

The German Sub-national Government Bond Market: Structure, Determinants of Yield Spreads and Berlin's Forgone Bail-out

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Summary

The paper presents a new and comprehensive data set of all bonds issued by the sixteen German federal states (Länder) since 1992. It thus provides a complete picture of a capital market comparable in size to the combined corporate bond and commercial paper market in Germany. The quantitative analysis reveals that Länder follow different issuing strategies: while some concentrate to a greater extent on large issues or issue joint bonds with other Länder (Jumbos), others rely more on comparatively small but frequent issues. Moreover, some Länder issue a significant volume-share of their bonds in foreign currencies. Suitable bonds are used to compute time series of yields for the respective Länder at a daily frequency as well as a liquidity measure. Based on the unique data set, we document that spreads of Länder yields to the Bund are driven to a great extent by general risk aversion. Public debt only has an economically marginal impact. Moreover, the recent refusal of the Federal Constitutional Court to grant additional federal funds to the city-state of Berlin did not change the risk assessment of German Länder by financial markets. Recent market turbulences have manifestly contributed to widening spreads as well as increased responsiveness of Länder spreads to international measures of risk aversion.

1 Introduction

Imposing fiscal discipline on governments, on the local, as well as the regional and the federal level, is in the focus of international policy makers and academics (Ter-Minasian 1997). A frequently discussed reform option consists of increasing fiscal discipline through capital markets. Several studies support the notion that for US states and cities capital markets increase risk premia in response to deterioration of fiscal fundamentals (Capeci 1991, 1994, Alesina et al. 1992, Bayoumi et al. 1995). Similarly, studies show the existence of risk premia reactions to fiscal policy in Europe (Copeland/Jones 2001,

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Codogno et al. 2003, Bernoth et al. 2004, Hallerberg/Wolff 2008, Bernoth/Wolff 2008). While the question of capital market discipline is thus a hotly discussed topic, the German sub-national government bond market has received virtually no attention so far from empirical researchers. To our knowledge, only three studies investigate the German sub-national bond market, all from a public finance angle. Heppke-Falk and Wolff (2008) and Lemmen (1999) rely on single bond issues respectively on on-the-run bonds. Similarly, Schuknecht, von Hagen, and Wolswijk (2008) use single bond issues to investigate government spreads of EMU central governments as well as spreads of Canadian, German and Spanish sub-national government issues. The studies find an economically weak (and in some cases statistically insignificant) effect of measures of indebtedness on risk premia. A potential reason for this paucity of studies of the German sub-national government bond market is the lack of data. We fill this gap by providing and discussing a comprehensive data set of both, bond volume issued and yields for each state (Land). Moreover, we document that fiscal determinants have economically only a small effect on the spread to federal paper (Bund). Arguably, the most important reason for this phenomenon is the existence of a practical bail-out guarantee.

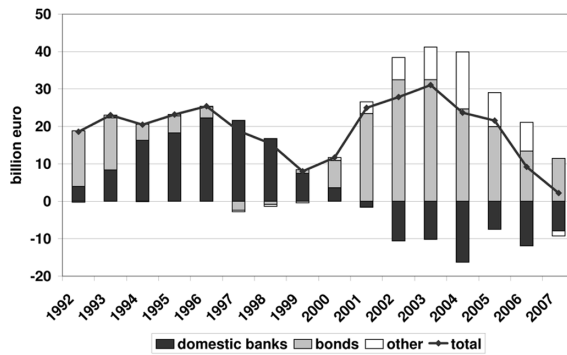
Traditionally, German states (Länder) borrow mainly from banks. These in turn refinance the granted loans by issuing Pfandbriefe (covered bonds).¹ Seeking finance for the German unification, Länder also turned to the capital market in the early 1990s. In the period from 1997 to 2000, which was characterized by a fiscal consolidation process, Länder reduced their net borrowing and relied predominately on bank loans (Figure 1a). Noticeably from the late 1990s on, Länder have substituted bank debt with bonds. Direct bond issues became more attractive for Länder as capital markets deepened.²

Overall, issuance activity by the Länder since 1992 has been slightly higher than in the German corporate bond market (including commercial paper, Figure 1b). The share of Länder bonds in net issues (gross issues minus redemptions) in the German bond market increased from a meager average of 3 % in the period of 1992–1999 to 16 % thereafter. The German sub-national sovereign bond market thus constitutes a significant segment of the German bond market, which has received very little coverage so far.

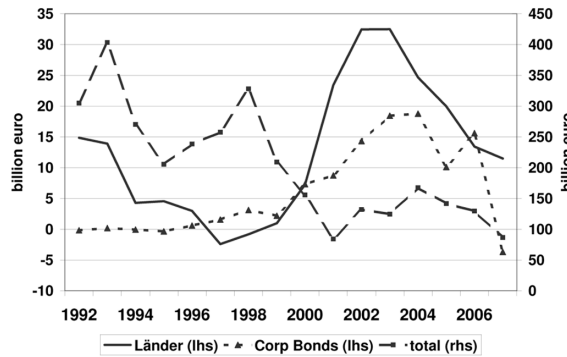
The present paper presents the most comprehensive data set on the German Länder bond market. We compile the full recorded issuance activity of all sixteen Länder on a single bond basis. We document substantial heterogeneity in issuing strategies of the Länder: while some concentrate on large issues or issue joint bonds with other Länder (Jumbos), others rely to a greater extent on comparatively small but frequent issues. Moreover, some Länder issue a significant volume-share of their bonds in foreign currencies. Based on the panel of bonds issued by the Länder, we compute time series of yields at a daily frequency measured as a weighted average of all traded bond yields with similar maturity on a given day for each Land. In addition, we compute a measure of liquidity based on the standard deviation of yields of those bonds used to compute the respective average yield.

¹ The German Pfandbrief market has a special segment for Public Pfandbriefe (Öffentliche Pfandbriefe), i.e., bonds covered by a collateral pool consisting of loans to the country's different regional authorities.

