European Journal of Political Economy 25 (2009) 371–384

Contents lists available at ScienceDirect

European Journal of Political Economy

journal homepage: www.elsevier.com/locate/ejpe

Government risk premiums in the bond market: EMU and Canada

Ludger Schuknecht [a,*], Jürgen von Hagen [b], Guido Wolswijk [a]

[a] European Central Bank, Directorate General Economics, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany
[b] Department of Economics, University of Bonn, Lennéstrasse 37, 53113 Bonn, Germany

ARTICLE INFO

Article history:
Received 10 June 2008
Received in revised 10 February 2009
Accepted 12 February 2009
Available online 28 February 2009

JEL classification:
E43
E62
H63
H74

Keywords:
Interest rates
Fiscal policy
Government debt
Bail out
Regional public finances

ABSTRACT

This paper focuses on risk premiums paid by central governments in Europe and sub-national governments in Germany, Spain, and Canada, using data for bond yield spreads for the period 1991–2005. We find that risk premiums by central governments respond positively to debt and deficits; German states enjoyed a favourable position in financial markets before EMU but not thereafter; Spanish and Canadian provinces risk premiums over the whole period; German and Spanish sub-central governments pay liquidity-related interest rate premiums; Canadian and German provinces/states that benefit from fiscal equalization lower spreads. This is evidence of market discipline at work and of credibility of the EU no-bailout clause.

1. Introduction

The potential effect of credit risk on government bond yields is an important issue for economists and policy makers alike. By charging risk premiums on bond yields that increase with government debt or deficits, financial markets can penalize governments for a lack of fiscal discipline, thus imposing discipline on them. Government bond yields would then be signals of the markets' assessment of the sustainability of fiscal policy. Market-imposed discipline of this kind is especially relevant in large federal states, such as Canada or the US, and in monetary unions, such as the European Economic and Monetary Union (EMU), where governments of the member states can issue debt in their own right but are more restricted in their ability to respond to financial difficulties since they do not control their own monetary policies. Faced with a fiscal crisis, such governments are likely to turn to other governments or the common central bank and ask for a bail-out.[1] This would allow them to spread the costs of their profligate fiscal policies over the entire federation or monetary union. To the extent that market-imposed discipline leads to more prudent fiscal policies and helps prevent fiscal crises in federal states and monetary unions, it protects the citizens against having to pay for the profligacies of the governments of other states.

In light of this, the existence of default risk premiums in sovereign bond yields has received a lot of attention in the debate over monetary union in Europe; see Bernoth et al. (2006) for a review of the literature. One way to detect and estimate such risk premiums is by considering the yield spreads of government bonds relative to a suitable benchmark. Following this approach, Goldstein and Woglom (1992), Bayoumi, Goldstein and Woglom (1995), and Poterba and Rueben (1999) show that state governments in the US pay risk premiums on their debt and that these premiums depend on indicators of fiscal performance. Lemmen (1999) shows that the yield spreads of bonds issued by state governments in Australia, Canada, and Germany over central

* Corresponding author. Tel.: +49 69 1344 6494; fax: +49 69 1344 7602.
E-mail address: ludger.schuknecht@ecb.europa.eu (L. Schuknecht).

[1] Sub-central government defaults can involve large externalities on the rest of the federation or the other members of a monetary union, which make it unattractive for the other states or the central government to refuse a bail-out (See e.g., Wildasin, 2001 and von Hagen et al., 2000).

0176-2680/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.ejpoleco.2009.02.004

government bond yields depend positively on the ratio of state debt to GDP. Booth et al. (2007) find that bond yield spreads of Canadian provinces over the federal government respond positively to measures of provincial indebtedness.[2]

Lonning (2000) compares the yields of a very small sample of DM issues of 11 EU governments with equivalent German government bonds in the mid-1990s and finds a positive, though not always significant impact of government debt and deficits. Gómez-Puig (2006) uses adjusted spreads of the yields on bonds issued by 10 European countries over DM bonds, where the adjustment uses appropriate swap rates to eliminate exchange rate uncertainty. She finds that the spreads increase with increasing debt relative to Germany.[3] Pagano and von Thadden (2004) show that average yield differentials of 10-year bonds issued by EMU member state governments relative to German 10-year bonds are positively correlated with bond ratings. Manganelli and Wolswijk (2007) show that spreads in euro area countries are systematically related to credit ratings, whereas Afonso et al. (2007) provide evidence that ratings are also driven by budgetary developments.

In a recent paper, Bernoth et al. (2006) analyze the spreads of yields-at-issue of sovereign bonds issued by EU central governments in DM (in Euros after 1999) or US dollars to estimate default risk premiums. The use of DM (Euro) and USD denominated bonds avoids the problems of exchange rate risk and different tax treatments that have plagued earlier studies using yields on bonds denominated in national currencies. 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. Bernoth et al. use data from before and after the start of EMU, allowing them to assess the impact of monetary union on bond yield spreads. Their results show that yield spreads respond significantly to measures of general government debt and deficits both before and after the start of EMU. This indicates that sovereign debt markets continue monitoring the fiscal performance of member states and exert disciplinary pressure on their governments.

Furthermore, Bernoth et al. show that yield spreads are affected by liquidity premiums. Countries with larger market shares in the DM (Euro) or USD markets pay significantly lower interest rates than EU countries with smaller market shares. In the euro-denominated debt market, however, these liquidity premiums have vanished with the start of EMU, a result consistent with the empirical analysis in Pagano and von Thadden (2004) and Favero, Pagano, and von Thadden (2005). Finally, Bernoth et al. find a significant flight-to-quality effect in the sense that spreads over US government bond yields respond positively to an increase in the spread between low-grade US corporate bonds and US Treasury bonds, a proxy for the general degree of risk aversion in international bond markets.

This paper extends the analysis of Bernoth et al. in several ways. First, we consider the response of risk premiums in central government bond yields to central rather than general government debts and deficits. This gives a more specific link between central government fiscal policy and the potential risk premium. We also control for a larger set of financial market variables to test for risk premiums.

Second, by using the German federal government as the benchmark borrower, Bernoth et al. cannot say anything about the consequences of EMU for public sector borrowing in Germany itself. To do this, we estimate the risk premiums on debt issued by German state governments, which, like provinces in Canada and states in the US, can issue debt in their own right and have used this right extensively in the past.[4] While state governments have full budgetary authority over their expenditures, their ability to raise taxes is limited by the fact that the rates of the main taxes are set jointly by all states and the federal government. Furthermore, their tax bases are smaller and more mobile than the federal government's tax base. As a result, one would expect state governments to pay risk premiums in excess of the federal government. Finding such premiums indeed corroborates the interpretation of the observed yield spreads as risk premiums related to credit risk. We also use yield spreads on bonds issued by provinces in Spain, the only other EMU country for which we were to find the fiscal data and economic data required for our empirical analysis.[5]

A significant feature of Germany's federal system is that state governments can expect financial help from the federal government, if they find themselves in financial troubles. This expectation is based on a highly noticed ruling by Germany's Constitutional Court in 1992. In a case brought forward by the state governments of the two small states of Bremen and Saarland, the Court concluded that states experiencing “extreme budgetary hardship” are entitled to financial support from the federation. Both states had issued large amounts of debt in the 1970s and 1980s, when their economies went into persistent decline. By the late 1980s, the servicing of these debts had become such a large burden on the state budgets that the governments threatened to cut the supply of public services dramatically. The Court ruled that the federal government owed the states financial aid to prevent that from happening. Financial markets apparently perceived this ruling as an indication of the default risk of German states being as low as that of the federal government, witness the fact that state governments have consistently received the same AAA-ratings as the federal government from Fitch Ratings in recent years.[6] In our context, this implies that we should not find a risk premium on German state debt relative to the German federal government.

[2] Balassone et al. (2004) show that yields spreads against Germany of government bonds issued by the other EU countries in their national currencies between 1980 and 2003 depend positively on the change in the government debt-to-GDP ratio. Using issues in national currencies, however, they cannot distinguish between credit risk and exchange rate risk, which distinction is no longer relevant in EMU.

