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In 2004 all publications will carry a motif taken from the €100 banknote.

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Abstract:

This paper provides a study of bond yield differentials among EU eurobonds issued between 1991 and 2002. Interest differentials between bonds issued by EU countries and Germany or the USA contain risk premia which increase with the debt, deficit and debt-service ratio and depend positively on the issuer's relative bond market size. Global investors' attitude towards credit risk, measured as the yield spread between low grade US corporate bonds and government bonds, also affects bond yield spreads between EU countries and Germany/USA. The start of the European Monetary Union had significant effects on the bond pricing of the member states.

Keywords: asset pricing, determination of interest rates, fiscal policy, government debt

JEL Classification: G12, E43, E62, H63

Non-technical summary

The potential effect of public debt on government bond yields is an important issue for economists and fiscal policy makers alike. If government bond yields include risk premia, increasing indebtedness may cause bond yields to go up, thus raising the cost of borrowing and imposing discipline on governments. Market discipline of this kind may be especially relevant and important in a monetary union, such as EMU, in which the governments of the member states can issue debt, but do not have the possibility to monetize and inflate away excessive debts.

In this paper, we contribute to the research on sovereign risk premia in three ways. First, we estimate the effects of fiscal variables on long term government bond yields, using a new data set. Our data consists of spreads between Deutsche Mark (Euro after 1999) and US dollar denominated bond issues of 12 EU governments and Germany or the US government, respectively. Second, using data from before and after the start of EMU, we can directly estimate the effects of monetary union on risk premia paid by European governments. Third, our empirical analysis distinguishes risk premia from liquidity effects in the bond market

Our results show that yield spreads between EU countries and Germany or the USA are affected by international risk factors and reflect positive default and liquidity risk premia. The default risk premium is positively affected by the debt and debt service ratios of the issuer country. This is consistent with the notion that credit markets monitor fiscal performance and exert disciplinary pressure on governments. Countries whose national debt has a larger share in the total EU debt pay lower interest rates than EU countries with smaller shares.

The liquidity risk premium, which compensates an investor for the risk that he may not be able to liquidate his investment within a reasonable time, is reduced with EMU membership, which points to an increase in financial market integration. Additionally, EMU members enjoy a lower default risk premium than before, but this benefit declines with the size of public debt compared to Germany. This is consistent with the view that markets may anticipate fiscal support for EMU countries in financial distress unless these countries had been very undisciplined before. In contrast, the impact

of debt service on interest rates rises with EMU. Thus, monetary union does not seem to have weakened the disciplinary function of credit markets.

1. Introduction

The potential effects of public debt on government bond yields is an important issue for economists and fiscal policy makers alike. If government bond yields include risk premia, increasing indebtedness may cause bond yields to go up, thus raising the cost of borrowing and imposing discipline on governments. Market discipline of this kind may be especially relevant and important in a monetary union, such as the US or the new European Monetary Union (EMU), in which the governments of the member states can issue debt, but do not have the possibility to monetize and inflate away excessive debts.

The question whether such risk premia can be identified empirically and how large they are has attracted considerable interest in recent literature. Goldstein and Woglom (1991), Bayoumi, Goldstein and Woglom (1995) and Poterba and Rueben (1997) find that the yield differentials of 39 US states relative to New Jersey depend positively on their levels of debt. Alesina, De Broeck, Prati and Tabellini (1992) use data from 12 OECD countries and show that the differential between public and private bond yields is positively related to the level of public debt. Lemmen (1999) uses yields of bonds issued by state governments in Australia, Canada, and Germany and shows that yield spreads depend positively on the ratio of government debt to GDP. Alexander and Anker (1997), Lemmen and Goodhart (1999), Lonning (2000), Copeland and Jones (2001) and Codogno, Favero and Missale (2003) consistently confirm a positive relationship between public debt and interest rates. Faini (2004) finds an effect of fiscal variables on both interest rate spreads and the overall level in an empirical study of euro area countries.

In this paper, we contribute to this line of research in three ways. First, we estimate the effects of fiscal variables on long term government bond yields, using a new data set. Our data consists of yield-at-issue spreads between DM (Euro after 1999) and US dollar denominated bonds issued by several EU governments and Germany or the US government, respectively. This data set has several advantages compared to those used in earlier studies. Looking at DM (Euro) and US dollar denominated bonds allows us to look at debt issued by national and sub-national governments without introducing the issue of exchange rate risk that arises in the comparison of bonds issued by national

governments in their national currencies.[1] Furthermore, the comparison of spreads on such issues is not distorted by differences in national tax regimes. Finally, looking at yields-at-issue assures the comparability of yields at different points in time, since, in contrast to average yields on debt outstanding, the residual maturity is always the full maturity and the bonds are actively traded on the day when the yields are recorded.

Second, using data from before and after the start of EMU, we can directly estimate the effects of monetary union on risk premia paid by European governments. A priori, these effects are ambiguous. Monetary union may increase the default risk of member governments, since they have surrendered their monetary sovereignty and, therefore, the possibility to monetize their debts, and other governments and the monetary union's central bank may not be compelled to rescue governments in financial crises. This presumption is in line with the "No bail-out clause" of the Maastricht Treaty and the historical experience that state governments in the US have defaulted on their debts. However, monetary union may also have reduced perceived default risk, if markets anticipate that member governments in fiscal troubles will be bailed out by other governments or the central bank.

Third, our empirical analysis distinguishes risk premia from liquidity effects in the bond market. Identifying the liquidity component of yield spreads is important, because it points to a lack of financial market integration rather than differences in public debt as a source of yield differentials.[2] Empirically, we observe that German government bond yields are still below those of bonds issued by governments with much better debt positions. This has been interpreted as showing that bond yields do not reflect fiscal performance appropriately (Reuters, June 2002). But the fact that German bonds enjoy a yield advantage compared to others may instead be due to the size of the German bond market and the fact that German bonds can be traded immediately at lower transaction costs and with a smaller risk of price changes due to individual transactions.

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[1] Alesina et al. (1992), Flandreau et al. (1998), Goodhart (1999), and Afonso et al. (2003) propose to circumvent this issue by comparing the returns on government debt and 'safe' private debt of corresponding maturity denominated in the same currency. It is not clear, however, that the credit risk of private firms is independent of the credit risk of their national governments, as governments in financial crisis might seize private assets or raise taxes and, thus, worsen the borrower quality of private firms.

[2] Blanco (2001) finds significant liquidity premia in the relative pricing of German bonds. Codogno et al. (2003) find a significant effect of trading volumes on euro-area government bond yields supporting the existence of liquidity premia. Gómez-Puig (2003) finds that liquidity, measured by bid-ask spreads, plays an important role in explaining the spreads between euro-denominated bonds issued by different governments.

Our paper proceeds as follows. Section 2 presents a discrete-time, two-asset portfolio model explaining interest rate differentials between bonds issued by two different governments. It serves to motivate the empirical analysis and derive the reduced-form equation estimated subsequently. Section 3 describes the data we use for the estimation. Section 4 reports the estimation results, and Section 5 concludes.

2. A Portfolio Model of Bond Yield Differentials

2.1. The Basic Model

Consider a domestic investor maximizing a utility function that depends positively on expected real wealth, $E_t[w_{t+1}]$ and negatively on its variance, $Var_t[w_{t+1}]$:

$$Max\ U\{E_t[w_{t+1}], Var_t[w_{t+1}]\},\ U_1 > 0,\ U_2 < 0. \tag{1}$$

The investor allocates a fraction θ of his real wealth w_t to a domestic security D and a fraction of 1-θ to a foreign security F. Both securities and real wealth are priced in the foreign currency, so that:

$$\theta_t\, w_t = D_t \tag{2}$$

$$(1 - \theta_t)\, w_t = F_t \tag{3}$$

We assume that the domestic security is subject to default risk, while the foreign asset is considered risk-free. More specifically, with a positive probability of 1-$P(x_t)$, $0 \leq P(x_t) \leq 1$, the domestic government will be unable to fully serve its debt. Here, x_t indicates a set of variables affecting this probability. In the case of default, the investor receives a fraction τ of his gross payment, $\tau \in [0, 1 + r)$, where r is the interest rate on the domestic bond. Investors incur transaction costs proportional to their investment in bonds which decrease with the liquidity of the bond market. We assume that the foreign bond has benchmark status in the bond market, i.e., the foreign bond market is considered to be more liquid than the domestic bond market. Expected wealth then is:

$$E(w_{t+1}) = (1+r_t)\theta_t w_t P(x_t) + \tau_t \theta_t w_t (1 - P(x_t)) - \theta_t w_t l_t + (1+r_t^*)(1-\theta_t)\, w_t, \tag{4}$$

where an asterix in the equation indicates the corresponding foreign variables, l is the expected transaction cost in the domestic bond market, and the transaction cost in the foreign market is normalized to zero. The objective function and the budget equations for a representative investor in the foreign country are analogue to the equations (1) and