² The yield spread of Öffentliche Pfandbriefe to Länder bonds is regularly positive, indicating a gain of directly approaching capital markets. No direct interest rate statistic for Länder loans is available. But yields of Öffentliche Pfandbriefe are a lower bound for the interest rate for loans granted to Länder, as they determine the refinancing cost of banks.



(a) Länder net borrowing



(b) German bond market

Figure 1 Left panel depicts means of Länder financing, annual net funds raised by all Länder. Right panel shows annual net issues of Länder, corporates (including commercial paper) and total net issues on the German bond-market, 1992–2007

Source: Deutsche Bundesbank, authors' calculations

We apply the newly computed data to investigate financial markets' risk assessment of German Länder. More specifically, we study spread determinants to the Bund and focus in particular on a recent episode, the rejected claim of the city of Berlin for additional funds. Since the rejection was not generally anticipated, one could have expected risk premia to jump on this day not only for Berlin, but also for the other Länder, whose prospects for receiving a bail-out abated. The paper thus contributes to recent research on the existence of investor moral hazard in financial markets. Dell'Arricia, Schnabel, and Zettelmeyer (2006) investigate, whether the surprising non-bail-out of Russia by the IMF and the United States Treasury changed risk assessments of *other* emerging markets. In fact, they find, that the rejected bail-out indeed lead to higher risk premia suggesting that before the event significant amounts of moral hazard existed in the international financial markets. To date, no research has investigated the effects of the Berlin ruling on the risk premia of the *other* German states. Heppke-Falk and Wolff (2008)

study the effects of the federal ruling on the states of Bremen and Saarland in 1992. They show that significant investor moral hazard exists in the German sub-national bond market. Moreover, comparing a single bond of Berlin with the Bund, they demonstrated that the risk premium on Berlin did not change around the time of the ruling due to the rejection of funds. However, the ruling could have affected the risk premia of all German states, requiring a full panel analysis.

The remainder of the paper is structured as follows. The next section provides a detailed discussion of the data set and the evolution of the German sub-national sovereign bond market. We then turn to the investigation of the determinants of risk premia in the market with a particular focus on the effects of the Berlin ruling. The last section concludes and gives an outlook of how this new and rich data set can be used for future research.

2 The market

2.1 Quantitative evolution

We evaluate the Bundesbank issuance statistic, which records the German primary bond market, from 1992 to 2007. All in all, German Länder issued 2864 bonds in that period. The number of issues was particularly high in the early 1990s, when Länder increasingly employed the capital market to finance costs related to German unification. In the fol-

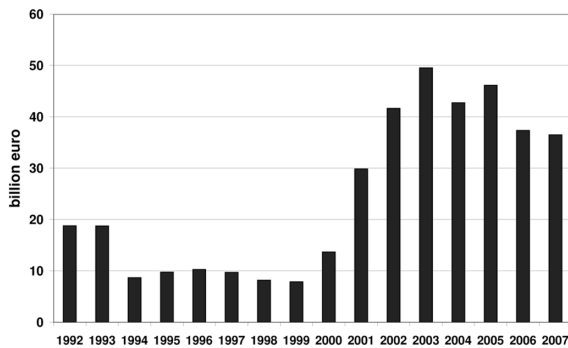


Figure 2 Gross issue volume per year, all Länder

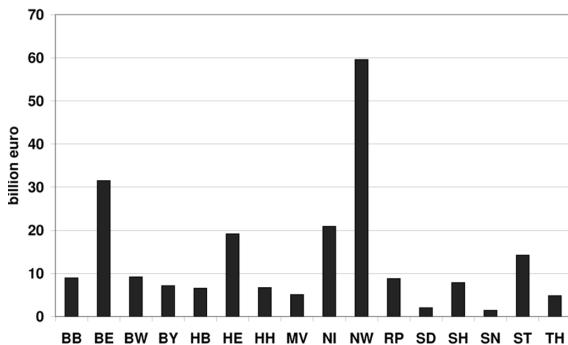
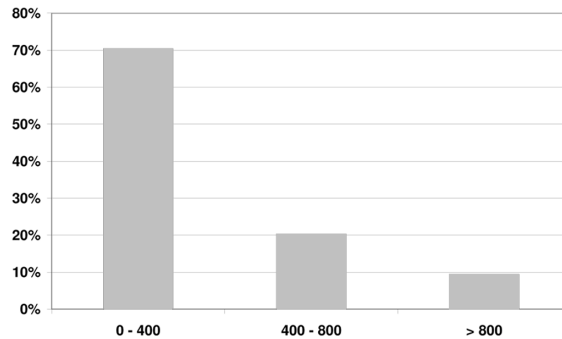
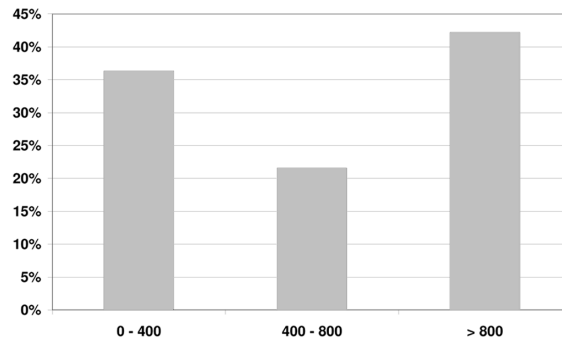


Figure 3 Net issue volume per Land, 1992–2007



(a) 1992-1998



(b) 1992-2007

Figure 4 Volume issued according to bond notional. Share of total volume issued; classes reflect notional of initial issuance in million euro

lowing years issuance activity was moderate, both in numbers of transactions and volume. Bond sales picked up in 2000 and were high during the recession of 2002–2003, slightly ebbing thereafter.

Figure 3 depicts the distribution of net issues across the Länder. Clearly, North Rhine Westphalia is the most active state in the bond market. Apart from Germany’s most populous Land, Berlin stands out with respect to funds raised, which reflects the financial difficulties of the capital. Furthermore, Saxony Anhalt has been the most frequent issuer, again except for North Rhine Westphalia, and has tapped the capital market for 14 billion euro net between 1992 and 2007.