[3] 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. In a similar vein, Lemmen and Goodhart (1999) and Codogno, Favero and Missale (2003) show that the differential between government bond yields and the corresponding swap yield of the same maturity depends positively on the level of public debt, while Heppke-Falk and Hüfner (2004) find that expected deficits have a positive impact on this differential in Germany, France, and Italy. It is not clear, however, that this differential properly reflects sovereign risk, since the credit risk of private issuers is likely to be correlated with the credit risk of their governments. See also Afonso and Strauch (2007) and Faini (2004).

[4] For another recent study that looks at German state government debt see Heppke-Falk and Wolff (2007).

[5] While our data source includes yield spreads do exist for many regions and municipalities in other EMU member states, data for regional and municipal debts, deficits, and GDP do not exist.

[6] See www.fitchratings.com. Standard & Poor and Moody's give German state governments ratings slightly below the federal government.

However, the anticipation that German state governments will be bailed out of financial troubles by the federal government may have changed with the start of EMU, as the German federal government is now subject to the strictures of the fiscal rules in EMU and the scrutiny of the European Commission and the European Council, and its own ability to deal with fiscal crises is weaker than before monetary union. In light of this, we check whether a risk premium on German state debt has emerged since the beginning of EMU.

Another significant feature of Germany's federal system is that states share their tax revenues through a system of fiscal equalization among themselves and with the federal government. Under the current design of the system, some states systematically receive equalization payments while others always pay transfers.[7] This suggests that states which are permanent recipients of funds under fiscal equalization suffer from persistent structural weaknesses limiting their tax capacities. Such states can hardly be expected to raise additional taxes in a fiscal crisis, leaving the central government with no alternative but to bail them out. In contrast, state governments which are permanent net contributors have stronger tax capacities and may count less on bail-outs in financial crises, as the federal government can expect them to solve their problems by raising additional taxes revenues. As Rodden (2007) shows, the state governments themselves behave in ways consistent with this expectation. More specifically, permanent net contributors to the equalization system typically cut expenditures sharply in response to negative revenue shocks, while permanent net recipients do not. In light of this, we test whether or not the risk premiums paid by German state governments depend on their position in the fiscal equalization system.

To pursue this last argument further, we also consider the risk premiums paid by Canadian provinces. Fiscal equalization is a feature of Canadian federalism, too. Its purpose is to guarantee provinces the financial means required to provide "reasonable comparable levels of public services at reasonably comparable levels of taxation" (Subsection 36(2) of the Constitution Act of 1982). Like in Germany, there are provinces that consistently receive equalization grants and others that do not. This allows us to test whether their risk premiums depend on their typical position in the Canadian equalization scheme.

The remainder of this paper is organized as follows. In Section 2, we develop our empirical approach for estimating risk premiums. In Section 3, we present the data and estimation approach. In Section 4, we report the empirical results. Section 5 concludes.

2. Risk premiums in government bond yields

Consider a risk-averse investor choosing between two securities issued by two different governments, the "domestic" and the "foreign" government for simplicity, in the same currency. The investor's rate of return on a security depends positively on the expected yield and negatively on the expected transaction cost the investor incurs, if, because of unforeseen circumstances, he has to sell the security before it matures. We assume that the expected transactions cost is proportional to the value of the security and a declining function of the liquidity of the security in the market. Taking the security issued by the foreign government as the benchmark in the market, we normalize the transactions costs related to it to zero.

We assume that the domestic security is subject to (partial) default risk, while the foreign asset is considered risk-free. More specifically, the domestic government will be unable to fully serve its obligations with a positive probability of $1-P(x_t)$, $0 \leq P(x_t) \leq 1$. Here, x_t indicates a set of variables affecting this probability. In the case of partial 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. Standard portfolio theory implies that the optimal amount invested in the domestic security depends positively on the yield on the domestic security, and negatively on the foreign yield, the domestic government's default probability, a liquidity premium, and the investor's risk premium. Furthermore, as Bernoth et al. (2006) show, for a given supply of securities in the market, the equilibrium yield spread of the domestic over the foreign security depends positively on the domestic government's default probability, the liquidity premium on the domestic security, the investor's degree of risk aversion, and the variance of the government's stochastic default process.

These considerations lead to the following reduced form equation for the yield spread, which will be the basis for our empirical analysis:

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

The left-hand side variable is the yield differential between the domestic and the foreign security. The first term on the right-hand side reflects the yield premium over the benchmark due to the partial default risk. Given the expected repayment in the case of default, $(1-\tau_t/(1+r_t))$, it increases with the probability of default, $(1-P(x_t))$. The second term reflects the liquidity premium. The third term stems from the investor's risk aversion and depends on the variance of the return on the domestic security.

In order to derive an equation that can be estimated empirically, we need empirical proxies of the variables on the right hand side. The main hypothesis of interest in this paper is that the yield differential can be explained by indicators of fiscal performance relating to a government's probability of default. Following the literature, we use two variables for this purpose, the ratio of government debt to GDP and the ratio of the government budget surplus to GDP.[8] They are measured as differences relative to the benchmark country. We expect that both affect the yield differential positively.

To approximate the liquidity premium, we cannot follow the conventional approach of using bid-ask spreads as a measure of trading costs in securities markets (Fleming, 2003), since our yields are yields at issue and bid-ask spreads do not exist on the first day of trading. Gravelle (1999) shows that the correlation between bid-ask spreads and the total supply of debt is significantly

[7] Note that, since the creation of the current equalization system in the 1950s, no state has changed from being a net contributor to being a net recipient, while only two states, Hesse and Bavaria, have switched positions from net recipients to net contributors.

[8] Bernoth et al. (2006) also use the ratio of government debt service to GDP as a fiscal indicator. This, however, is not available for all sample governments.

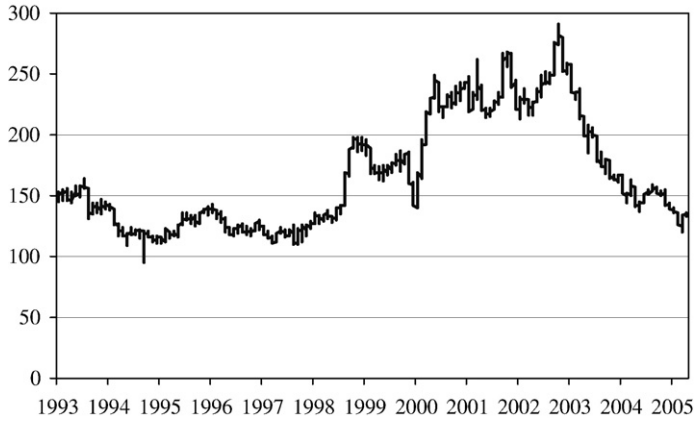

Fig. 1. Yield spread between US low grade corporate bonds and US government bonds.

negative. This suggests that the size of the market for a given security has a positive effect on its liquidity. Bernoth et al. (2006) use the ratio of the total debt of the issuer country denominated in the currency under consideration as a proxy for market size. Since these data are not available for all sub-national governments under consideration in this study, we use the size of a debt issue as a proxy for its liquidity. In addition, liquidity effects may be captured by the inclusion of dummies reflecting whether the issuer is a central or a regional government.

The impact of general *investors' risk aversion* on yield spreads between countries suggested by Eq. (1) is supported by empirical observations. Dungey et al. (2000) show strong evidence of a common international factor in many yield differentials. Copeland and Jones (2001) note 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. Similarly, 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 greater 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 follow Codogno et al. (2003), Favero and Giavazzi (2004), and Bernoth et al. (2006) and use the yield spread between low grade US corporate bonds (BBB) and benchmark US government bonds as an empirical proxy for global risk aversion.[9] Fig. 1 illustrates the development of this proxy between 1993 and 2005. We observe that the yield spread hovered around 130 percentage points during the early years of the 90s. With the burst of the asset price bubble in 1999, and again in 2000, the spread increased sharply, illustrating the markets' increasing scepticism and risk aversion in that period. After peaking in November 2002, the yield spread decreased continuously and reached its level of the early 1990s again in March 2005.

