

Dresden University of Technology, ifo Dresden and CESifo

The EMU has completely eliminated exchange rate risks for the holders of European government bonds. However, yield differentials still persist for various reasons. Codogno, Favero and Missale argue that there are basically three explanations for the remaining yield differentials. First, some countries are more likely to default on their outstanding debt and, therefore, have to pay a risk premium (default risk). Secondly, bonds that can be more easily traded are preferred by investors; a higher liquidity thus translates into lower returns (liquidity risk). Thirdly, international risk factors generate movements in yield differentials between euro zone government bonds.

Using daily and monthly data of government bond yields, Codogno, Favero and Missale arrive at the conclusion that the default risk and general international factors dominate the liquidity effect in explaining yield differentials. This result suggests that yield differentials reflect fundamentals rather than inefficient or incomplete markets.

The authors have used an innovative approach in analysing the sources of yield differentials, so it is not surprising that there still are some open questions where further research is needed. One of the main objectives of the paper is to sort out as to what extent yield differentials are caused by liquidity factors and default risks. In the following, I will discuss these two explanations in turn.

The *default risk* is exclusively measured through debt-to-GDP ratios. It turns out to be significant for yield differentials only in the cases of Italy and Spain. I wonder whether refinements or alternative measures might be needed here. The debt-to-GDP ratio is a rather weak indicator for potential default. The explicit government debt is usually only a small fraction of all outstanding obligations. In many countries under consideration, the implicit debt which mostly comes from comprehensive public pension systems is much larger than the explicit debt. In Germany, for instance, the implicit debt is more than three times the explicit debt.[12]

[12] See Raffelhüschen (2001); this is a fairly conservative estimate for the implicit debt in Germany.

The inclusion of the implicit debt might not affect the empirical results if the implicit debt grows in line with the explicit debt. In the period under consideration, however, several countries planned or executed major reforms of their public pension systems. From 1999 until 2002, reform measures were undertaken in Austria, Finland, France, Germany, Italy, the Netherlands and Spain. Most of the reform measures have aimed at reducing the implicit debt of public pension systems. Taking up the example of Germany again, the reform in 2001 reduced the implicit debt from public pensions by more than 10 percentage points of GDP (from 214.9 to 204.3% of GDP; see Raffelhüschen, 2001). Hence, the impact of the pension reform on total government debt is certainly much larger than the impact of policies aiming at the explicit debt.

While default risk is definitely an economically sound argument for yield differentials, *liquidity factors* are more obscure from a theoretical point of view. As a non-expert in this field, I was a bit surprised by the strong focus on liquidity as a possible explanation of yield differentials. I am not aware of a generally accepted theory of liquidity premia, so in reading the paper I would have appreciated more guidance and more detail on theoretical treatments of liquidity as a relevant factor.

Panel discussion

Stijn Claessens doubted whether liquidity and default risk may be reliably identified separately, since they are not independent. Carlo Favero replied, also referring to Richard Portes' discussion, that the paper's identification strategy is based on the idea that the effect on spreads of international perceptions of risk affect depends on fiscal fundamentals. Steve Cecchetti pointed out that risk aversion and perceived uncertainty matter separately as determinants of the risk premium, and that a country's expected fiscal policy can change dramatically (mentioning Brazil as an important example). Carlo Favero replied that the paper simply uses the current value of debt as the indicator of fiscal fundamentals, on the basis of forward solution of the government budget constraint. In reply to Marcel Thum's discussion he agreed that it would be desirable, but does not appear possible, to use a more comprehensive measure for total government liabilities.

Stijn Claessens thought it would be important to exploit information regarding financial market structure across countries and time. Patrick Honohan added that variation in liquidity across different government bonds could also be exploited to disentangle country-specific effects from liquidity factors. Lorenzo Codogno replied that, in order to focus on macro structural issues, the paper chooses to disregard bond-specific phenomena and concentrate empirical efforts on the 10-year benchmark bond. Jonathan Haskel asked for an economic interpretation of the persistence parameter lambda in the regressions, and wondered whether the very different estimates of that parameter across countries may offer useful information.

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