Länder use two main channels to approach the bond market: private placements and public issues. In general, the latter are of substantially higher volume, thus reducing the liquidity premium demanded by investors.³ In contrast, privately placed bonds can be tailored to the needs of Länder treasurers. This dichotomy can also be read

³ The liquidity premium compensates for risk, that an investor is not able to buy or sell a desired volume at the present market price.

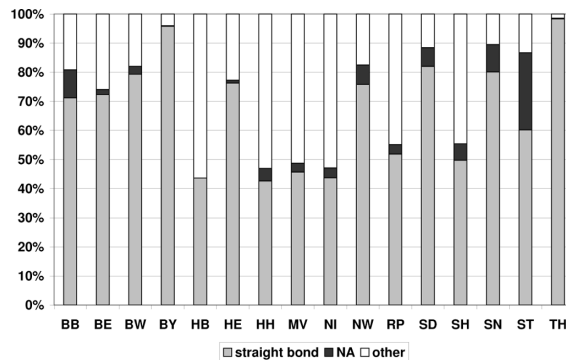


Figure 5 Type per Land, 1992–2007, volume share

Source: Deutsche Bundesbank and Bloomberg. NA indicates bonds not available in Bloomberg

off in the distribution of the issue size. In the period of 1992 to 1998 Länder raised 70 % of funds on the capital market with issues worth up to 400 million euro. Subsequently this share has dropped to 36 % (Figure 4), reflecting an increasing propensity to issue tradable debt. However, most Länder bonds have rather small notional values. Over the full sample, the mean of a Land's bond volume was approximately 120 million euro, while the median was slightly below 30 million euro. The comparatively wealthy states of Baden-Wuerttemberg, Bavaria and Hesse, tend to issue a higher proportion of traded bonds, resulting in higher average issue volumes.⁴ Noteworthy, Lower Saxony has concentrated on a rather small number of transactions, selling on average paper worth 488 million euro per transaction.

The Länder employ a wide variety of features with respect to structuring bonds. We distinguish straight bonds, paying a fixed coupon and having a fixed maturity, from other bonds, e.g., those having embedded call or put options, or variable or contingent interest payments. Straight bonds are the dominant source of funds (Figure 5).⁵ However, noteworthy differences both across states and time can be observed. Lower Saxony has the largest share of bonds with some features, issuing more than half of its volume in that category. All other states use straight bonds for at least half of the capital raised. The share of straight bonds in total volume issued has been increasing since 2003. This is consistent with the increase of the mean issue size, as both hint to a greater use of actually traded bonds.

From 1999 onwards Länder have issued bonds also in foreign currency. Among the six Länder employing this instrument, again North Rhine Westfalia has been the largest issuer in absolute terms, while Saxony Anhalt has raised the highest share of its funds in

⁴ These Länder (and Hamburg) enjoy the highest per capita tax revenues and the lowest per capita rates of debt (besides Saxony). This comparison is somewhat biased as large issues tend to be more suitable for more populated states and some smaller states issue joined paper (see below).

⁵ Next to simple termination options for either issuer or investor, different forms of variable interest rates are used. Some Länder have also issued "exotic" bonds, e.g., paper indexed to commodity prices and an islamic bond. Bonds not available on Bloomberg provide a conservative estimate of private placements, as traded bonds are probably fully covered by that database.

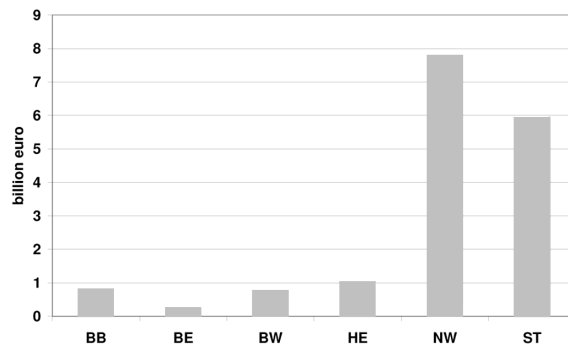


Figure 6 Amount issued in foreign currencies per Land, 1999–2007. Currency conversion on the issue date

foreign currencies among all Länder.⁶ Länder issued bonds in 15 foreign currencies, though a great majority of funds have been borrowed in low interest rate currencies, i.e. the Japanese Yen, the Swiss Franc and to a lesser extent the US-dollar (Figure A1 in the appendix exhibits a breakdown by currency).

A special segment of the Länder bond market are the so called Jumbos. These are bonds issued by a group of Länder. Up to now, 33 Jumbos have been issued by syndicates of five to seven Länder, with the exception of the particularly large Jumbo of 1997 which was shared by ten Länder. So far, all Jumbos have been arranged as straight bonds and the average issue size is slightly higher than one billion euro, more than seven times the size of an average Land issue. Participants of the Jumbo program are mostly states which are either small by size or population (Figures A2 and A3). Jumbos are more liquid than typical Länder bonds, saving the state treasurers part of the liquidity risk premium compared to a rather small single-issuer bond. From the investors point of view, a Jumbo constitutes a structured bond composed of separate claims against the participating Länder according to their share in the joint issue.⁷

2.2 Yields and liquidity

We calculate time series for yields of every Land. We restrict the sample to straight bonds denominated in euro, as these form a homogenous group which is suited best for direct comparison to Bund yields; roughly 1800 bonds remain in the sample.

As the numbers of bonds available is limited especially in the mid 1990s, we group all straight bonds into four different maturity classes: up to four years, four to seven years, seven to eleven years and more than eleven years.⁸ We refrain from computing spot rates,

⁶ For example, Saxony Anhalt issued in 2005 50 % of its debt in other currencies. The hedging of exchange rate risk is regulated by each Land in the budget laws (Haushaltsgesetz), which in principle rule out speculative positions. To the extent of our knowledge, Länder do not take any exchange rate risk, indeed. Given the covered interest rate parity, Länder need to identify frictions in capital markets to reduce borrowing cost relative to euro denominated debt.