General risk aversion may also be affected by the general level of yields offered in other financial markets. The financial market literature suggests that, if long-term rates are generally low compared to short-term rates, investors ask for lower risk premiums as they are eager to find investment opportunities offering attractive spreads over short-term interest rates. This suggests including a short-term interest rate or the spread between a long-term and a short-term interest rate in the relevant currency market as additional proxies for investors' risk aversion.

Furthermore, we include the time to maturity of the bonds at the time of issue as additional control related to the investors' risk premium, since our sample contains issues of different maturities. It controls for the possibility that investors receive a compensation for investing in long-term bonds instead of buying short-term bonds and rolling them over. This yields the following model:

$$\frac{r_{it} - r_{jt}}{1 + r_{it}} = \beta_0 + \beta_1' z_{it} + \gamma s_t + \varepsilon_{ijt}. \tag{2}$$

In Eq. (2), β_0 and γ are scalar parameters and β_1 is a vector of parameters. r_{it} is the yield at issue of a security issued by government i at time t and r_{jt} the yield at issue of a security issued by the benchmark government j at the same time. z_{it} is a vector containing the fiscal indicators, our measure of issue size, the short-term interest rate, and the years to maturity. The variable s_t is the corporate spread from Fig. 1. Finally, ε_{ijt} is a stochastic error term.

In this paper, we are particularly interested in the yield spreads on sub-national government debt. There are a number of reasons why sub-national governments may pay risk premiums in excess of those paid by central governments. First, their tax capacity is typically smaller than that of central governments, as central governments usually own the revenues from the most important taxes, such as income taxes and VAT. Even if sub-national governments own (shares) of these taxes, they may, as in Germany, be restricted in their authority to change tax rates and, therefore, in their ability to react to revenue and spending shocks. Second, sub-national governments face a much more mobile tax base for most taxes except real estate taxes, which further restricts

[9] A variable that measures the respective corporate bond spread for the complete euro area 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 and Cline, 1997; Kamin and von Kleist, 1999; Eichengreen and Mody, 2000). Therefore, data on US corporate-government bond yield spreads can be used as a good proxy for the overall investors' risk attitude.

Table 1
Bond issues selected by issuer government and by currency.

	USD	DM/EUR	Can $	Total
EU central governments	69/84	47/63	3/17	119/164
Spanish regions	6/2	2/2	–	8/4
German states	0/2	33/134	0/1	33/137
Canadian provinces	–	–	42/48	42/48
Total	75/88	82/199	45/66	202/353

Note: The first entry is the number of issues until December 1998, the second entry the number of issues after 1 January 1999.

their ability to raise additional revenues in case of fiscal crises. Third, central governments can, in principle, use monetary policy to inflate away excessive debts issued in domestic currency. While this does not hold for debt issued in foreign currency, it still reduces the likelihood of default on foreign currency debt. These considerations suggest that sub-national governments should pay larger risk premiums than central governments.

At the same time, there may also be risk-alleviating effects in favour of sub-central governments. The first is an (explicit or implicit) commitment of the central government to bail out sub-national governments in fiscal crises. If such a commitment exists, a sub-national government should pay the same risk premium as its central government. In addition, Germany and Canada have explicit mechanisms of fiscal equalization, i.e., arrangements for sharing tax revenues among the states or provinces. Such arrangements provide some insurance against state or province-specific shocks. Since, in these two countries, there are some states which always receive transfers through these systems and others which always pay in, one may expect that the risk-alleviating function is particularly important for those which are always net recipients.

In view of these considerations, we include in Eq. (2) a set of dummy variables SUB_k, for sub-central governments, where $SUB_{k,i}=1$, if government i is a sub-central government in country k, and zero otherwise; see Eq. (3). We use these dummy variables as additional intercepts and interactively with the other determinants of the yield spreads. The coefficient φ_0 indicates the average extra premium charged on sub-central government debt, while the coefficients φ_1 on the interactive term indicate any differences in the reaction of the yield spread of sub-national governments to changes in the relevant right-hand-side variable compared to the reaction of the yield spread of central governments. The total reaction of the yield spread of sub-national governments is the sum of the coefficients on the right-hand-side variable and the interactive term.

$$\frac{r_{it}-r_{jt}}{1+r_{it}}=\beta_0+\beta_1' z_{it}+\gamma s_t+\sum_k SUB_k\left[\varphi_0+\varphi_1'\left(z_{kjt}\right)\right]+\varepsilon_{ijt}. \tag{3}$$

At the start of EMU in 1999, all public debt of the EMU member states that had previously been issued in national currencies or the currency of another EMU member state (DM) was converted into euros. This had two major implications in the context of this study. First, this debt was denominated in a currency the issue of which was not controlled by the individual member governments. From this perspective, euro-denominated central government debt has the same properties as debt issued in national currency by a sub-national government. National governments can no longer use national monetary policies to inflate away excessive debts.[10] This should increase the credit risk of central governments in EMU. However, euro-denominated debt is different from foreign-currency debt in that the government of a EMU member state receives its tax revenues in euros, i.e., the same currency its obligations are denominated in. In national currency systems, fiscal crises typically come with large devaluations of the domestic currency. This implies that it is even harder for a government hit by a crises to serve its foreign-currency obligations, which adds to the risk of default. Since this adverse exchange rate effect vanishes in EMU, the risk-premium on euro-denominated debt may also be lower than the premium on foreign-currency debt before EMU. Finally, financial markets may well perceive that governments of EMU member states faced with fiscal crises would receive financial assistance from other EMU member states or the ECB, as a default of a member state government might damage the euro-area financial system and the international reputation of the common currency.[11] Such a perception would also tend to reduce the risk premium on government debt.

The second implication of the conversion of all public debt into euros concerns the liquidity of securities markets, as a common currency increases the substitutability of government bonds of different countries and, hence, market size. This should lead to a decline in liquidity premiums. This is consistent with the evidence for interest rate convergence in the market for public debt in the euro area, see, e.g., Pagano and von Thadden (2004).

In sum, the effects of EMU on the yield spreads on government bonds are ambiguous and deserve empirical analysis.[12] To investigate them, we augment our model as follows:

$$\frac{r_{it}-r_{jt}}{1+r_{it}}=\beta_0+\beta_1' z_{it}+\gamma s_t+\sum_k SUB_k\left[\varphi_0+\varphi_1'\left(z_{kjt}\right)\right]+EMU(\delta_0+\delta_1' z_{it})+\varepsilon_{ijt}. \tag{4}$$

[10] Even prior to EMU, this option did not exist for foreign-currency debt, either. Nevertheless, governments could have used surprise inflation to reduce the burden of debt issued in national currencies in order to improve their abilities to service their foreign debt. Thus, the introduction of the euro may have consequences for foreign-currency issues as well.

[11] While the Treaty on European Union explicitly rules out bail-outs of excessively indebted governments, it is not clear whether this rule should be interpreted as an outright ban on any financial assistance.

[12] Note that the anticipation of EMU may have affected yield spreads in years prior to EMU. If so, our specification tends to underestimate the true effects. Due to the nature of our data, however, we cannot estimate a dynamic model incorporating expectations effects.

Table 2
Summary statistics of interest spreads and budgetary variables per issuing government country/region.

		Regions			Central governments	Total sample
		Germany	Canada	Spain		
Interest spread	Min.	1.3	10.0	18.0	0.0	0.0
	Avg.	22.6	38.2	63.1	35.6	32.7
	Max.	92.0	131.0	123.0	132.0	132.0
Fiscal balance ratio	Min.	−4.9	−5.8	−1.1	−10.8	−10.8
	Avg.	−0.0	0.2	1.8	−1.5	−0.8
	Max.	2.2	4.3	7.3	6.4	7.3
Debt ratio	Min.	−30.6	−65.9	−46.0	−59.8	−65.9
	Avg.	−4.1	−38.3	−32.2	34.5	9.4
	Max.	31.7	−5.9	−14.5	98.2	98.2

Note: The deficit and debt ratio variables are the differences of the deficit and the debt-to-GDP ratios of the issuer country/region and the benchmark country. The benchmark issuer is the central government of the country in whose currency the bond is issued, i.e., Germany, the US or Canada. A positive number implies that deficit ratios are lower (or surplus ratios higher) than that of the benchmark issuer, respectively that debt ratios are higher than that of the benchmark issuer.