(2) of the domestic investor. We assume no discrimination between domestic and foreign investors in the case of default, $\tau = \tau^*$. The foreign investor's expected real wealth is:

$$E\left(w_{t+1}^*\right) = \left(1+r_t\right)\theta_t^* w_t^* P\left(x_t\right) + \tau_t \theta_t^* w_t^* \left(1-P\left(x_t\right)\right) - \theta_t^* w_t^* l_t + \left(1+r_t^*\right)\left(1-\theta_t^*\right) w_t^* \tag{5}$$

Due to the uncertain investment return of domestic securities, the variance of next period's real wealth of the domestic and the foreign investor is non-zero and given by:

$$Var(w_{t+1}) = \theta_t^2 w_t^2 \left(1+r_t-\tau_t\right)^2 P\left(x_t\right)\left(1-P\left(x_t\right)\right), \tag{6}$$

for the domestic investor and

$$Var(w_{t+1}^*) = \theta_t^{*2} w_t^{*2} \left(1+r_t-\tau_t\right)^2 P\left(x_t\right)\left(1-P\left(x_t\right)\right) \tag{7}$$

for the foreign investor. Utility maximization yields the optimal shares invested in domestic securities, $\hat{\theta}_t$ and $\hat{\theta}_t^*$:

$$\hat{\theta}_t = \frac{P\left(x_t\right)\left(1+r_t\right) + \tau_t\left(1-P\left(x_t\right)\right) - l_t - \left(1+r_t^*\right)}{\Phi_t \left(1+r_t-\tau_t\right)^2 P\left(x_t\right)\left(1-P\left(x_t\right)\right)}, \tag{8}$$

$$\hat{\theta}_t^* = \frac{P\left(x_t\right)\left(1+r_t\right) + \tau_t\left(1-P\left(x_t\right)\right) - l_t - \left(1+r_t^*\right)}{\Phi_t^* \left(1+r_t-\tau_t\right)^2 P\left(x_t\right)\left(1-P\left(x_t\right)\right)}, \tag{9}$$

where $\Phi_t = -2w_t U_2 / U_1$ and $\Phi_t^* = -2w_t^* U_2^* / U_1^*$ denote the coefficients of relative risk aversion for the domestic and the foreign investor.

Let S be the total supply of bonds issued by the domestic government. Equilibrium in the domestic bond market requires:

$$S_t = D_t + D_t^* = \frac{P\left(x_t\right)\left(1+r_t\right) + \tau_t\left(1-P\left(x_t\right)\right) - l_t - \left(1+r_t^*\right)}{\left(1+r_t-\tau_t\right)^2 P\left(x_t\right)\left(1-P\left(x_t\right)\right)}\left(\frac{w_t}{\Phi_t} + \frac{w_t^*}{\Phi_t^*}\right). \tag{10}$$

This can be solved for the interest rate differential:

$$\frac{r_t - r_t^*}{1+r_t} = \left(1-P\left(x_t\right)\right)\left(1-\frac{\tau_t}{1+r_t}\right) + \frac{l_t}{1+r_t} + \frac{S\left(1+r_t-\tau_t\right)^2 P\left(x_t\right)\left(1-P\left(x_t\right)\right)}{\left(w_t/\Phi_t + w_t^*/\Phi_t^*\right)\left(1+r_t\right)}. \tag{11}$$

In what follows, by the interest rate spread or differential, we mean the term on the left hand side of the equation.

Equation (11) separates the yield spread between the two bonds into three terms. The first term on the right hand side reflects the *default risk premium*. It depends positively on the default probability of the risky issuer country, (1 - $P(x_t)$). The default risk premium decreases with an increase in the fraction of repayment the investor receives in case of default, τ. Since τ ranges between 0 and (1 + r_t), the default risk premium is always positive.

Second, the bond yield differential depends on the *liquidity risk premium*. The more liquid the domestic bond market, the smaller will be the liquidity risk premium.

The third term is the *country-specific risk premium*. It depends negatively on τ and positively on the variance of the default probability $P(x_t)(1 - P(x_t))$, the gross nominal return (1 + r_t), and the level of the relative risk aversion of investor Φ and Φ^*. The more investors care about the variance of their future wealth w_{t+1} (the larger U_2), the larger will be the interest rate differential between the risky and the risk-free country. Furthermore, the country specific risk premium increases with the total supply of domestic bonds, *S*, relative to total wealth.

2.2. The Reduced-form Equation

To test this model empirically, we estimate the following equation:

$$\frac{r_{it} - r_{jt}^{*}}{1 + r_{it}} = \beta_0 + \beta_1' z_{it} + \Phi_t(\gamma_0 + \gamma_1 z_{it}) + EMU(\delta_0 + \delta_1' z_{it}) + \lambda_t + \mu_i + \varepsilon_{it} \qquad (12)$$

The dependent variable is the yield spread of a bond issued in EU country *i* over the benchmark in currency *j*. z_{it} is a vector containing several variables related to fiscal performance, two dummies for the authority level of the issuing government, an indicator of the cyclical stance of the economy, a liquidity variable, and a maturity variable.

The fiscal variables reflect the government's quality as a borrower. We use three fiscal variables in our regression. The first two are motivated by their common use in policy debates and the Maastricht Treaty. These are the debt/GDP ratio and the deficit/GDP ratio. The third is the ratio of government debt service to current government revenues. This variable is closer in spirit to measures of borrower quality commonly used in corporate finance, such as the ratio of debt service to cash flow. It

allows for the fact that governments in different countries may differ in their ability to raise taxes from a given volume of GDP, and it focuses on the constraint high debt burdens impose on the annual budgetary flows. All three fiscal variables relate to the general government. They are measured as the difference relative to the benchmark country Germany (respectively, the USA) in the case of DM/Euro bonds (respectively, US$ bonds). We include levels and quadratic terms of the fiscal variables to allow for non-linear relationships.[3]

The dummies for the level of government are one for debt issued by state or provincial authorities (SA) and debt issued by local authorities (LA), respectively. Since state and governments have less fiscal sovereignty and tax collecting capacities than national governments, it is likely yields on bonds issued by sub-national governments contain larger default risk premia than central government bond rates.[4]

The inclusion of an indicator of the cyclical stance follows the suggestion of Alesina et al. (1992) that default risk depends on the overall economic situation of a country. In an economic slow-down, government revenues decrease, and the probability of default may rise. Since such effects most likely relate to severe recessions and strong upswings rather than small cyclical movements, our indicator takes the value 1, when the nominal GDP of a country is more than half a standard deviation above its trend (boom), -1 when it is more than half a standard deviation below its trend (recession), and 0 otherwise. Using sample standard deviations accounts for the fact that the volatility of the business cycle varies substantially across countries. The difference of this variable between the issuer and the benchmark country is zero, if both countries are in the same cyclical position; it is (-2) and (2), if one is in a strong boom and the other in a strong recession, and (-1) and 1 in the case of less severe differences in the cyclical stance.[5]

The *liquidity* variable serves to estimate the liquidity premium. Due to lack of data, we cannot follow the conventional approach to use bid-ask spreads, which reflect

[3] Bayoumi et al. (1995) and Flandreau et al (1998) talk about a 'credit punishing' effect, when interest rate spreads grow non-linearly with the level of fiscal variables.

[4] We regress local/state government bond yield spreads on national fiscal variables since data on local fiscal variables is not available. In this sense we assume that state/local governments will be bailed out by central governments in case of default, and that local governments in general have to pay a higher risk premium.

[5] We also included the nominal GDP as a linear variable in our regressions, but it turned out to be insignificant. Intuitively it makes sense that the yield spread between two countries does not depend solely on the issuer's GDP, but on the relative size of the issuer's GDP to that of the benchmark countries, Germany and the USA. The trend of the individual GDP time series is subtracted for comparability reasons.

trading costs in trading securities (Fleming, 2003). However, Gravelle (1999) shows that the correlation between bid-ask spreads and the total supply of debt is significantly negative. This suggests that total volume of supply of a security has a positive effect on its liquidity. Following this reasoning, we assume that liquidity depends on market size and, additionally, that all debt issued by a government in a given currency is homogeneous up to maturity. Thus, the liquidity premium is assumed to be proportional to the ratio of the debt issued by a government in DM/Euro or US$ to the total debt of EU countries issued in DM/Euro or US$.[6]

The *maturity* variable contained in vector z_{it} measures the time to maturity of the bonds at the time of issue and controls for the possibility that default premia vary with the length of the contract. In this case, an investor receives a compensation for investing in long-term bonds instead of buying short-term bonds and rolling them over.

Our model suggests that the general *investors' risk aversion* towards credit risk determines the yield spread between countries. This suggestion is supported by the empirical observations. Dungey et al. (2000) show strong evidence of a common international factor in many yield differentials. Deutsche Bank Research (2001) notes that interest rate differentials between EMU member countries widened in periods of financial crises such as the Russian crisis in 1998 or the Turkish currency crisis in 2001. Lemmen (1999) observes that the difference between provincial and federal yields in Australia, Canada, Germany, Switzerland and the US widened considerably after the outbreak of the Asian crisis in 1997 and the Russian default of August 1998. Thus, it seems that in periods of global financial crises or uncertainty investors move to safer and more liquid assets and that bond yield spreads increase as a result.