⁷ For a more detailed description of the data set, see Schulz and Wolff (2008a).

⁸ The maturity buckets are similar to those of widespread bond indices. We use 11 instead of the more common 10 years as the boundary for class 3 since many bonds are issued with a maturity of slightly above 10 years.

as the market for Länder bonds is rather shallow, compared to central governments' bond markets. The necessary interpolation would rather add additional noise than ameliorate the analysis. Länder issue predominantly bonds with an initial maturity of four to eleven years, whereas both the maturity classes from four to seven and from seven to eleven years account for somewhat less than 40 % of the gross amount issued; longer-running bonds are rather exceptional for the Länder. We obtain yield to maturity for each single bond from Datastream. The yield series of each Land is then calculated as the volume weighted average yield of all bonds in a given maturity class. We eliminate non-traded observations from the calculation of the average yield.⁹ The maturity class of four to seven years turned out to be the most liquid one with the most continuous time series.¹⁰ In the analysis we therefore focus on this maturity class.

Finally, we address the liquidity of Länder bonds. Amihud and Mendelson (1991) demonstrate the liquidity effect in asset pricing, i.e., that two identical cash flows may have different prices, due to market structure or transaction costs. An easily available indicator for liquidity is the amount outstanding of a bonds, which unfortunately provides no information about actual trade. In contrast, the turnover of a bond is a direct measure of trade, but it is hardly on-hand.¹¹ A standard price based measure of liquidity is the yield spread between on-the-run and off-the-run bonds (Warga 1992).¹²

Our comprehensive data set allows us to generalize the simple off-the-run-spread and compute the yield variation between all bonds of a single issuer at one point in time. The law of one price states, that the bonds of one Land outstanding at a point in time (after adjusting for the term spread as we pool bonds into maturity classes) should have identical yields. Assuming the absence of arbitrage opportunities, the remaining yield differences are a sign of differing liquidity. Otherwise, traders would be able to exploit the yield differential thus equalling the yields of the respective bonds.

Our measure is related to Longstaff (2004) as he compares the spread between two bonds with equal credit risk (US Treasuries and bonds of Refco, which enjoys a federal guarantee). We compare the yield dispersion of two or more bonds which have the same credit risk, as the issuer is identical. However, given the infrequent issuance of Länder bonds, we have to correct for different maturities. Hence, the illiquidity measure $L_{i,t}^j$ for bonds of Land i at time t is computed as the standard deviation of the yields of all bonds in each maturity class.

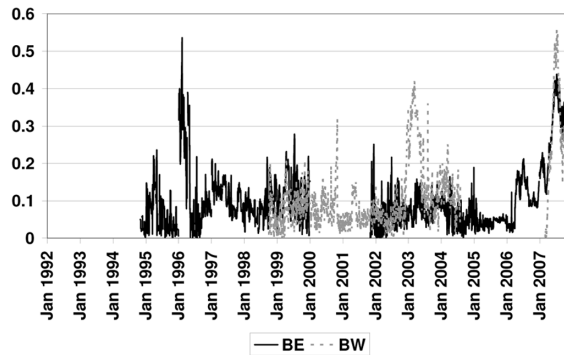
$$L_{i,t} = \text{std}\{r_{i,t}^j\}_{j=1}^n \quad \text{with} \quad r_{i,t}^j = y_{i,t}^j - \left(y_{Bund,t}^{tm(j)} - y_{Bund,t}^l \right), \quad (1)$$

⁹ A bond is deemed non-traded, if its yield does not change for five consecutive days.

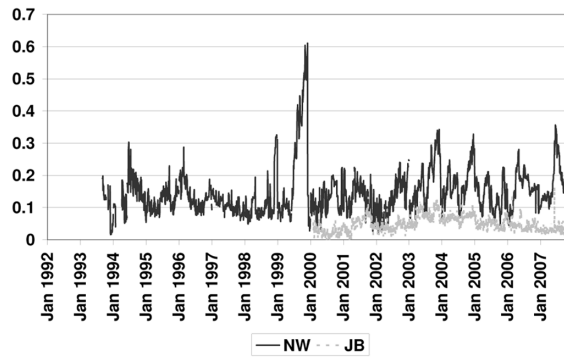
¹⁰ Especially low issuance activity in the mid 1990s hampers the computation of uninterrupted time series. Still, some time series exhibit either breaks or spikes due to changes of the composition of the underlying portfolio (which may be a single bond), pointing at the low trading in secondary markets for many bonds, as discussed later on.

¹¹ Especially, since most bond trading takes place outside exchanges. For example, in 2006 98 % of German Bunds traded over-the-counter or on electronic market places (Deutsche Bundesbank 2007).

¹² The latest issue of a certain series, e.g. the ten year Bund, is referred to as being "on the run". Typically six month later the next new Bund is issued, rendering its predecessor "off the run". Vayanos and Weill (2008) propose an explanation for the on-the-run phenomenon based on search externalities for short sellers in a repo market. Alternative price measures include the bid/ask spread, which is often time-invariant (Deutsche Bundesbank 2006, or the spread between government paper and agencies enjoying an explicit government guarantee (Longstaff 2004).



(a)



(b)

Figure 7 Liquidity measure for bonds of Berlin, Baden-Wuerttemberg, North Rhine Westphalia and Jumbos (4–7 years time to maturity), standard deviation of yields of single bonds

where $y_{i,t}^j$ is the yield of bond j ($j = 1 \dots n$) of Land i at time t . $y_{Bund,t}^{ttm(j)}$ is the rate of the Bund's yield curve with the same time to maturity $ttm(j)$ as bond j . $y_{Bund,t}^l$ denotes the rate of the Bund's yield curve at the lower bound of bond j 's maturity class. For example, this is four years in the four to seven year class. Thus the yield of a bond with remaining time to maturity of six years is corrected by the spread between the four and six year rate of the Bund yield curve.¹³ std is the standard deviation operator.