In Eq. (4), EMU is a dummy variable which is one for EMU member states after 1998 and zero otherwise. The coefficient δ_0 indicates the effect of EMU on the level of the yield spread, while the coefficients δ_1 indicate any changes in the slope parameters occurring after 1998. The total effect of the right-hand-side variables on the yield spread is the sum of the coefficients β_1 and δ_1.[13]

3. Data and estimation

We analyse the spreads of DM, euro, and USD-denominated bonds issued by the central governments of 13 European countries and by sub-central governments of Germany and Spain, and the spreads of Canadian-dollar denominated bonds issued by Canadian provinces. The sample period runs from 1991 to the beginning of 2005. The data are provided by Capital Data Bondware, now part of Dealogic Group.[14] As documented in Bernoth et al. (2006), the majority of foreign-currency bond issues by EU governments prior to 1999 were in either DM or USD. After the beginning of EMU in 1999, we use euro-denominated instead of DM-denominated issues. For DM and euro denominated bonds, the spreads are calculated relative to the yield on German federal government bonds, which continue to be the benchmark bond in the euro bond market. We use US treasury bonds and Canadian central government bonds respectively as the benchmark bonds in the other two markets.[15] We select all issues for which Capital Data Bondware reports an appropriate benchmark yield. The yield spread is measured in basis points and is based on the difference in the yield to maturity at the time of issue between the bond under consideration and a benchmark bond with the same maturity and coupon payment structure.[16] We rely entirely on Capital Data Bondware to identify the appropriate benchmark security. This implies that our sample does not include all foreign currency (and euro) issues by the sample governments during the period under consideration. It assures, however, that we do not introduce mistakes by trying to identify benchmarks ourselves.

The number of bond issues under consideration, sorted by issuing party and by currency of issuance, is reported in Table 1. We have a total of 555 foreign currency issues with an appropriate benchmark bond. Of these, 163 issues are in USD, 281 in DM or euros, and 111 in Canadian dollars. For each currency, about half of the issues are from the time before the start of EMU. There are 283 central government bonds and 272 sub-national government issues. Among the 13 EU central governments, Austria issued the most foreign-currency denominated bonds during the period under consideration (57), followed by Denmark (42), Sweden (41) and Italy (40). Only the governments of France and Luxembourg did not issue foreign currency bonds during that period.

Turning to sub-national governments, most issues are by German states. Among them, North Rhine–Westphalia (24) tops the list in Germany, followed by Saxony–Anhalt (21) and the city of Berlin (20). In Spain, most issues are by the region of Andalucia (5). In Canada, finally, Ontario is the main provincial issuer (29), followed by British Columbia (16) and Quebec (8). We could not use foreign currency issues of other sub-national governments in the EU since appropriate data for the fiscal indicators do not exist.

Data on the budgetary variables come from various sources. Central government variables include the budget balance-to-GDP and debt-to-GDP ratios as provided by Eurostat (fiscal balance) and the OECD (debt). Data on budget balances and debt in German states are taken from the German Statistical Office. Budgetary data on Canadian provinces, following national definitions, are taken from the Canadian Department of Finance. As to the debt measure for Canadian provinces, we used outstanding bonds as an (imperfect) measure of their total gross debt as well as total liabilities, which is conceptually more similar to the gross debt data

[13] Canzoneri et al. (2002) argue that is it important to condition on the stance of monetary policy when estimating the effects of fiscal policy on interest rates, as monetary policy might react to fiscal policy. Our use of yield spreads on foreign currency issues makes this point less relevant, as it seems much less likely that the central bank of the currency of issue would react to the fiscal policy of a different country. The ECB has often stated that it does not react to the fiscal policies of individual EMU member states. In view of this, we do not include a measure of the monetary policy stance in the model.

[14] The precise starting and final year of the data differs per country/region depending on availability of budgetary data.

[15] Using German federal government bonds as the benchmark against which spreads are calculated does not imply that we assume that these bonds are risk free. For a given spread, an increase in the riskiness of German federal government bonds as perceived by the market would increase the yield on these bonds and, for given spreads, the yields of all other DM denominated bonds with them. Similar reasoning applies to the US and Canadian treasury bonds. Note, also, that spreads can in principle be negative for bonds which are perceived less risky than the benchmark.

[16] Capital Data Bondware defines equivalence as meaning that the benchmark bond is similar to the government bond under consideration with respect to the time of issuance, the coupon payment structure, the underlying currency, and the time to maturity.

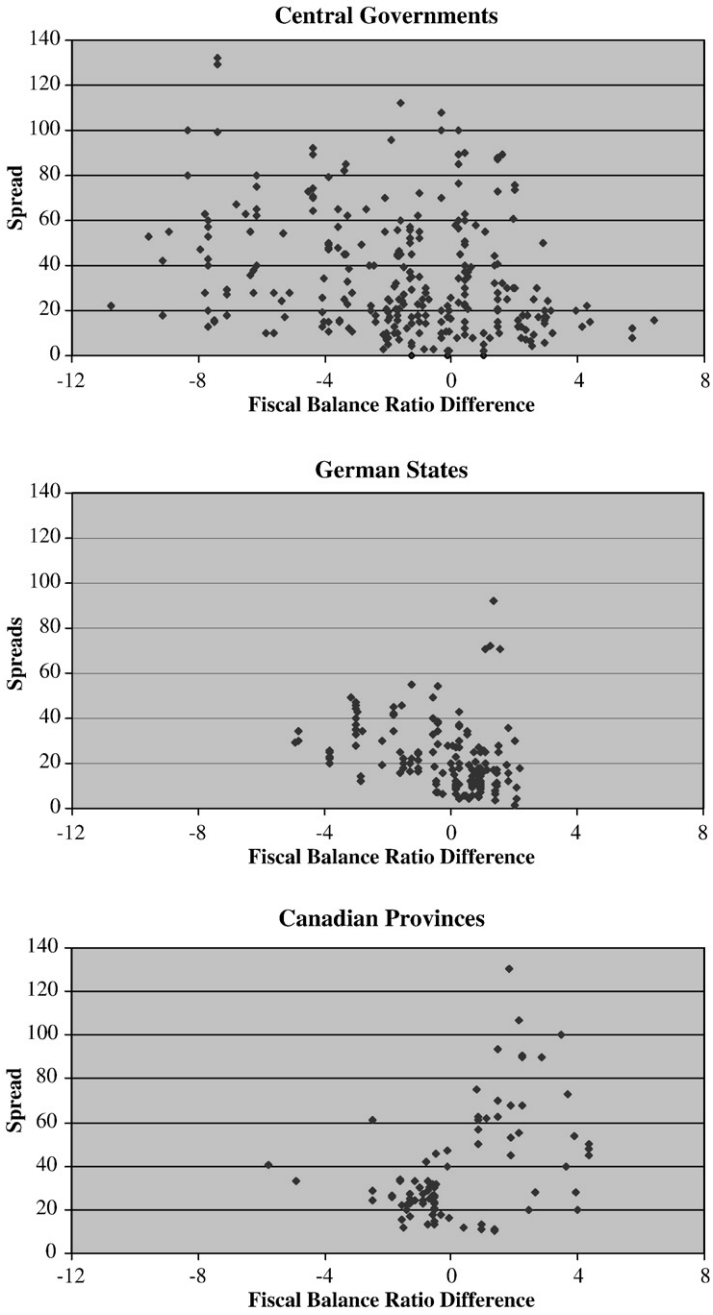

Fig. 2. Yield spreads and fiscal balances.

used for the European governments. Budgetary data on Spanish regions are from the Banco de España and the Spanish National Statistical Institute. Note that the regional statistics may be based on somewhat different definitions of the deficit and public debt than for central government (see Appendix A for further details on the data and their sources).