Since investors' risk aversion is not directly observable, we use the yield spread between low grade US corporate bonds (BBB) and benchmark US government bonds as an empirical proxy.[7] Figure 1 illustrates the development of this proxy between 1990 and 2002. After the peak in the early months of 1991, when the yield spread was more than 2.5 basis points, one observes a continuous downward trend of the corporate-government

[6] We also used the issue size as an alternative proxy for liquidity, but since this variable shows insignificant coefficients, we exclude it from reported regression analysis.

[7] A variable that measures the respective corporate bond spread for the complete Euroarea is not available, but the empirical literature on sovereign bond spreads of emerging markets shows that spreads are sensitive to US risk factors (see, e.g., Barnes et al. (1997), Kamin et al. (1999), Eichengreen et al. (2000)). Therefore, data on US corporate-government bond yield spreads can be used as a good proxy for the overall investors' risk attitude.

bond yield spread, which reflects the growing investors' optimism and willingness to take risk. In 1999, with the burst of the asset price bubble, the yield spread increases sharply by more than 1.5 basis points and fluctuates between 1.5 and 2 basis points in the years after, which illustrates the market participants' skepticism and risk aversion in that period.

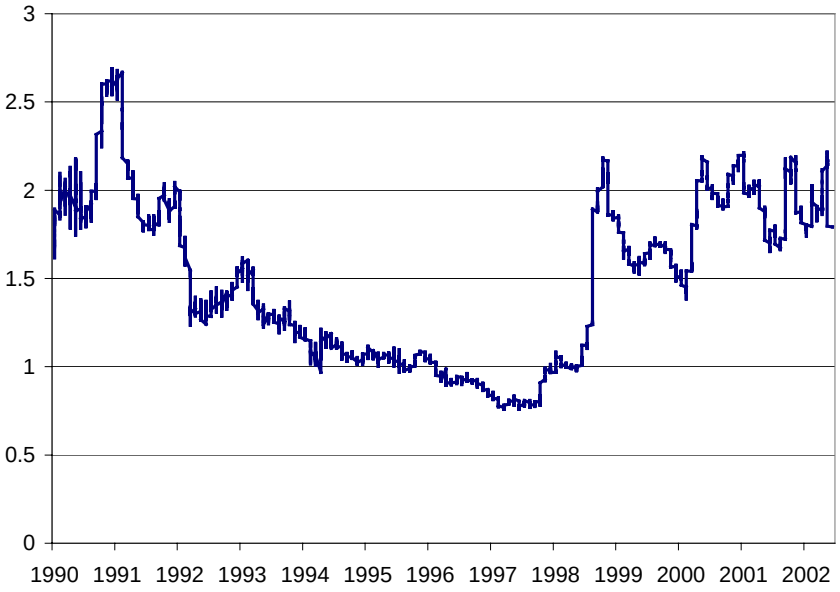

Figure 1: Yield Spread between US low grade Corporate Bonds and US Government Bonds

To estimate the effects of EMU on yield spreads, we introduce an *EMU* dummy that takes the value of one for all EMU member countries after 1999 and for Greece after 2001 and zero otherwise. A significant coefficient on this dummy points to a general effect of EMU on yield spreads of all member countries. Furthermore, we interact the *EMU* dummy with the fiscal variables and the liquidity variable, to see whether EMU has changed the effect of the fiscal variables and market liquidity on interest rates. Finally, all regressions are estimated with and without time fixed effects, λ_t.[8]

[8] We also estimated the regressions with country fixed effects, μ_i. The fiscal variables in these regressions have either insignificant or significantly smaller coefficients than in the regressions with, and without, time fixed effects. Table A1 in the Appendix shows the estimation results when regressing the estimated country fixed effects on the average debt, deficit, and debt service differential of each country. The results show that the country fixed effects are significantly and positively related to the deficit and debt service

3. Data Description

3.1. Data

The data on the yield spreads were provided by Capital DATA Bondware. We compare government bonds issued by the 13 EU countries, i.e., Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Portugal, Spain, Sweden, and the UK, between 1991 and beginning of 2002 that are denominated on the one hand in DM before 1998 and subsequently in Euro, and on the other hand in US$. In this way, interest differentials will be net of expected changes in exchange rates between currencies.

Alesina et al. (1992) argue that default risk premia might be lower for foreign-currency than domestic-currency issues, if countries issue little debt in foreign currencies and because a country has much to lose by defaulting in international markets. Table A2 in the Appendix reports the amount of US$ and DM denominated bond issues of each country during our sample period in million Euros. The figures suggest that this concern is not substantiated for our data set. Except France, all EU countries issued a large amount of their debt in DM or US$. Between 1991 and 2001, Italy issued every year on average 3,905 million Euros, Sweden 1,834 million Euros, and Finland and Spain around 800 million Euros of their debt in US$. Austria, Denmark, Finland, Spain, and Sweden issued between 1991 and 1998 on average every year more than 500 million Euro of their debt in DM.

The interest differential for the DM/Euro denominated bonds is measured as the difference in the yield to maturity at the time of issue between the national bond under consideration and an equivalent German government bond. Similarly, the differential for the bonds issued in US$ is the difference to an equivalent US government bond. In each case, we take the German or US benchmark indicated by Capital DATA Bondware, which is the nearest new issue of the German or US federal government, respectively. The whole data set consists of 185 DM/Euro bond spreads and 132 US$ bond spreads

variables. This suggests that the impact of fiscal variables on government bond yield spreads will be biased downwards when controlling for country fixed effects, since the latter also reflect the default risk of each country. For this reason, we do not focus our discussion on regressions with country fixed effects. The estimation results with country fixed effects are available from the authors on request.

issued by all 15 EU countries. 97 of these DM/Euro denominated bonds and 90 of these US$ bonds are issued before EMU. Recall that, in view of equation (11), all interest differentials are divided by the gross interest rate factor of the respective national bond.

Variable	Desciption	Average	Std. Dev.	Min.	Max.
Spread S_{it}	The spread between the yield of a government bond issue of an EU country and a comparable goverment bond issued in the same currency related to the gross nominal return of the government bond issue. Expressed in basis points. Compare equation (11) . Source: Capital DATA Bondware.	37.41	35.40	-28.08	439.86
Debt	Difference of debt to GDP outstanding at the end of the fiscal year between the issuer country and the benchmark country. *Source:* European Commission (Ameco database)	10.19	24.42	-49.22	90.86
Deficit	Difference of deficit to GDP (including debt service payments) at the end of the fiscal year between the issuer country and the benchmark country. *Source:* European Commission (Ameco database)	0.48	2.31	-8.32	10.13
Debt Service	Difference of debt service payments to total revenue in the current fiscal year between the issuer country and the benchmark country. *Source* : European Commission (Ameco database)	0.01	0.05	-0.13	0.29
Corp. Spread	Spread between 7 to 10 years low grade corporate bonds (BBB) and 7 to 10 government bonds in the US to the time of issuance. *Source:* Meryll Lynch	1.46	0.45	0.79	2.68
Maturity	Time to maturity of the government bond issue measured in years. *Source:* Capital DATA Bondware.	8.37	5.64	1.6	30.1
Liquidity	The ratio of the total debt of the issuer country over the total debt of the EU issued in DM/Euro or US$. *Source:* European Commission (Ameco database) and own calculations.	10.88	9.69	0.71	29.84
Business Cycle	The difference of the business cycle variable between the issuer country and the benchmark county, which collates the value 1 when the detrended and standardized nominal GDP is bigger than 0.5, the value -1, when it is smaller then -0.5 and 0 otherwise.	-0.19	0.79	-1	1
SA	Dummy variable when the sovereign borrower is the State/provincial authority.	0.27	0.44	0	1
LA	Dummy variable when the sovereign borrower is the local authority.	0.10	0.31	0	1
EMU	Dummy variable for all member countries of the EMU after 1998.	0.36	0.48	0	1

Table 1: Variable Description and Summary Statistics

The corporate spreads variable, which measures the difference between 7 to 10 year low grade corporate bonds (BBB) and 7 to 10 year benchmark government bonds in the USA, is provided by Merrill Lynch. All other macro variables like the debt/GDP, deficit/GDP, debt service/revenue, and the liquidity measured as the share of the issuers debt over the overall European debt, are provided by Ameco.[9]

Detailed summary statistics of all variables used in the regressions are listed in Table 1.

3.2. A Descriptive Look at the Data

Figures A1 – A3 in the Appendix plot the yield spreads of EU central government bond issues over time. The figures exclude bonds issued by state and provincial governments, since we expect these to incorporate a positive risk premium, and their inclusion would, in this case, deteriorate the graphical analysis.