Figure 7 plots the evolution of the so-computed liquidity measure for selected Länder. Over time, three Land-specific liquidity shocks can easily be identified. While the illiquidity spike for North Rhine Westphalia's bonds in November 1999 is caused by a change in the composition of the calculation portfolio, the spikes for Berlin in February

¹³ A yield curve for German Federal bonds, estimated with the Nelson-Siegel-Svensson approach, is published daily by the Bundesbank at http://www.bundesbank.de/statistik/statistik_zinsen.-php/#zinsstruktur.

1996 and Baden-Wuerttemberg in March 1999 cannot easily be attributed to a single event. Interestingly, we find a common liquidity event at the start of the current financial turmoil in the summer of 2007. Later, bonds of the three Länder depicted tend to become more liquid again, possibly as the result of some safe haven flows. A noteworthy fact is the moderate decrease in liquidity for North Rhine Westphalia's bonds (the largest Land) and the complete absence of an illiquidity spike for Jumbos, indicating the greater depth of the market.

3 Determinants of the Länder risk premia and the impact of the Berlin ruling

In general, Länder bonds trade at a spread to issues of the Bund, which is the reference debtor in the euro area. The spreads of selected Länder are depicted in Figures A4 – A7 in the appendix. The average annual spread of Länder bonds to Bunds over the whole sample is between 8 and 28 basis points, with substantial variations across time and Länder.¹⁴ Spreads to Bunds moderated during the mid to late 1990s and rose thereafter in accordance with low issuance activity. From 2001 until early 2005 Länder spreads were falling, matching the decline in other bond markets' spreads, like corporate bond spreads or emerging market spreads and were accompanied by strong issuance activity. Spreads picked up in 2005 and the rise since summer of 2007 is particularly steep. Regarding the cross section dimension, Hamburg enjoys the lowest average spread while Mecklenburg Western Pomerania has the largest spread in the investigated time period. Finally, jumbo bonds exhibit an average spread of 15 basis points, which is less than those of the individual bonds of the participating Länder.

This raises the question of the determinants of yield spreads in the German fiscal federation. Since, in principle, German states belong to a federation that has not only strong revenue equalization but also witnessed several cases of more or less outright bail-outs, one could assume that Länder bonds should be identically priced to Bunds. However, market participants might fear payment delays in case of fiscal difficulties of a Land. Some rating agencies, therefore assign different ratings to the different Länder. Moreover, since Länder are of different size (and therefore have very heterogenous borrowing needs in absolute terms) and follow different issuing strategies, the liquidity of their bonds differs. This could be a further determinant of spreads to the very liquid Bund. Indeed, the relatively low spreads of Jumbos, which typically have large volumes and are issued jointly by several states, demonstrate the potentially beneficial effect of enhanced liquidity to the cost of borrowing. Finally, if investors consider Bunds as safer and more liquid than Länder bonds, then they might prefer them in times of greater risk aversion leading to an increase in spreads.¹⁵ A recent court ruling could have had a serious impact on Germany's fiscal structure and henceforth the potential to alter the risk assessment of German Länder by financial markets. In 2003, the state of Berlin filed a case at the Federal Constitutional Court (Bundesverfassungsgericht), asking for substantial supplementary federal grants to alleviate its grave budgetary position. The Berlin

¹⁴ The extent of these spreads is consistent with the level of the relative swapspreads of Bund and Länder bonds in the primary market, i.e. the respective difference between the bond's issue yield and the appropriate swap rate. Schuknecht et al. (2008) estimate the spread at equal fiscal conditions to be 25 basis points.

¹⁵ Furthermore, only federal government paper is deliverable for the Bund and Bobl Futures and Bunds are standard instruments in repo transactions, allowing the holder easy access to credit.

claim was based on the notion, that its budget deteriorated as a consequence of the German unification and the special situation of the formerly divided city. According to this reasoning, Berlin had come in difficulties not through fault of its own, but rather by outside factors. Furthermore, Berlin declared, it would not be able to relief the extreme budget hardship, even by extraordinary endeavors. The official hearing occurred on 26 April 2006 and the court finally rejected Berlin's claim on 19 October 2006.¹⁶

In a similar proceeding, the Constitutional Court had acknowledged substantial transfers to the states of Bremen and Saarland between 1992 and 2004 on the basis of the loyalty principle ("Bundestreue") of the German federation.¹⁷ This quasi bail-out was studied by Heppke-Falk and Wolff (2008), who show that financial markets do factor in bail-out likelihood on the basis of an indicator used by the court in 1992, the interest payment to revenue ratio. Berlin's fiscal position in 2003 was comparable to that of Bremen and Saarland in the early 1990s. Berlin claimed that the extreme budgetary hardship was visible in an interest payment to revenue ratio of 20.8 percent which was about twice as high as the Länder average. The outcome of this trial was considered at least open at that time. The prime minister of the Land of Saxony, Georg Milbradt, demanded shortly before the decision that Berlin should be put under the control of a savings commissioner ("Sparkommissar"), if the court granted money to Berlin.¹⁸ Representatives of the rating agencies Fitch and Standard & Poor's argued that the credit rating of Berlin might be changed if the Constitutional Court should decide against a federal bail-out.¹⁹ The Constitutional Court's ruling, which confirmed the legitimacy of ultima ratio supplementary federal grants in general but denied that Berlin suffered (yet) from irreversible extreme budgetary hardship, was therefore to some extent un-expected.

To evaluate the direct effect of the court's ruling on Berlin, we look in a first step at the yield of Berlin's bonds relative to all Länder. Figure 8 depicts the yield spread of Berlin versus the composite of all Länder.²⁰ If the judgement indeed fundamentally changed market perception of default risk, we would expect a subsequent upward jump in the spread of Berlin relative to the average. The central reason for this upward jump is that, while the bail-out probability of all Länder changed, the increase in the risk premia should depend on the fiscal position of the Land. Arguably, Berlin's situation was worse than the average. We therefore expect an upward jump. Indeed, in 2006, Berlin's yields were slightly higher than the composite. However, after the denied bail-out, spreads did not move immediately, but fell gradually until summer 2007. The continuous improvement of Berlin's spreads relative to the average Land might reflect the incoming positive news regarding the fiscal situation of Berlin. Cash statistic data show that the balance of

¹⁶ See decisions of the Federal Constitutional Court (Bundesverfassungsgerichtsentscheidungen), 2 BvF 3/03. For details on the ruling see also Häde (2007).