Table 2 provides some summary statistics. Yield spreads range between zero and 132 basis points for central governments and average about 36 basis points. Minimum spreads are slightly higher for sub-national governments. Average spreads are larger for sub-national governments than for national governments in Canada and Spain, but not in Germany. Fig. 2 shows the yield spreads on bonds issued by the sub-national governments in Germany and Canada, and by the 13 EU central governments, plotted against their fiscal balance ratio differences. The figure indicates that the fiscal balance ratios of sub-national governments are more or less symmetrically distributed around those of the benchmark countries. In contrast, central government fiscal balances are more often less favourable than those of the central governments of the benchmark countries as witnessed by negative values on the x-axis.

Table 3
Regression results for DM (Euro) and USD issues.

Explanatory variable	(A)	(B)	(C)	(D)
Public debt	0.26***	0.27***	0.28***	0.28***
p-value	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal balance	−3.80***	−3.83***	−3.36***	−3.44***
p-value	(0.00)	(0.00)	(0.00)	(0.00)
Time to maturity	0.92***	0.89***	1.05***	1.11***
p-value	(0.00)	(0.00)	(0.00)	(0.00)
BBB spread	−0.03			
p-value	(0.72)			
Short-rate	0.84			
p-value	(0.56)			
Size	−0.001			
p-value	(0.32)			
BBB spread*US	0.25***	0.21***	0.23***	0.23***
p-value	(0.00)	(0.00)	(0.00)	(0.00)
Short-rate*US	−2.07	−2.44**	−2.80***	−2.72***
p-value	(0.32)	(0.01)	(0.00)	(0.00)
Constant	8.55	3.57	0.06*	−0.50***
p-value	(0.56)	(0.48)	(0.98)	(.85)
USD-dummy	−8.84			
p-value	(0.55)			
EMU Effects				
EMU-dummy	−0.76	−1.47	−0.44	−0.50
p-value	(0.88)	(0.76)	(0.91)	(0.90)
Public debt*EMU	−0.21*	−0.24**	−0.26***	−0.26***
p-value	(0.06)	(0.02)	(0.00)	(0.00)
Fiscal balance*EMU	2.22**	2.02**	1.59**	1.59**
p-value	(0.03)	(0.03)	(0.04)	(0.04)
German States				
Constant			25.88***	25.92***
p-value			(0.00)	(0.00)
Constant*EMU			−19.68**	−19.53**
p-value			(0.00)	(0.00)
Fiscal balance			4.29***	4.42***
p-value			(0.00)	(0.00)
Fiscal balance*EMU			−4.20**	−4.29***
p-value			(0.01)	(0.00)
Spanish Regions				
Constant			70.85***	66.99***
p-value			(0.00)	(0.00)
Constant*EMU			−29.16**	−35.24**
p-value			(0.03)	(0.00)
Fiscal balance			−2.04	
p-value			(0.39)	
Fiscal balance*EMU			−5.79	
p-value			(0.34)	
NOBS	263	263	444	444
R^2 adjusted	0.63	0.62	0.67	0.67

Explanatory variable	(E)	(F)
Public debt	0.28***	0.27***
p-value	(0.00)	(0.00)
Fiscal balance	−3.44***	−3.22***
p-value	(0.00)	(0.00)
Time to Maturity	1.11***	1.09***
p-value	(0.00)	(0.00)
BBB spread*US	0.23***	0.23***
p-value	(0.00)	(0.00)
Short-rate*US	−2.72***	−2.71***
p-value	(0.00)	(0.00)
Constant	−0.35	−0.78
p-value	(0.93)	(0.86)
EMU Effects		
EMU-dummy		−0.48
p-value		(0.90)
Public debt*EMU	−0.26***	−0.25***
p-value	(0.00)	(0.00)
Fiscal balance*EMU	1.59**	1.36*
p-value	(0.04)	(0.07)

Table 3 (*continued*)

Explanatory variable	(E)	(F)
German States		
Net Contributors		
Constant	26.99***	32.88***
p-value	(0.00)	(0.00)
Constant*EMU	−19.41**	−25.71**
p-value	(0.01)	(0.00)
Fiscal balance	3.46*	
p-value	(0.08)	
Fiscal balance*EMU	−4.53	
p-value	(0.12)	
Net Recipients		
Constant	26.90***	26.04***
p-value	(0.00)	(0.00)
Constant*EMU	−20.58***	−19.49**
p-value	(0.00)	(0.00)
Fiscal balance	4.99***	4.59***
p-value	(0.00)	(0.00)
Fiscal balance*EMU	−4.72**	−4.19**
p-value	(0.01)	(0.02)
Spanish Regions		
Constant	66.72***	64.84***
p-value	(0.00)	(0.00)
Constant*EMU	−34.87***	−32.64**
p-value	(0.00)	(0.00)
		v
	444	444
	0.67	0.67

Note: Stars (*, **, and ***) indicate significance of the coefficients on 10, 5 and 1% significance levels. *p*-value indicates the significance level of rejecting the Null that a coefficient is zero.

Another noteworthy difference is that, with few exceptions, spreads of German states are below 60 basis points, while for Canadian provinces and EU central governments yield spreads are often larger. Finally, the data show some correlation between the spread and the fiscal balances for central governments but, at first sight, less obviously so for Canadian and German regions.

Pre-testing estimates of Eq. (4) for DM/euro, USD, and Canadian dollar issues separately show that we can pool the data for the first two markets, as the slope coefficients from these estimates were not significantly different. This is similar to the results in Bernoth et al. (2006). In contrast, we have to estimate the model for yield differentials in the Can$ market separately. In the model for Can$ issues, we drop the EMU related terms. We use OLS for the estimation and include time fixed effects to capture the impact of common trends, business cycles and other unobserved factors.[17]

4. Empirical results

Table 3 reports our empirical results for DM/Euro and USD issues. Column A uses data only for EU central governments. It shows that yield spreads over the benchmark bonds depend significantly and positively on the ratio of central government debt to GDP and the central government budget balance over GDP. A central government with a debt ratio exceeding Germany's ratio by 10% pays 2.6 basis points more on its debt than the benchmark government. A government running a budget deficit exceeding the benchmark government's deficit by 1% of GDP pays about 4 basis points more on its debt than the benchmark government. Both coefficients are strongly statistically significant, indicating that markets do consider governments' fiscal performance when pricing their bonds. While the implied risk premiums may seem economically small, one has to keep in mind that the coefficients reflect the impact of the debt and the budget balance ratios on the perceived likelihood of default *and* the expected repayment in case of partial default, and that the latter could still be relatively large; see Eq. (1).

Since the size of the individual issue did not appear significantly in the regressions, we do not report the coefficients on this variable. Thus, we cannot account for liquidity premiums explicitly. Table 3 also shows that adding a year to the maturity of a bond relative to the benchmark raises the yield spread by almost one basis point. We find significant effects of international risk aversion as reflected by the corporate spread variable only in the USD-denominated market. This is consistent with a similar finding in Bernoth et al. (2006). Similarly, we find that the monetary policy stance in the benchmark country as reflected in the short-term interest rate has a significant effect only in the USD-denominated market. Neither the constant nor the dummy for USD-denominated issues are statistically significant.

The table shows that the coefficient on the EMU-dummy is negative, pointing to a small, general reduction in yield spreads compared to the DM-denominated market, but it is not statistically significant. However, the slope parameters for central

[17] The time-fixed effects run from 1992 to 2003. We do not include country fixed effects as this would eliminate much of the variation in fiscal data.

Table 4
Hypothesis tests.