A striking aspect of Figure A2 is the outlier of a Swedish bond issued in 1992. With a yield of more than 450 basis points above an equivalent US government bond, this observation is more than four times higher than all other yield spreads in this data set. The Swedish financial crisis in 1992 is a reasonable explanation and provides evidence of financial markets' concern that Sweden might have had serious problems repaying its debt. In Figure A3 we drop this outlier to better illustrate of the development of the remaining bond yield spreads.

As shown, the bond yields of all EU countries converged between 1991 and 1997 to German and US levels. This development may reflect the increased fiscal discipline of the EU countries during this period. After 1997, except for Greece, there is a divergence of EU interest rates relative to German and US levels.

Figures A4 and A5 show the yield spreads of the EU countries as related to their debt differentials and Figures A6 and A7 the yield spreads are related to the debt service differentials relative to Germany or the US.[10] In all four figures, we observe a positive relationship between debt, or debt service, differentials and interest rate spreads, which

[9] Ameco is the annual macro-economic database of the European Commission's Directorate General for Economic and Financial Affairs. The main data source is Eurostat (the Statistical Office of the European Commission), complemented, where necessary, by other appropriate national and international sources.
[10] The figures exclude again bonds issued by state and provincial governments and the Swedish outlier observed in 1992.

supports our hypothesis that fiscal discipline has a decreasing effect on government bond yields. The positive relationship between these fiscal variables and bond yield spreads seems to be mainly driven by the Greek observations. It is interesting that, although the Belgium debt ratio is much higher, Belgium yield spreads are not higher than the yield spreads of Denmark.

4. Estimation Results

4.1. DM/Euro Bonds

Tables 2 and 3 report the estimation results for the DM/Euro denominated bonds with and without time fixed effects. The first regression in both tables contains all three fiscal variables, the debt/GDP, deficit/GDP and debt service/revenue differential, while the following regressions include each of them separately to control for collinearity and exclude insignificant variables. Since the time fixed effects improve the precision of the estimates without changing the basic results, we focus the discussion on the estimates in Table 3.

The results indicate that a positive relation between yield spreads and the fiscal variables, and that EMU membership changes this relation significantly. Before EMU, and for non-EMU countries after 1998, an increasing debt ratio relative to Germany widens the interest rate spread with small decreasing marginal effects. This result contradicts the 'credit punishing hypothesis' of Goldstein and Woglom's (1991) and supports the estimation results of Lemmen and Goodhart (1999). A debt ratio exceeding Germany's by 25 percent of GDP causes a yield spread of 30 basis points, while a debt ratio exceeding Germany's by 50 percent results in a yield spread of 47.5 basis points. EMU membership reduces the linear effect of debt on interest rates, but increases the nonlinear, marginal effect.[11] The results imply that the risk premium is lower after the start of EMU for countries with debt ratios no larger than 68.5 percent above Germany's ratio and higher for countries with debt ratios larger than that. This is consistent with the view that markets anticipate fiscal support for EMU countries in financial distress unless these countries had been very undisciplined before.

[11] The *F*-test rejects at every significance level the hypothesis that the effect of debt ratios on yield spreads is extinguished for EMU countries.

	Regression			
	1	2	3	4
Constant	**-19.92** (0.09)	**-14.07** (0.05)	**-4.11** (0.54)	**2.35** (0.75)
Debt	**0.57** (0.63)	**1.37** (0.00)		
$Debt^2$	**-0.01** (0.24)	**-0.01** (0.00)		
Deficit	**-1.69** (0.47)		**2.54** (0.00)	
$Deficit^2$	**0.18** (0.68)		**0.90** (0.00)	
Debt Serv.	**204.28** (0.77)			**-45.10** (0.63)
Debt Serv.^{2}	**1962.30** (0.48)			**1601.42** (0.00)
Liquidity	**-0.39** (0.56)	**-0.71** (0.03)	**-0.46** (0.08)	**-1.05** (0.00)
Corp.-Spread	**18.76** (0.07)	**12.99** (0.01)	**5.83** (0.26)	**4.89** (0.31)
Co-Spr.* Debt	**0.39** (0.68)			
Co-Spr.* $Debt^2$	**0.00** (0.87)			
Co-Spr.* Deficit	**2.35** (0.26)			
Co-Spr.* $Deficit^2$	**0.09** (0.80)			
Co-Spr.* DebtServ.	**-314.41** (0.61)			
Co-Spr.*DebtServ.^{2}	**-203.50** (0.93)			
Co.Spr.*Liquidity	**-0.28** (0.62)			
Maturity	**1.58** (0.00)	**1.48** (0.00)	**1.84** (0.00)	**1.54** (0.00)
Bus. Cycle	**-3.37** (0.06)	**-4.72** (0.00)	**-1.79** (0.21)	**-5.01** (0.00)
SA	**13.29** (0.03)	**13.62** (0.05)	**3.27** (0.49)	**12.07** (0.03)
LA	**13.37** (0.01)	**14.13** (0.01)	**10.57** (0.03)	**13.03** (0.01)
EMU	**-8.64** (0.31)	**-0.08** (0.99)	**-1.01** (0.85)	**-2.95** (0.50)
Debt*EMU	**-1.58** (0.04)	**-1.29** (0.00)		
$Debt^2$*EMU	**0.00** (0.95)	**0.02** (0.01)		
Deficit*EMU	**-1.92** (0.54)		**-5.37** (0.02)	
$Deficit^2$*EMU	**-0.02** (0.97)		**-1.24** (0.00)	
Debt Serv.*EMU	**1018.42** (0.06)			**179.41** (0.04)
Debt Serv.^{2}*EMU	**3781.61** (0.67)			
Liquidity*EMU	**0.76** (0.12)	**0.42** (0.09)		**0.88** (0.00)
R^2	**0.68**	**0.44**	**0.54**	**0.59**
N	**185**	**185**	**185**	**185**

P-values in paranthesis, R^2 is the proportion of the total variation in S_{it} explained by the regression. The Debt, Deficit, Debt Service, and Business Cycle variables are related to values of benchmark country Germany.

Table 2: Estimation Results for DM/Euro Denominated Bonds without Fixed Effects

	Regression			
	1	2	3	4
Constant	**-8.04** (0.64)	**-1.40** (0.93)	**-0.36** (0.98)	**23.92** (0.04)
Debt	**1.07** (0.33)	**1.45** (0.00)		
$Debt^2$	**-0.02** (0.12)	**-0.01** (0.00)		
Deficit	**-1.20** (0.70)		**2.42** (0.03)	
$Deficit^2$	**0.27** (0.62)		**0.97** (0.00)	
Debt Serv.	**184.05** (0.76)			**-87.49** (0.32)
Debt $Serv.^2$	**1711.34** (0.50)			**1772.54** (0.00)
Liquidity	**-0.14** (0.84)	**-0.52** (0.09)	**-0.38** (0.20)	**-0.95** (0.00)
Corp.-Spread	**18.63** (0.02)	**20.17** (0.00)	**5.47** (0.22)	**6.53** (0.09)
Co-Spr.* Debt	**-0.21** (0.82)			
Co-Spr.* $Debt^2$	**0.00** (0.58)			
Co-Spr.* Deficit	**1.93** (0.43)			
Co-Spr.* $Deficit^2$	**0.09** (0.83)			
Co-Spr.* DebtServ.	**-249.68** (0.63)			
Co-Spr.*$DebtServ.^2$	**-173.19** (0.93)			
Co.Spr.*Liquidity	**-0.43** (0.37)			
Maturity	**1.55** (0.00)	**1.38** (0.00)	**1.74** (0.00)	**1.57** (0.00)
Bus. Cycle	**-0.70** (0.68)			
SA	**15.68** (0.01)	**18.59** (0.01)	**7.57** (0.12)	**16.54** (0.00)
LA	**15.76** (0.00)	**18.74** (0.00)	**13.58** (0.01)	**17.53** (0.00)
EMU	**-17.45** (0.06)	**10.53** (0.08)	**-9.26** (0.21)	**-12.07** (0.05)
Debt*EMU	**-1.29** (0.06)	**-1.37** (0.01)		
$Debt^2$*EMU	**0.00** (0.98)	**0.02** (0.01)		
Deficit*EMU	**-1.83** (0.55)		**-6.66** (0.00)	
$Deficit^2$*EMU	**-0.09** (0.86)		**-1.55** (0.00)	
Debt Serv.*EMU	**1254.18** (0.01)			**191.57** (0.02)
Debt $Serv.^2$*EMU	**-1111.08** (0.91)			
Liquidity*EMU	**0.72** (0.06)		**0.51** (0.05)	
R^2	**0.73**	**0.48**	**0.62**	**0.64**
N	**185**	**185**	**185**	**185**

P-values in paranthesis, R^2 is the proportion of the total variation in S_{it} explained by the regression. The Debt, Deficit, Debt Service, and Business Cycle variables are related to values of benchmark country Germany.