¹⁷ See decisions of the Federal Constitutional Court (Bundesverfassungsgerichtsentscheidungen), 86, 148.

¹⁸ Cf. *Süddeutsche Zeitung*, "Länder wollen nicht für Berlins Schulden aufkommen", 16 Oct 2006, p. 1. The *Financial Times Deutschland* newspaper summarized that the ruling would be awaited with eagerness ("Belohnung für die Schludrigkeit?", 16 Oct 2006, p.5).

¹⁹ *Frankfurter Allgemeine Zeitung*, "Gute Schuldner, schlechte Schuldner", 18 Oct 2006, p. 16, see Strasser (2007) for a detailed assessment of a rating agency representative. Stadler (2007) also stresses that the capital markets awaited the ruling tensely.

²⁰ The composite is calculated as the daily average of all Länder bonds' yields weighted by outstanding volume (maturity class four to seven years). See section 2.2 for the selection of bonds.

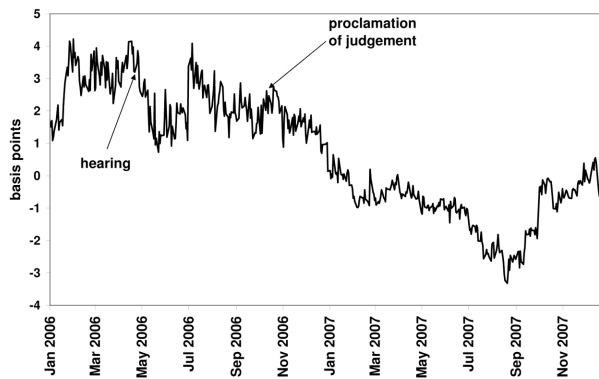


Figure 8 Spread of Berlin's bonds to all Länder's bonds, basis points, 4–7 years maturity, time series for composite Länder yields is volume weighted daily average of all Länder bonds outstanding

current revenue and current expenditure turned positive in 2007, a trend which was confirmed for the first quarter of 2008.²¹ Nevertheless, the tightened requirements for additional federal grants might still affect the Länder, especially those in a relatively difficult fiscal situation.

Figure 9 shows the spread of selected Länder to the Bund. Again, we do not find evidence of a different pricing of Länder bonds due to a different risk perception. However, we do observe widening spreads in the context of financial market turmoil as of summer 2007. In mid June, rumors about considerable losses of two hedge funds spread. Confidence in structured securities sharply declined and led in combination with deteriorating fundamentals to the still ongoing chain of massive write-downs. Amidst severe money market frictions, the major central banks started unprecedented liquidity supplies on August 9–10; in mid September the Federal Reserve began to lower the federal funds target rate. The financial market crisis has led to significant portfolio reallocations towards “safe havens”. Since the liquidity of a bond is a major criterion for an investor searching a temporary sanctuary, the yield of Bunds should fall more than that of Länder bonds, expanding the spread. The observed spread widening thus appears to be linked to the financial turbulence.

While visual inspections seemingly rejects the notion of changed bail-out expectations immediately around the ruling, a more encompassing econometric study might provide more rigorous insights. It is thus worthwhile to test in a panel econometric context, whether the determinants of risk premia have changed due to the denial of additional funds, especially since the 2006 ruling came as a surprise to the general audience after the granted bail-out in 1992. We use our new data set to investigate the determinants of German Länder spreads relative to the Bund more formally. To this end, we perform

²¹ *Source:* German Federal Statistical Office, Fachserie 14. Cash data do not include transfers from the revenue equalization scheme.

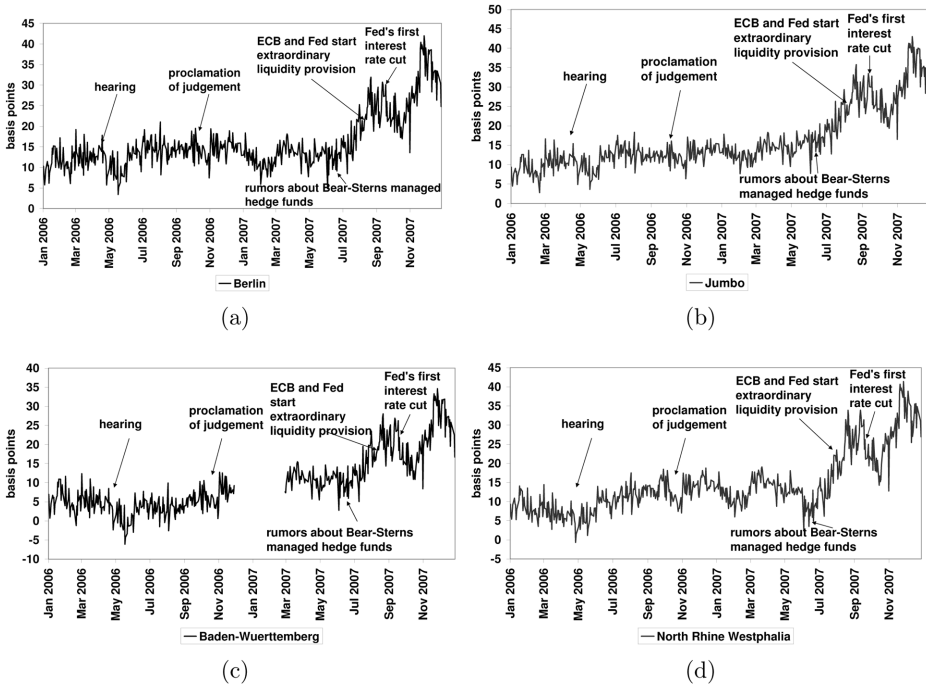


Figure 9 Spread of selected Länder bonds to the Bund, basis points, 4–7 years maturity. Jumbos are joint issued by several Länder