Model	B	C	D	E	F
Hypothesis					
No reaction to public debt in EMU	0.70	0.72	0.76	0.72	0.70
No reaction to fiscal balance in EMU	0.02	0.005	0.001	0.001	0.001
German States no reaction to fiscal balance before EMU		0.32	0.29	0.19	0.25
No discrimination in favour of German states in EMU		0.93	0.90	0.84	0.75
Pre-EMU constant equal for all German states					0.20
EMU constant equal for all German states					0.082
EMU effect equal for German states and Spanish regions					0.52

Note: Entries in this table show the significance levels at which the relevant hypothesis is rejected.

government debt and the budget balance change significantly with the start of EMU. This is indicated by the coefficients on the terms interacting the EMU dummy with the fiscal variables. The effect of the debt ratio on the yield spreads almost disappears with the introduction of the euro. The effect of the general government balance on the yield spreads becomes significantly smaller. As noted above, this may be due to the more favourable risk profile of euro-denominated debt compared to foreign currency debt and does not necessarily reflect bail-out expectations in EMU.

Column B in Table 3 repeats the same estimate dropping the insignificant terms involving the corporate spread, the short-term interest rate, and the dummy for USD-denominated issues. The results are unchanged. A Wald test of the hypothesis that the sum of the slope coefficients on the government debt ratio is zero is not rejected. We report this and the following tests in Table 4. Accordingly, the effect of the debt ratio on risk premiums disappears in the euro-denominated market. In contrast, a Wald test of the hypothesis that the sum of the coefficients on the central government balance is zero is rejected, see Table 4. Assuming that the expected repayment rate, τ, in case of partial default is the same before and after the beginning of EMU, this suggests that markets price fiscal risk less than before the start of EMU, but still in a statistically significant way. An EU government running a deficit of 1% in excess of Germany's deficit saves roughly 2 basis points in the interest payment on its debt since the start of EMU.

In column C, we report the estimate of the same model adding Spanish and German sub-national government bonds to the sample. German state governments paid a fixed premium of about 26 basis points over the benchmark bond, while Spanish provincial governments paid a much larger fixed premium of over 70 basis points. The interaction of the sub-national government dummies with the EMU dummy shows that these fixed premiums fell significantly after the introduction of the euro. This may reflect primarily the fact that, in the much greater euro-denominated debt market, liquidity is larger than in the DM-denominated market.

For the German states, the slope coefficient on the budget balance is significantly larger than for the central governments, but this effect is eliminated after the introduction of the euro, as indicated by the term interacted with the EMU dummy. For Spanish regions, the slope coefficients on the budget balance are not statistically significant.

Column D reports the results of estimating the same model as in C, but dropping the extra fiscal balance terms for the Spanish regions. The results in the upper part of Table 3 remain unchanged compared to column B, indicating that adding the sub-national government bonds does not change the previously discussed results concerning maturity, global risk aversion, and the stance of monetary policy in the USD-denominated market.

Table 4 indicates that the parameter tests regarding the debt and fiscal balance ratios of central governments remain unchanged. This table also shows that the sum of the coefficients on the balance ratio and the balance ratio interacted with the dummy for German state is not statistically different from zero. Furthermore, the sum of the slope coefficients on budget balances for German states with and without EMU is not statistically different from zero. Taken together, these results indicate, first, that German states had a privileged position in the debt market before the start of EMU, in that they paid no premium related to any differences between their fiscal balances at all. Markets seem to have paid no attention to the soundness of their fiscal positions. This is consistent with the hypothesis that markets expected state governments to be bailed out by the Federal government in the case of a fiscal crisis. Furthermore, our results indicate that this expectation vanished after the introduction of the euro. As the German Federal government is now restricted in its ability to issue debt due to the fiscal framework of EMU, markets may perceive that bailouts have become unlikely.

Next, we ask whether a state's position in Germany's fiscal equalization system affects the markets' bailout expectations. Specifically, we ask whether states that are consistently net recipients of the Federal equalisation system are treated differently compared to those that are consistently net contributors. For this purpose, consider columns E and F in Table 3, where we differentiate between net contributors and net recipients. The table shows that, for net contributing states, the slope coefficient on the budget balance is only weakly significantly positive before the start of EMU and not significantly different from zero thereafter. For net recipient states, in contrast, both slope coefficients are highly significant and the pattern detected in column C is confirmed. We conclude that the special treatment before the start of EMU was indeed reserved for states which were net recipients.

To see how much a government's fiscal performance contributes to the spreads actually observed, we calculate the fiscal risk premiums implied by the model in column F for four small EMU member states in 2005, a year in which the cyclical stance of the EMU economy was approximately neutral and during which Germany was in breach of the Stability and Growth Pact. We consider two high-debt countries, Greece and Portugal, and two countries with good fiscal performance, Austria and Finland. Greece paid a spread of 13 basis points on a bond issued April 13. According to our estimates, 9.3 basis points or 72% of the spread were due to its fiscal performance relative to Germany. Portugal paid 11 basis points over Germany on a bond issued November 8, 7.8 basis points

Table 5
Results for Canadian provinces.

	A	B	C	D	E	F
Public debt	0.46***	0.32***	−0.40	0.14	0.09	0.09
p-value	(0.00)	(0.00)	(0.20)	(0.22)	(0.20)	(0.24)
Fiscal balance	−4.34	−4.36***	−8.95***	−6.43***	−6.39***	−6.46***
p-value	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Small recipient provinces						
Constant			37.87**	16.96***	17.29***	17.32***
p-value			(0.01)	(0.00)	(0.00)	(0.00)
Public debt			0.26			
p-value			(0.54)			
Fiscal balance			7.96***			5.24***
p-value			(0.00)			(0.00)
Intermediate recipient provinces						
Constant			24.31			
p-value			(0.16)			
Public debt			0.35			
p-value			(0.46)			
Fiscal balance			7.15			
p-value			(0.11)			
All recipient provinces						
Fiscal balance			7.14	5.53***	5.50***	
p-value			(0.11)	(0.00)	(0.00)	
Time to maturity	0.38	0.35	0.18	0.16	0.15	0.16
p-value	(0.33)	(0.38)	(0.53)	(0.62)	(0.64)	(0.64)
BBB spread	0.12	0.10	0.12*	0.15**	0.14**	0.12*
p-value	(0.15)	(0.22)	(0.10)	(0.04)	(0.05)	(0.10)
Quebec			−2.46			
p-value			(0.73)			
C		47.81***	21.85	47.06***	40.71***	45.11***
p-value		(0.00)	(0.29)	(0.0.00)	(0.00)	(0.00)
Debt measure	Securities	Liabilities	Securities	Securities	Liabilities	Liabilities
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
NOBS	90	90	90	90	90	90
R^2 adjusted	0.76	0.75	0.85	0.83	0.83	0.82

Stars (*, **, and ***) indicate significance of the coefficients at 10, 5 and 1 significance levels.

or 71% of the spread were due to its fiscal performance relative to Germany. Finland and Austria paid 6.5 and 8 basis points respectively on bonds issued on May 18 and April 27. Since Finland had deficit and debt ratios smaller than Germany's, our estimates indicate that its spread was lowered by 4.7 basis points or 72%, thus rewarding its good fiscal performance. In the Austrian case, fiscal performance added merely 0.07 basis points to the spread, a result which is due to the fact that the deficit of Austria's central government was smaller than Germany's. These results suggest that our estimated risk premiums go in the right direction and can be substantial relative to the spreads observed in the European bond market.

To investigate the effects of fiscal equalization on risk premiums further, we now turn to the other large federation in our sample with an explicit equalization scheme, Canada. Table 5 reports the results for Canadian provinces. Lacking Canadian data for provincial gross debt that are comparable to those for European (sub-national) governments, we use two alternative definitions of government debt for the Canadian federal and provincial governments, namely total securities outstanding (columns A, C, and D) and total gross liabilities (columns B, E, and F). The latter includes non-securitized debt such as bank loans. Columns A and B use debt and deficits relative to the federal government as explanatory variables together with the corporate spread and the time to maturity. The positive and significant coefficients on the debt ratio suggest that Canadian provinces pay a risk premium of approximately 0.30 basis points for every percentage point their debt ratios increase relative to the federal government's debt ratio. The significant and negative coefficients on the balance ratio indicate that the risk premium also responds positively to an increase in the deficit relative to the federal government. As in the European case, the risk premium responds significantly to changes in investors' risk aversion as reflected in the corporate bond spread. Finally, premiums increase with longer maturities, but the effect is not statistically significant. These results are broadly consistent with Booth et al. (2007).[18] Using total gross liabilities as the debt variable yields similar results and a slightly higher R-squared.