Table 3: Estimation Results for DM/Euro Denominated Bond with Time-Fixed Effects

Regression (3) shows that an increasing deficit ratio relative to Germany increases the yield differential with positive marginal effects. Before EMU, and for non-EMU countries after 1998, a deficit differential of one percent relative to Germany causes a yield spread of 3.39 basis point.[12] If the deficit rises from one percent to two percent relative to Germany, the yield differential increases by 5.33 basis points due to the non-linear effect. EMU-membership changes this punishing effect significantly. The EMU dummy interacted with the deficit variables shows negative and significant coefficients in both tables. In the regression without time fixed effects, a *F*-test does not reject the hypothesis that the effect of deficits on interest rates vanishes after the start of EMU. When we control for time fixed effects, this hypothesis is rejected at the 3 percent significance level. This result may be driven by the fact that the two largest member countries, Germany and France, had the largest deficits in the early years of EMU.

According to regression (4), the impact of the debt service ratio on interest rates is positive and shows an increasing marginal effect, which supports the 'credit punishing' hypothesis. Before EMU, and for non-EMU countries after 1998, a debt service/revenue differential of five percent relative to Germany causes an interest rate spread of 4.43 basis points. With EMU, the debt service ratio gains in importance. A debt service/revenue differential of the same magnitude in an EMU country explains an interest spread of around 14 basis points. The R^2 is higher in the regressions when the debt service ratio is included than in the regressions with either debt or deficit ratios as alternative regressors. Accordingly, this fiscal variable explains more of the variation in yield spreads across EU countries than debt and deficit ratios, the two variables commonly used in policy debates and the Maastricht Treaty.

The *Business Cycle* variable shows negative and significant coefficients in the regressions without controlling for fixed effects. Accordingly, when the issuing country is in a good economic condition relative to Germany, its interest differential decreases. In Table 3 the coefficients of this variable turn out to be insignificant, since year dummies filter the effect of business cycle variations on yield spreads. The dummies SA and LA are positive and significant in all regression. Local governments' interest rates are 15 basis points higher than the interest rate on central government bonds.

[12] Note that deficits are expressed by positive figures.

Yield differentials across European countries reflect liquidity risk. The liquidity variable shows negative and significant coefficients in almost all regressions. An increase of the relative debt size by one percent causes a reduction of the issuer country's interest rate by around 0.7 basis points. An interesting result is that this liquidity effect diminishes or even vanishes with EMU, as shown by the positive and significant coefficients on the *Liquidity*EMU* variable in most regressions. This is consistent with the notion that financial market integration has become more complete in Europe.

In half of our regressions, the *Corporate Spread* variable has positive and significant coefficients. Accordingly, in periods of high risk aversion, measured by a large spread between low grade US corporate bonds and US government bonds, the interest differentials of EU countries versus Germany rise. When the corporate-government bond yield spread increases by one percent, Germany pays an interest rate that is an additional 20 basis points smaller than the one of other EU countries. The impact of fiscal performance and market liquidity on yield spreads seems to stay unaffected by the degree of investors' risk aversion.

Finally, yield spreads increase by around 1.6 basis points with every additional year to maturity.

4.2. US$ Bonds

Tables 4 and 5 show the estimation results for US$ denominated bonds.[13] The regressions in the second table are estimated with year dummies and therefore control for time fixed effects. We focus the discussion of the estimation results on the estimates reported in Table 5.

The estimation results support that yield spreads between EU countries and the USA are affected by fiscal performance. The yield spread increases with the debt, deficit, and debt service differential between the issuer country and the USA. The debt ratio shows decreasing marginal effects and the debt service ratio increasing marginal effects on interest rates. According to regression (2), a debt differential of 25 percent causes for non-EMU countries a yield spread of 35.5 basis points. The significant coefficients on

[13] For the estimations, we dropped the Swedish outlier described in Section 4.2.

	Regression			
	1	2	3	4
Constant	**7.93** (0.68)	**9.81** (0.32)	**-15.67** (0.11)	**20.85** (0.19)
Debt	**0.36** (0.58)	**1.14** (0.02)		
$Debt^2$	**0.00** (0.74)	**-0.01** (0.09)		
Deficit	**-3.61** (0.4)		**0.34** (0.91)	
$Deficit^2$	**1.68** (0.09)		**3.27** (0.05)	
Debt Serv.	**555.15** (0.10)			**576.03** (0.01)
Debt $Serv.^2$	**1774.57** (0.20)			**3687.16** (0.00)
Liquidity	**-3.13** (0.02)	**-1.04** (0.04)	**-0.58** (0.11)	**-3.20** (0.01)
Corp.-Spread	**33.89** (0.01)	**25.86** (0.00)	**38.34** (0.00)	**16.26** (0.10)
Co-Spr.* Debt	**-0.56** (0.29)	**-0.39** (0.03)		
Co-Spr.* $Debt^2$	**0.00** (0.90)			
Co-Spr.* Deficit	**4.21** (0.16)		**1.40** (0.43)	
Co-Spr.* $Deficit^2$	**-1.55** (0.03)		**-2.12** (0.03)	
Co-Spr.* DebtServ.	**-104.67** (0.66)			**-252.64** (0.08)
Co-Spr.*$DebtServ.^2$	**-745.24** (0.54)			**-1792.20** (0.03)
Co.Spr.*Liquidity	**0.98** (0.25)			**1.07** (0.12)
Maturity	**1.54** (0.00)	**1.33** (0.00)	**1.39** (0.00)	**1.35** (0.00)
Bus. Cycle	**-9.56** (0.00)	**-11.10** (0.00)	**-10.83** (0.00)	**-11.05** (0.00)
SA	**11.28** (0.07)	**26.40** (0.00)	**13.51** (0.00)	**24.43** (0.00)
LA	**25.76** (0.00)	**27.94** (0.00)	**18.76** (0.04)	**32.06** (0.00)
EMU	**-59.04** (0.21)	**-8.45** (0.27)	**-4.89** (0.50)	**-2.35** (0.74)
Debt*EMU	**-1.60** (0.07)	**-1.58** (0.04)		
$Debt^2$*EMU	**0.07** (0.16)	**0.04** (0.02)		
Deficit*EMU	**-37.13** (0.06)			
$Deficit^2$*EMU	**7.89** (0.22)			
Debt Serv.*EMU	**-2042.27** (0.25)			
Debt $Serv.^2$*EMU	**-10672.76** (0.47)			
Liquidity*EMU	**4.22** (0.14)			**0.93** (0.06)
R^2	**0.79**	**0.45**	**0.49**	**0.72**
N	**132**	**132**	**132**	**132**

P-values in paranthesis, R^2 is the proportion of the total variation in S_{it} explained by the regression. The Debt, Deficit, Debt Service, and Business Cycle variables are related to values of benchmark country USA.

Table 4: Estimation Results for US$ Denominated Bonds without Fixed Effects

	Regression			
	1	2	3	4
Constant	**109.03** (0.00)	**72.87** (0.02)	**54.88** (0.03)	**74.72** (0.01)
Debt	**0.13** (0.86)	**2.17** (0.01)		
$Debt^2$	**-0.02** (0.11)	**-0.03** (0.06)		
Deficit	**-0.82** (0.86)		**5.59** (0.00)	
$Deficit^2$	**-0.55** (0.54)		**0.14** (0.81)	
Debt Serv.	**1156.10** (0.00)			**602.00** (0.00)
Debt $Serv.^2$	**1230.16** (0.39)			**1621.99** (0.00)
Liquidity	**-4.59** (0.00)	**-3.51** (0.01)	**-1.25** (0.01)	**-5.02** (0.00)
Corp.-Spread	**-29.31** (0.11)	**-17.69** (0.26)	**-1.62** (0.88)	**-23.12** (0.11)
Co-Spr.* Debt	**0.08** (0.89)	**-0.95** (0.01)		
Co-Spr.* $Debt^2$	**0.01** (0.41)	**0.01** (0.09)		
Co-Spr.* Deficit	**4.10** (0.16)			
Co-Spr.* $Deficit^2$	**-0.27** (0.67)			
Co-Spr.* DebtServ.	**-666.91** (0.00)			**-278.68** (0.01)
Co-Spr.*$DebtServ.^2$	**-293.15** 0.82			**2.49** (0.00)
Co.Spr.*Liquidity	**2.02** (0.01)	**1.65** (0.02)		
Maturity	**1.36** (0.00)	**1.39** (0.00)	**1.37** (0.00)	**1.19** (0.00)
Bus. Cycle	**-9.20** (0.00)	**-12.43** (0.00)	**-6.08** (0.01)	**-9.40** (0.00)
SA	**12.01** (0.16)	**22.90** (0.01)	**11.26** (0.17)	**19.59** (0.00)
LA	**31.69** (0.00)	**33.65** (0.00)	**23.64** (0.01)	**37.26** (0.00)
EMU	**-82.06** (0.16)	**-12.91** (0.16)	**-30.51** (0.01)	**-2.29** (0.79)
Debt*EMU	**-2.70** (0.01)	**-1.64** (0.09)		
$Debt^2$*EMU	**0.05** (0.28)	**0.03** (0.10)		
Deficit*EMU	**-64.95** (0.00)			
$Deficit^2$*EMU	**13.93** (0.01)			
Debt Serv.*EMU	**-1490.94** (0.40)			
Debt $Serv.^2$*EMU	**4480.76** (0.73)			
Liquidity*EMU	**8.53** (0.02)		**1.50** (0.03)	
R^2	**0.82**	**0.56**	**0.55**	**0.78**
N	**132**	**132**	**132**	**132**

P-values in paranthesis, R^2 is the proportion of the total variation in S_{it} explained by the regression. The Debt, Deficit, Debt Service, and Business Cycle variables are related to values of benchmark country USA.