a panel regression analysis, in which the yield spread between a Land i and the Bund is regressed on risk aversion, liquidity and debt per capita.²²

$$\text{spread}_{i,t} = \beta_1 \text{rav}_t + \beta_2 \text{liquidity}_{i,t} + \beta_3 \text{debt}_{i,t} + \beta_4 \text{rulingdummy} + \beta_5 \text{rulingdummy} \times \text{debt}_{i,t} + \beta_6 \text{rulingdummy} \times \text{rav}_t + \beta_6 \text{spread}_{i,t-1} + \mu_i + \varepsilon_{i,t} \quad (2)$$

where t is a daily observation and μ_i is a Land fixed effect.

We compute the spread of a Land's yield and Bunds by the difference of the yields presented in section 2.2 for the Länder and the Bundesbank-calculated yields on bonds outstanding issued by the Bund ("Umlaufrendite"). Global risk aversion, rav , is measured by the spread between BBB rated corporate bonds denominated in US-dollar and US Treasuries, taken from Merrill Lynch (Datastream). Liquidity of each Land's bonds is identified with the measure described in equation (1), i.e., the standard deviation of bond yields at each day for each Land.²³ Alternatively, we gauge liquidity based on quantity. We employ the absolute amount of all bonds outstanding of Land i at each point in

²² We focus on debt per capita in contrast to debt to GDP as the financial strength of a German state depends mostly on the size of the population and only to a lesser extent on GDP, due to the financial equalization scheme.

²³ Yields within the analyzed maturity bracket, corrected for the term spread.

time.²⁴ Furthermore, to assess the impact of fiscal policy, we employ debt per capita of the Land relative to the debt per capita of the Bund in the respective year.²⁵ Information on debt and population is obtained from the German Federal Statistical Office. To see, whether the ruling has changed risk assessment, we create a dummy taking the value of 1 as of 19 October 2006 and interact this dummy with debt per capita as well as with risk aversion. The data cover the period 1999–2007.

Since we use daily data of yield spreads, it is very likely that spreads at time t closely follow the spreads at time $t - 1$. At the same time, spreads of German Länder relative to the Bund are likely to remain in a limited range. Thus, to capture the high degree of autocorrelation, we estimate a dynamic panel data model including the lagged dependent variable as a regressor. As our panel has extremely large T , we do not need to worry about problems typically encountered in panels with macroeconomic size respectively panels with large N and small T such as the Nickell (1981) bias.²⁶ It is therefore suitable to include the lagged dependent variable as a regressor in the fixed effects regression.

The regression results are presented in Table 1. The first important result is given in regression A. Here we find that the US corporate bond spread, the measure of risk aversion in international financial markets, significantly increases spreads. In other words, in times of high risk aversion, spreads are high as well. This suggests that central government bonds serve more as a safe haven than state bonds. A possible explanation for this result is the greater liquidity of the central government bond market, which facilitates the buying and especially selling of bonds. In regression B we add the liquidity control variable of the Länder bonds as constructed in equation (1). This has practically no influence on the spread to the Bund.²⁷ As a second alternative liquidity variable we use, as suggested by Bernoth, von Hagen, and Schuknecht (2004), the outstanding volume of each Land's bonds as a liquidity measure. The results presented in Table A2 of the appendix suggest that greater liquidity is associated with lower spreads, even though the effect is quantitatively small.²⁸ All other findings are robust to that change in the liquidity variable.

In regression C we add debt per capita relative to central government debt per capita as a further explanatory variable of risk premia. We find that increasing debt levels are not connected with higher risk premia, a result in contrast to Heppke-Falk and Wolff (2008), who found a statistically significant but economically weak effect. Heppke-Falk and Wolff (2008) find that an increase of the debt per capita level relative to the Bund by 1000 euros increases the spread by only 4 bp. Schuknecht, von Hagen, and Wolswijk (2008) find that an increase of the relative debt to GDP ratio by 10 percentage points increases the spread by 2.6 bp. The results of the second study do not refer to the German states but to central government debt in EMU and are in line with results of Hallerberg and Wolff (2008). Moreover, Schuknecht, von Hagen, and Wolswijk (2008) document

²⁴ Amount outstanding is taken from the monthly Bundesbank issuance statistic. Hence values remain constant in any given month.

²⁵ Since debt and population data are available on a yearly basis, debt per capita remains constant in any given year.

²⁶ The estimator will be biased of order $1/T$, which can be neglected as the panel is composed of almost nine years of daily observations ($T > 2000$), see e.g. Baltagi (2005: 135).

²⁷ The parameter in B and successive regressions is at the brink of significance only at the 10 % level, using more than 20 000 observations.

²⁸ Note, that issued volume is available on a monthly basis.

Table 1 Determinants of risk premia

	A	B	C	D	E	F	G	H
lagged dependent variable	0.96***	0.96***	0.96***	0.95***	0.95***	0.95***	0.96***	0.96***
559.27	483.46	482.87	479.95	479.74	477.69	479.75	476.63	476.63
0.005***	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***
9.7	8.94	8.88	9.19	9.2	8.92	8.52	8.43	8.43
liquidity	-0.364*	-0.362*	0.354*	0.374*	0.400*	0.352*	0.327*	0.327*
debt per capita	-1.7	-1.69	-1.65	-1.73	-1.85	-1.59	-1.46	-1.46
dummy after ruling		0.0000	0.0001**	0.0001*	0.0001*	0.0001*	0.0001*	0.0001*
dummy after ruling * debt per capita		0.78	2.18	1.74	1.82	1.93	1.93	1.93
dummy after ruling * rav			0.305***	0.366***	-0.508	2.327	2.423	2.423
observations end in			3.49	2.98	-1.27	0.81	0.79	0.79
				0.000	0.000	0.000	0.000	0.000
				0.7	0.73	0.5	0.37	0.37
				0.008**	-0.021	-0.022	-0.022	-0.022
				2.29	-0.75	-0.73	-0.73	-0.73
					May07	Mar07	Mar07	Mar07
N	26435	22381	22381	22381	22381	22381	21346	20914
R ²	0.94	0.93	0.93	0.93	0.93	0.93	0.93	0.93