Canadian fiscal equalization is characterized by the fact that the three largest provinces, Alberta, British Columbia, and Ontario, never receive equalization grants, while the others, Manitoba, New Foundland, Nova Scotia, Prince Edward Island, Quebec, and Saskatchewan, always do (see Table A1). During the 1990s, equalization grants on average amounted to about 14% of the receiving provinces' own revenues, but to 49% for New Foundland.[19] Among the receiving provinces, there is a group of

[18] Note that Booth et al. (2007) use a less precise measure of interest rate spreads, namely spreads computed from average yields on government bonds outstanding.
[19] Standing Senate Committee on National Finance (2002).

Table 6
Average public debt and fiscal balance ratios in Canada by size.

Dependent variable	Public debt ratio	Fiscal balance ratio
Small recipient provinces	71.82***	0.49
p-value	(0.00)	(0.33)
Medium-sized recipient provinces	63.88***	0.29
p-value	(0.00)	(0.40)
Large provinces	36.77***	0.05
p-value	(0.00)	(0.87)
R^2	0.63	0.00

Note: Public debt measure is total gross liabilities. Stars (*, **, and ***) indicate significance at the 10, 5 and 1% significance levels.

small ones consisting of New Foundland, Prince Edward Island, and Nova Scotia, and a group of medium-sized ones, i.e., Manitoba, Quebec, and Saskatchewan. To see how the position in fiscal equalization affects the risk premium, column C adds intercept and interactive slope dummies for these two groups of receiving provinces. A first result from this is that the coefficient on the debt ratio loses statistical significance. It even obtains a negative sign when we use total debt outstanding as the measure of indebtedness. This suggests a strong correlation between the dummy for small and medium-sized recipient provinces and the debt ratio. In fact, a regression of the debt ratio on a constant and a dummy each for the two groups shows a strongly significant, positive relationship, see Table 6. The coefficients in this regression give the average debt ratios for these three groups in the sample, i.e., small and medium-sized recipient provinces and large, non-recipient provinces. The left panel of the table shows that small provinces have the largest debt ratios, followed by medium-sized provinces and large provinces. The right panel of the table shows that a similar statistically significant correlation between provincial size and the fiscal balance ratios does not exist.

While the debt ratio thus loses significance, the intercept dummy for small recipient provinces is positive and significant, showing that these provinces pay higher risk premiums than large provinces in Canada. The intercept dummy for the medium-sized recipient provinces is not significant. We interpret the intercept dummy for the small provinces as a liquidity premium on the debt issued by small provinces, since it is not related to fiscal performance. The interactive dummies for small and medium-sized provinces on the debt ratio are not statistically significant. In contrast, the interactive slope dummies on the fiscal balance ratios are positive for both groups of recipient provinces and highly statistically significant for the small recipient provinces. The coefficient for the medium-sized provinces is only marginally significant. Furthermore, they are of similar magnitude and of similar absolute value compared to the slope coefficient on the fiscal balance which now measures the effect of the fiscal balances on the risk premium paid by large provinces. A Chi-square test shows that the Null hypothesis that this slope coefficient and each coefficients of the interactive dummies on the fiscal balance sum to zero cannot be rejected. Thus, small and medium-sized provinces receiving equalization grants do not pay a risk premium on their debt related to their fiscal performance relative to the Canadian government. Column C also shows that a dummy variable for Quebec, included to reflect financial markets' assessment of a pursuit for more autonomy, is not statistically significant. Hence, we drop it together with the interactive dummy on the debt ratio as we move from column C to column D. Column D also restricts the interactive dummy on the fiscal balance to be the same for small and medium-sized recipient provinces. Column E uses gross liabilities as the measure of debt. There results are again very similar. Finally, in column E we restrict the slope coefficient on the fiscal balance to be the same for large and for medium-sized recipient provinces. The drop in the adjusted R-square shows that this results in a loss of explanatory power for the same number of parameters, leaving us with columns C and D as the preferred versions of the regressions.

In sum, the empirical results indicate that provinces which are expected to receive transfers under fiscal equalization are not punished by financial markets for incurring larger deficits. This result closely resembles our findings for German states prior to EMU. It indicates that fiscal institutions such as equalization have significant financial market effects generating financial benefits for the recipient sub-central governments.

5. Conclusions

This paper extends recent empirical work on sovereign risk premiums in European bond markets to sub-national governments in Germany, Spain, and Canada. We find that yield spreads over appropriate benchmark bonds depend significantly on indicators of fiscal performance. This is consistent with the notion of sovereign risk premiums for (partial) defaults. We find such risk premiums both before and after the start of EMU, although their nature and magnitude has changed somewhat. In the context of a monetary union such as EMU, this form of market discipline complements the institutional provisions of the Stability and Growth Pact and thus reinforces the framework aiming at safeguarding sustainable public finances.

German states enjoyed a particularly favourable position in the financial markets before EMU. Based on the investors' anticipation that the federal government would bail out financially troubled states, they did not pay risk premiums related to their fiscal deficits. The evidence suggests that this benefit accrued especially to states that usually receive transfers under the German fiscal equalization scheme. However, this special status has disappeared with EMU. Thus, monetary union has increased the market pressure for fiscal discipline on German states. We also consider the risk premium paid by Spanish provinces and find that they did

not receive a similar, favourable treatment as German states before the start of EMU. Since then, markets treat them similarly to German states. These findings are also interesting from the perspective of fiscal institutions: The evidence presented in this paper supports the notion of credibility of the no-bailout clause in the EU Treaty while the bail out expectation for German states appears to have lost perceived importance.

Pursuing our investigation into the effects of fiscal equalization on risk premiums paid by lower-level governments, we estimate similar models for Canadian provinces. Here, too, we find that the position of a provincial government in the fiscal equalization scheme makes a significant difference. Large Canadian provinces, which never receive equalization grants, are generally penalised for running large budget deficits. However, markets do not penalize provinces that consistently receive transfers under the Canadian fiscal equalization system for running large deficits. This suggests that markets expect the Canadian government to provide financial assistance to the governments of these provinces should a financial crisis occur, a result which is similar to our findings for German states before the start of EMU. The fact that large provinces have significantly lower debt levels than provinces receiving equalization grants provides prima-facie evidence that fiscal discipline as imposed by financial markets can be effective. Our results for Germany and Canada suggest that, beyond their principal function of reducing inequalities within a federation, fiscal equalization schemes affect the credit risk of sub-central governments and, therefore, allow recipient states to borrow at more favourable terms than others.

Acknowledgments

The views expressed in this paper are those of the authors and do not necessarily reflect those of the European Central Bank. The authors wish to thank G. Schwab (ECB) for excellent data research and K. Heppke-Falk (Bundesbank) for providing German budgetary statistics.

Appendix A. List of variables and their sources

Bond size = issue size of the bond issued, in mln euro. Source: Capital DATA Bondware.

Corporate spread (BBB spread) = difference between 7–10 year BBB-rated US corporate bonds (BBB) and 7–10 year US benchmark government. Source: Merrill Lynch.

Debt:

Canadian provinces: gross direct government debt (excluding guarantees). Source: Bank of Canada, Banking and Financial Statistics, K8 tables: Gross amount of bonds outstanding and total outstanding liabilities. Source: Statistics Canada, Balance sheet of federal, provincial and territorial general and local governments, tables 385-0014.

EU Central governments: OECD, Central Government Debt, statistical yearbook, 1980–2005.

German states: Credit market debt plus loans for cash-flow improvement. Not inclusive of hospitals with commercial accounting. Source: Federal Statistical Office Germany. 2005 data are provisional.

Spanish provinces: Banco d'España.