Table 5: Estimation Results for US$ Denominated Bonds with Time-fixed Effects

the EMU dummy interacted with the debt variables show that the influence of debt ratios on yield spreads changes with EMU. A coefficient test cannot reject the hypothesis that the coefficients on the debt variable and the latter interacted with the EMU dummy are jointly zero. Accordingly, the interest rates for EMU countries stay unaffected by their debt ratio. Contrarily, the impact of deficits and debt service ratios on bond yields is unaffected by EMU membership. Independent of EMU membership, the interest rate of an EU country increases by 5.59 basis points when the deficit differential relative to the USA increases by one percent. An EU country with a debt service/revenue spread of 0.05 pays an interest rate that is 34.15 basis points bigger compared to the interest rate in the USA.

Similar to the estimation results for the DM/Euro denominated bonds, the R^2 is the highest, when we include the debt service ratio in the regression. Accordingly, the debt service ratio explains more of the variation of EU government bond yield spreads than debt/GDP and deficit/GDP ratios, which are closely linked to the Maastricht Treaty.

From the magnitude of the coefficients on the liquidity variable one can conclude that US$ denominated bonds contain bigger liquidity risk premia than DM/Euro denominated bonds. The interacted liquidity variable with the EMU dummy shows significant and positive coefficients in three regressions, which indicated that the liquidity risk premium decreases after EMU.

The variable measuring the corporate-government bond yield spread in the USA shows positive and significant coefficients in all regressions, when we do not control for time fixed effects. A rise in this spread by one percent, which reflects an increase of investors' risk aversion towards credit risk, causes the yield spread between EU countries and the USA to rise by more than 20 basis points. When we control for time fixed effects, this effect disappears, which is not very surprising. While for the DM/Euro denominated bonds the level of the *Corporate Spread* variable does not effect the impact of fiscal variables on yield spreads, we observe that for US$ denominated bonds fiscal variables become less important in explaining yield differentials across EU countries if the corporate-government bond spread rises. The estimation results show further that also the impact of liquidity on bond yield spreads seems to depend on the degree of investor's risk aversion. In risky periods the overall decreasing effect of the relative debt

size of the issuer country on the yield spread, due to a positive liquidity premium, diminishes.

The estimation results in both tables support the results for the DM/Euro denominated bonds and show that the interest differential of EU countries versus the USA depends positively on the time to maturity of the bond issue, and that local and state governments pay in general higher interest rates on their debt than central governments. Interest differentials are affected by the relative position of the issuer country on its business cycle. If the USA is in a recession and an EU country in a boom, the yield spread between these two countries decreases by around 20 basis points.

5. Conclusions

This paper contributes to the literature on the impact of fiscal policies on interest rates by analyzing the role of capital markets on the sustainability of public finances in the euroarea. We examine whether bond yield differentials across EU countries are determined by default and/or liquidity risk aspects, and whether EMU had significant impact on bond pricing. We exploit a unique data set of US$ and Euro denominated government bond issue spreads between 1991 and 2002, which has the advantage that we can ignore exchange risks and distortions by differences in national tax regimes.

Our results show that yield spreads of EU countries versus Germany or the USA reflect positive default and liquidity risk premia. The default risk premium is positively affected by the debt and debt service ratios of the issuer country. This is consistent with the notion that credit markets monitor fiscal performance and exert disciplinary pressure on governments. The debt service variable explains more variation in yield spreads across EU countries than both the debt or the deficit variable. Countries whose national debt has a larger share in total EU debt pay lower interest rates than EU countries with smaller shares.

Liquidity risk premia are reduced with EMU membership, which points to an increase in financial market integration. For DM/Euro denominated bonds, EMU membership reduces the linear effect of debt on default risk premia but increases the non-linear, marginal effect. Accordingly, EMU members enjoy a lower risk premium than before, but this benefit declines with the size of public debt compared to Germany.

This is consistent with the view that markets anticipate fiscal support for EMU countries in financial distress unless these countries had been very undisciplined before. In contrast, the impact of debt service on interest rates rises with EMU. Thus, monetary union does not seem to have weakened the disciplinary function of credit markets.

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Appendix

Country Dummies	1	2	3
	US$		
constant	**29.06** (0.01)	**22.82** (0.03)	**38.52** (0.00)
Debt	**0.60** (0.12)		
Deficit		**9.87** (0.06)	
Debt Service			**468.68** (0.00)
R^2	0.22	0.31	0.60
Obs.	12	12	12
	US$		
constant	**-12.41** (0.20)	**-7.21** (0.29)	**-15.26** (0.15)
Debt	**0.52** (0.12)		
Deficit		**11.19** (0.01)	
Debt Service			**258.71** (0.10)
R^2	0.21	0.46	0.23
Obs.	13	13	13

Table A1: Relationship between Country Dummies and Fiscal Variables

	Austria		Belgium		Denmark		Finland	
	US$	DM	US$	DM	US$	DM	US$	DM
1991	254.48	-	848.25	-	-	-	254.48	485.73
1992	1017.89	766.94	-	255.65	848.25	225.65	2968.87	1533.88
1993	721.01	1482.75	848.25	1022.58	2222.41	1074.74	1060.31	1533.88
1994	1017.89	255.65	848.25	511.29	-	-	2544.75	1661.69
1995	-	1022.58	848.25	511.29	169.65	664.68	-	-
1996	169.65	1406.05	424.15	-	296.89	715.81	1102.72	1661.69
1997	-	345.12	763.42	-	1874.63	1763.96	-	-
1998	424.12	-	-	-	424.12	-	-	-
1999	1015.58	-	-	-	1222.30	-	-	-
2000	-	-	-	-	1335.50	-	-	-
2001	1097.94	-	-	-	1655.65	-	-	-
	France		**Greece**		**Ireland**		**Italy**	
	US$	DM	US$	DM	US$	DM	US$	DM
1991	-	-	-	-	339.29	-	1696.50	-
1992	-	-	296.89	-	254.48	255.65	709.88	-
1993	-	-	678.59	511.29	424.12	766.94	7048.94	2556.46
1994	-	66.47	593.77	511.29	-	-	1272.37	639.11
1995	169.65	-	-	434.60	-	-	1696.49	-
1996	-	-	602.26	1083.94	-	-	4035.69	-
1997	-	-	-	1022.58	-	-	1662.57	-
1998	-	-	1654.08	383.47	-	-	3180.93	-
1999	-	-	-	-	-	-	862.81	-
2000	-	-	-	-	-	-	5357.43	-
2001	-	-	-	-	-	-	11524.80	-
	Portugal		**Spain**		**Sweden**		**UK**	
	US$	DM	US$	DM	US$	DM	US$	DM
1991	-	-		-	-	-	-	-
1992	-	-	1272.37	1022.58	1972.18	1278.23	2544.75	2556.46
1993	848.25	-	402.92	2249.68	4775.64	-	-	-
1994	-	1278.23	347.78	1278.23	5394.86	146.49	-	-
1995	-	-	309.61	-	2438.71	1789.52	-	-
1996	55.14	766.94	-	1022.58	1017.90	1406.05	3392.99	-
1997	212.06	-	157.77	-	2527.78	230.08	-	-
1998	-	-	1442.02	-	212.06	-	-	-
1999	990.89	-	1109.58	-	-	-	-	-
2000	-	-	1580.28	-	-	-	-	-
2001	-	-	1167.13	-	-	-	-	-