Deficit:

Canadian region: Public account of Provincial and Territorial governments, department of finance, Canada (fiscal reference table no. 5). Fiscal year numbers have been allocated to the calendar year in which the largest part of the fiscal year falls (e.g. 2004/2005 is allocated to 2004).

EU Central governments: Eurostat, net lending of central governments.

German states: Deficit on an ESA-basis. Source: Federal Statistical Office Germany.

Spanish provinces: Banco d'España

Short-term interest rate:

Canada: 1 month Canada treasury bill rates. Source: Datastream.

US: 3 month US$ Libor rate. Source: Reuters.

DM/euro: 3 month FIBOR, replaced on 1 January 1999 by the 3 month EURIBOR rate. Source: Datastream.

Spread = difference in the yield to maturity at the time of issue between the national/regional bond and an equivalent government bond issued in the same currency by the government of the issue-currency. Source: Capital DATA Bondware.

Time to Maturity = time until planned maturity of the bond. Source: Capital DATA Bondware.

References

Afonso, A., Strauch, R., 2007. Fiscal policy events and interest rate swap spreads: evidence from the EU. Journal of International Financial Markets, Institutions & Money 17 (3), 261–276.

Afonso, A., Gomes, P., Rother, P., 2007. What "Hides" Behind Sovereign Debt Ratings? European Central Bank, Frankfurt. Working Paper Series, 171.

Alesina, A., De Broeck, M., Prati, A., Tabellini, G., 1992. Default risk on government debt in OECD countries. Economic Policy 15, 427–451.

Balassone, F., Franco, D., Giordano, R., 2004. Market-induced fiscal discipline: Is there a fall-back solution for rule failure? In: Banca D'Italia (ed.), Public Debt, Banca d'Italia, Rome, pp. 389–426.

Table A1
List of government issuers included in our sample.

EU central governments	Germany	Net transfer position	Spain	Canada	Size	Net transfer position
Austria	Baden–Württemberg	C	País Vasco	Newfoundland and Labrador	S	R
Belgium	Bayern	C	Madrid	Prince Edward Island	S	R
Denmark	Brandenburg		Galicia	Nova Scotia	S	R
Finland	Hessen	C	Catalunya	New Brunswick	S	R
France	Mecklenburg–Vorpommern	R	Castilla–La Mancha	Quebec	M	C
Greece	Niedersachsen	R	Cdad Valenciana	Ontario	L	C
Ireland	Nordrhein–Westfalen	C	Andalucía	Manitoba	M	C
Italy	Rheinland–Pfalz	R		Saskatchewan	M	C
Netherlands	Sachsen	R		Alberta	L	C
Portugal	Sachsen–Anhalt	R		British Columbia	L	C
Spain	Schleswig–Holstein	R				
Sweden	Thüringen	R				
United Kingdom	Berlin	R				
	Bremen	R				
	Hamburg	C				

L = large, M = medium, S = small. R = net recipient, C = net contributor.

Barnes, K., Cline, W., 1997. Spreads and Risks in Emerging Market Lending. Institute of International Finance. Working Paper 97-1.
Bayoumi, T.A., Goldstein, M., Woglom, G., 1995. Do credit markets discipline sovereign borrowers? Evidence from US states. Journal of Money, Credit, and Banking 27, 1046–1059.
Bernoth, K., Hagen, J.V., Schuknecht, L., 2006. Sovereign Risk Premiums in the European Government Bond Market. SFB/TR 15 Discussion Paper 150.
Booth, L., Georgopoulos, G., Hejazi, W., 2007. What drives provincial-Canada yield spreads? Canadian Journal of Economics 40, 1008–1032.
Canzoneri, M., Cumby, R., Diba, B., 2002. Should the European Central Bank and the Federal Reserve be concerned about fiscal policy? Proceedings of a Conference on Rethinking Stabilization Policy. Federal Reserve Bank of Kansas City, Jackson Hole.
Codogno, L., Favero, C., Missale, A., 2003. Yield spreads on EMU government bonds. Economic Policy 18, 503–532.
Copeland, L., Jones, S.-A., 2001. Default probabilities of European sovereign debt: market-based estimates. Applied Economic Letters 8, 321–324.
Dungey, M., Martin, V.L., Pagan, A.P., 2000. A multivariate latent factor decomposition of international bond yield spreads. Journal of Applied Econometrics 15, 697–715.
Eichengreen, B., Mody, A., 2000. What explains changing spreads on emerging market debt? In: Edwards, S. (Ed.), Capital Flows and the Emerging Economies: Theory, Evidence, and Controversies. University of Chicago Press, Chicago, pp. 107–134.
Faini, R., 2004. Fiscal policy and interest rates in Europe. In: Banca D'Italia (ed.), Public Debt, Banca d'Italia, Rome, pp. 481–512.
Favero, C.A., Giavazzi, 2004. Inflation Targeting and Debt: Lessons from Brazil. NBER, Cambridge, Massachusetts. Working Paper 10390.
Favero, C.A., Pagano, M., von Thadden, E.L., 2005. Valuation, Liquidity and Risk in Government Bond Markets. Innocenzo Gasparini Institute for Economic Research, Milan. Working Paper 281.
Fleming, M.J., 2003. Measuring treasury market liquidity. Economic Policy Review, vol. 9. Federal Reserve Bank of New York, pp. 83–108.
Gómez-Puig, M., 2006. Size matters for liquidity: evidence from EMU sovereign yield spreads. Economic Letters 90, 156–162.
Goldstein, M., Woglom, G., 1992. Market based fiscal discipline in monetary unions: evidence from the US municipal bond market. In: Canzoneri, M., Grilli, V., Masson, P. (Eds.), Establishing a Central Bank. Cambridge University Press, pp. 226–260.
Gravelle, T., 1999. Liquidity of the Government of Canada Securities Market: Stylized Facts and some Market Microstructure Comparisons to the United States Treasury Market. Bank of Canada, Ottawa. Working Paper 99–11.
Heppke-Falk, K., Hüfner, F., 2004. Expected Budget Deficits and Interest Rate Swap Spreads – Evidence for France, Germany and Italy. Deutsche Bundesbank, Frankfurt. Discussion Paper 40.
Heppke-Falk, K., Wolff, G.B., 2007. Moral Hazard and Bail-Out in Fiscal Federations: Evidence for the German Länder. Deutsche Bundesbank, Frankfurt. Discussion Paper 7.
Kamin, S.B., von Kleist, K., 1999. The Evolution and Determinants of Emerging Market Credit Spreads in the 1990s'. Board of Governors of the Federal Reserve System, Washington. International Finance Discussion Paper 653.
Lemmen, J., 1999. Managing Government Default Risk in Federal States. Financial Markets Group, Nijmegen, Netherlands. Special Paper 116.
Lemmen, J., Goodhart, C., 1999. Credit risks and European government bond markets: a panel data econometric analysis. Eastern Economic Journal 25, 77–107.
Lonning, I.M., 2000. Default premia on European government debt. Weltwirtschaftliches Archiv 136, 259–283.
Manganelli, S., Wolswijk, G., 2007. Market Discipline, Financial Integration and Fiscal Rules: what Drives Spreads in the Euro Area Government Bond Market? European Central Bank, Frankfurt. Working Paper 745.
Pagano, M., von Thadden, E.-L., 2004. The European bond markets under EMU. Oxford Review of Economic Policy 20 (4), 531–554.
Poterba, J., Rueben, K., 1999. State fiscal institutions and the U.S. municipal bond market. In: Poterba, J., von Hagen, J. (Eds.), Fiscal Institutions and Fiscal Performance. University of Chicago Press, Chicago.
Rodden, J.A., 2007. And the Last Shall Be First: Federalism and Soft Budget Constraints in Germany. Mimeo, Stanford University, Stanford.
Standing Senate Committee on National Finance, 2002. The Effectiveness of and Possible Improvements to the Present Policy of Equalization, 14th Report, March, Ottawa. http://www.parl.gc.ca/37/1/parlbus/commbus/senate/com-E/FINA-E/rep-e/rep14mar02-e.htm.