Table A2: Amount of DM and US$ Denominated Bond Issues in Million Euro

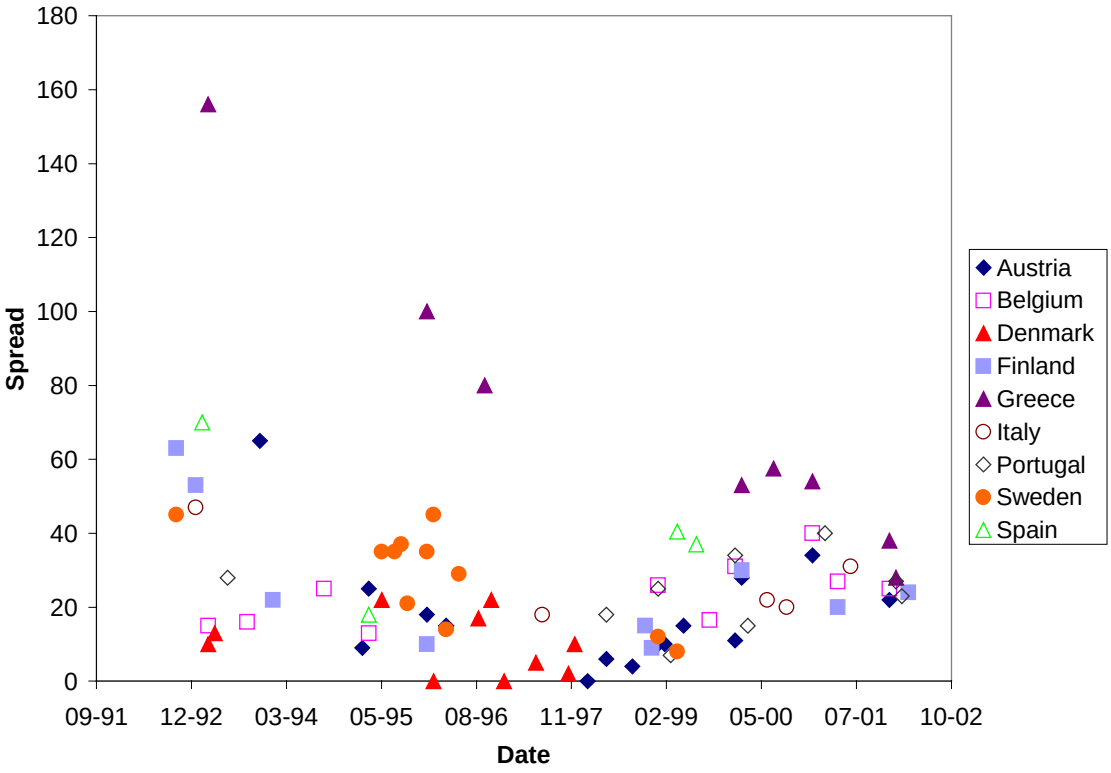

Figure A1: DM/Euro Bond Yield Spreads between 1992-2002

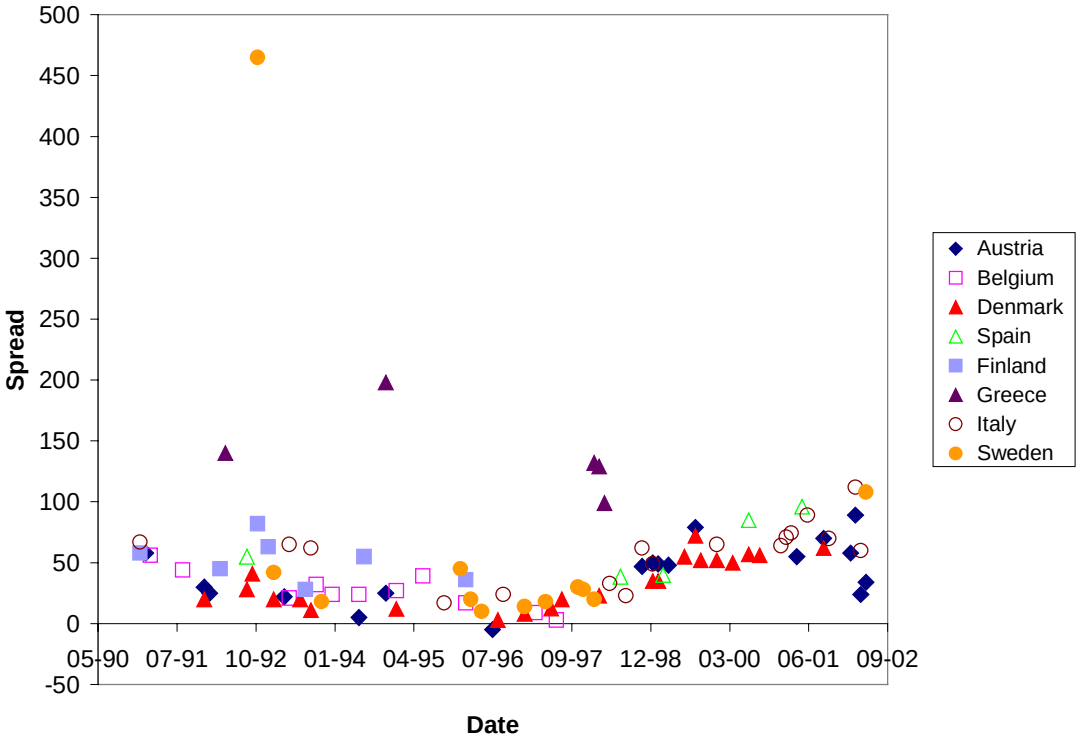

Figure A2: US$ Bond Yield Spreads between 1992-2002

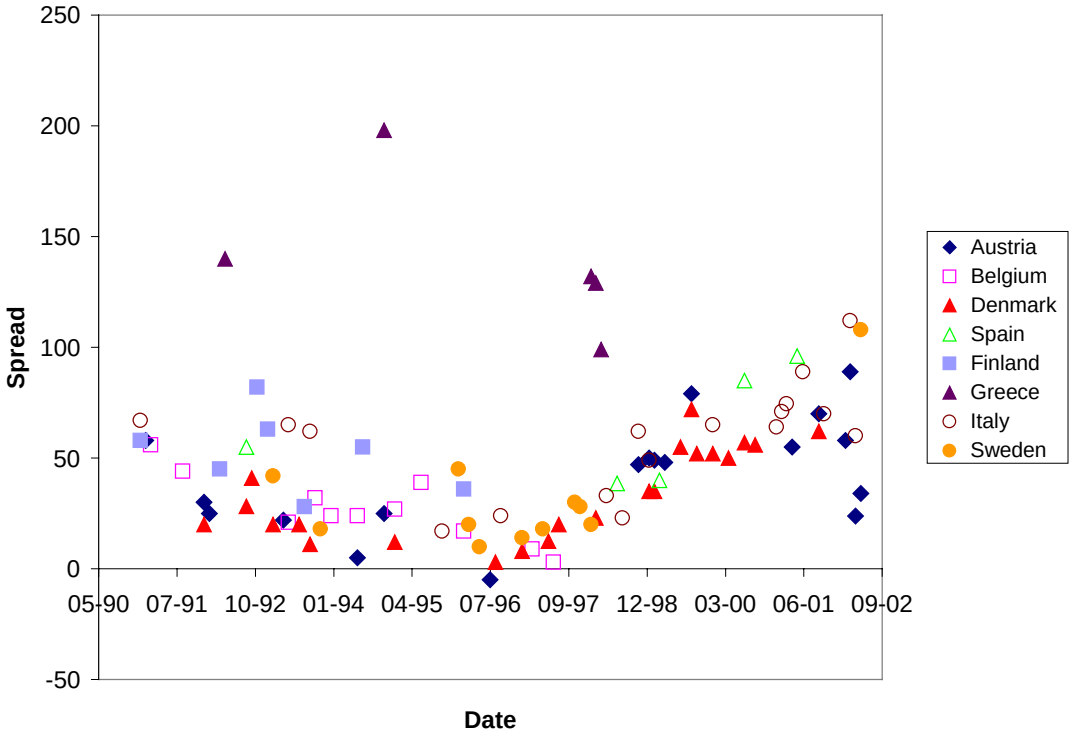

Figure A3: US$ Bond Yield Spreads between 1992-2002 without Swedish Outlier

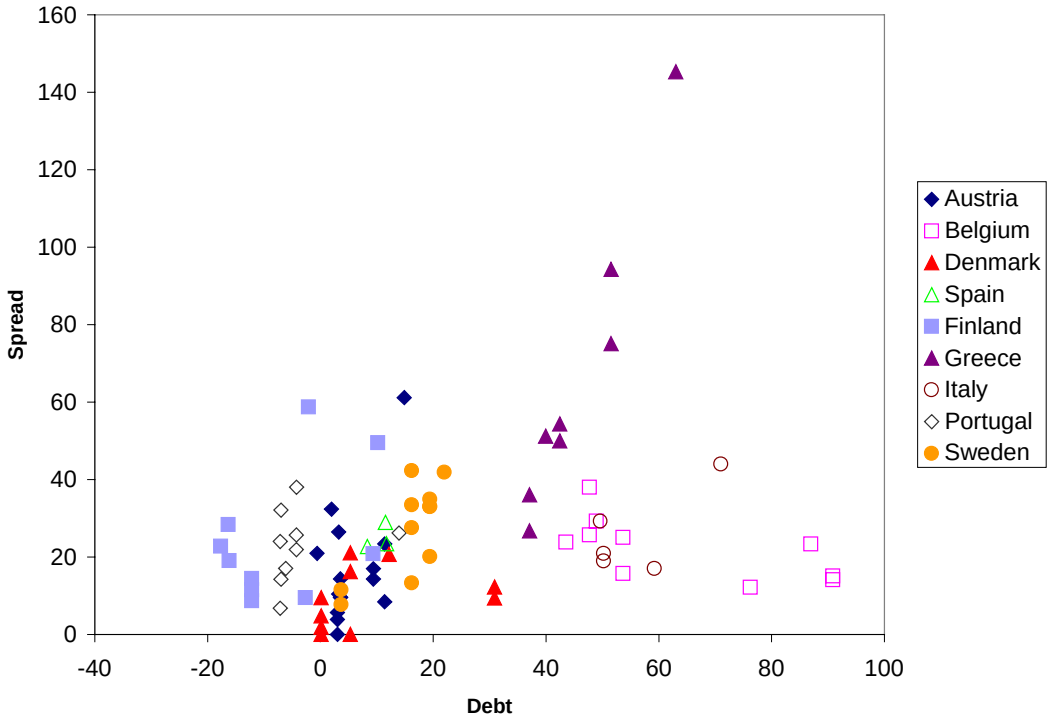

Figure A4: DM/Euro Bond Yield Spread in Relation to Debt/GDP Differential, 1991-2002

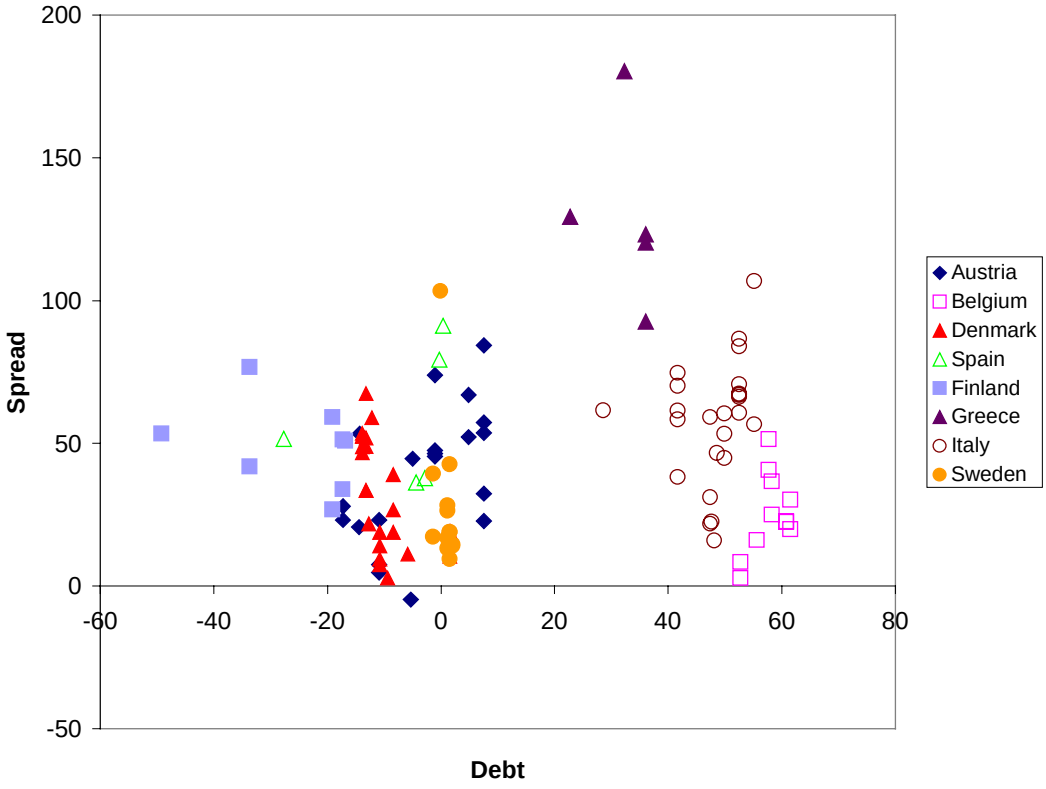

Figure A5: US$ Bond Yield Spread in Relation to Debt/GDP Differential, 1991-2002

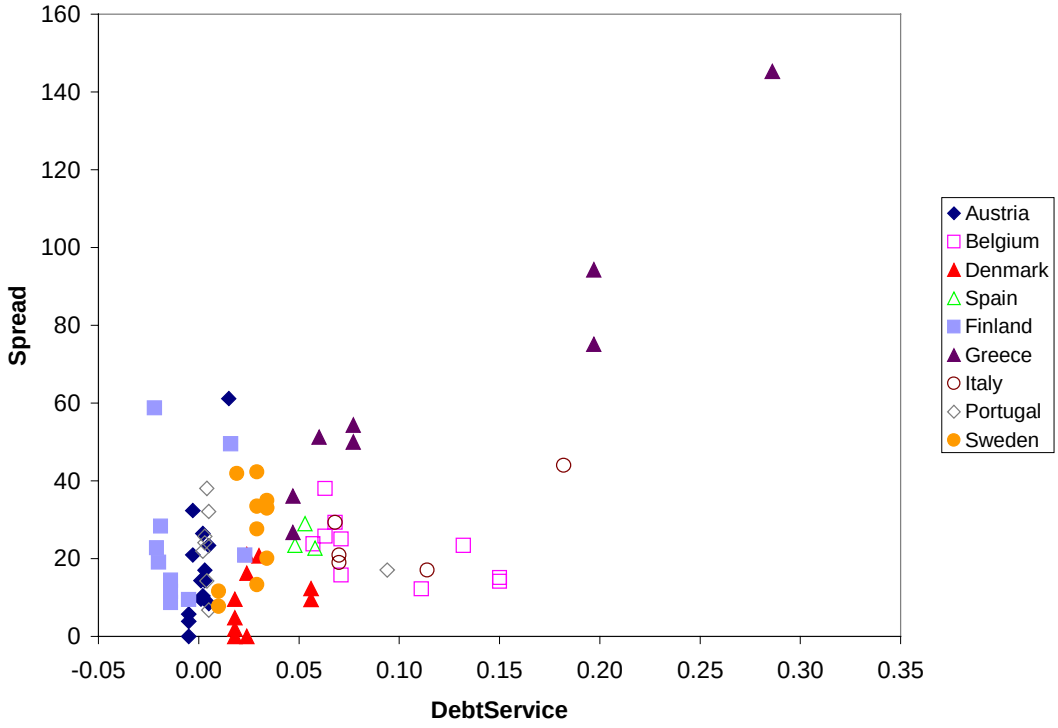

Figure A6: DM/Euro Bond Yield Spread in Relation to Debt Service/ Revenue Differential, 1991-2002

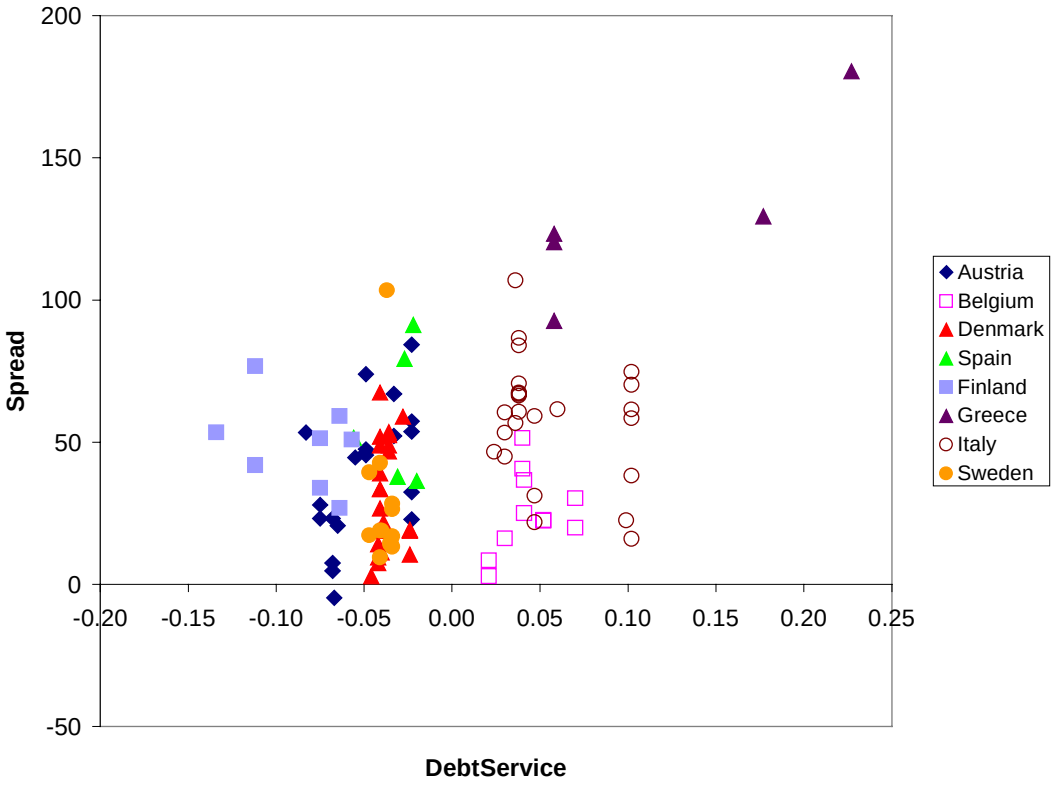

Figure A7: US$ Bond Yield Spread in Relation to Debt Service/Revenue Differential

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