Notes: Fixed effect regressions. Dependent variable: yield spread measured as spread between yield on bonds of Land *i* and respective Bunds' yield in basis points (excluding Jumbos, $i = 1 \dots 16$). Daily observations, 1999–2007. t-values reported below coefficients. Significance at 10%, 5% and 1% level is indicated by *, **, ***, respectively

that the effect of debt becomes statistically insignificant in EMU, which corresponds to our sample.²⁹ The empirical result thus stands in contrast to the notion that financial markets assess the default risk of Länder basing their judgment on the debt level as an important fiscal indicator. This finding would therefore support the notion that eventually investors believe in a bail-out of Länder in the German fiscal federation.³⁰ The high relevance of the lagged dependent variable and risk aversion in contrast to debt and liquidity could be regarded as a sign that Länder bonds are priced relative to the Bund yield curve, taking only fundamental changes in Länder specific factors into account.

The Constitutional Court's ruling on Berlin directly addressed the system of fiscal federalism in Germany. We therefore add a dummy in regression D, which takes a value of 1 as of the day of the Berlin ruling. The coefficient is significant and indicates that spreads are higher after the ruling than before. Moreover, the coefficient on the debt per capita level becomes strongly significant. This could be taken as evidence that the ruling has changed the market assessment of bail-out probabilities and investors now penalize higher debt levels. However, 2007 has been a year with significant market turbulence. Moreover, a significant coefficient on debt for the entire period does not necessarily mean that the market penalizing of debt has changed due to the ruling. In regression E we therefore interact the debt per capita variable with the dummy for the time after the ruling. The regression results do not show a significant change due to the ruling. However, the overall effect of debt after the ruling on risk premia is still significant.

In regression F we address the concern that the results are driven by increased risk premia in 2007 due to higher risk aversion in the markets unrelated to the ruling. Indeed, we find that the interacted coefficient is clearly significant. This suggests that in the period after the ruling an increase in international risk aversion has been associated with stronger spread reactions. This effect, however, is unrelated to the ruling of the court. Indeed, if we restrict the sample to end in May or March 2007, some time before the beginning of the current financial crisis, no such effect can be found (Regressions G and H). Moreover, the dummy on the ruling turns insignificant suggesting that the previously found positive effect is really capturing the financial market turbulence. However, debt per capita remains a statistically significant determinant of risk premia, even though the quantitative size of the coefficient is economically faint. Thus markets do not adjust yields to

²⁹ See regression B of Table A2 and discussion on page 21. Schuknecht et al. (2008), however, do find a significant effect of the fiscal balance, which is however significantly reduced in EMU. Moreover, the effect for the Länder is statistically not different from central governments in EMU. The overall effect of the budget balance on spreads of German Länder in EMU in their paper is therefore, according to the estimates presented in Table A2 (column C), relatively small at $(-3.36 + 1.59 + 4.29 - 4.2) = -1.68$. Heppke-Falk and Wolff (2008) do not find a significant effect of deficits for German Länder in a sample restricted to the German Länder exclusively. A potential reason for the slightly different results might be the inclusion of country dummies. Our sample covers the observations after 1999 as before issuance activity of Länder bonds was weak making the computation of yield and liquidity series difficult.

³⁰ However, it should also be noted that debt levels change only once a year in the present data set leading to very little variation in the data compared to the daily spreads. Moreover, since we control for autocorrelation and country fixed effects the most important variations of Länder risk are already controlled for. A regression without fixed effects would indeed lead to higher coefficients for the debt variable. However, in such a setting one cannot attribute causality to the fiscal variable. Moreover, even without fixed effects, the resulting effect on spreads is rather limited from an economic point of view as can be seen by the Länder's narrow spread levels despite highly different fiscal fundamentals.

altering fundamentals, which is consistent with the belief in a worst-case bail-out. In other words, investor moral hazard remains an issue in the German sub-national government bond market.

Overall, the econometric exercise has shown that general risk aversion in international financial markets is positively associated with intra-German sovereign spreads, which are persistent. Markets hardly price differences in debt levels. The decision of the Constitutional Court to reject claims of the Land Berlin did not change risk assessments nor spread levels of German Länder. Recent market turbulences have manifestly contributed to widening spreads as well as increased responsiveness to international measures of risk aversion.

4 Conclusions

The present paper presents a comprehensive data set of the German sub-national government bond market since 1992. We document the quantitative evolution of this market, which is comparable in size to the German corporate bond market. We identify different issuing strategies with respect to issue size, currency and structuring. Moreover, we compute yield to maturity time series at a daily frequency for all German Länder and a measure of liquidity of state government bonds.

The new data set is used to establish basic facts of yield spreads in the German federation. Risk premia increase with general risk aversion, the effect is more pronounced in recent episodes of financial markets turbulences. Moreover, high public debt levels relative to the Bund have barely an economic effect on spreads to the Bund. Beyond that, we analyze the impact of the recent Federal Constitutional Court judgement rejecting Berlin's claims for additional financial assistance on risk assessment in the German sub-national bond market. The ruling did not change investors' risk assessments of German Länder. Moral hazard continues to prevail in the German sub-national bond market.

The new data set of daily yields for all German Länder can be used in further studies. The data allow to perform event studies of important changes in the German federation. It could also be used to study effects of regional bond market integration, as done in Schulz and Wolff (2008b). Finally, reforms of the system of fiscal transfers across states and central government could be assessed by studying risk premia in the market. A further interesting analytical topic could be to test for certain models of fiscal decision making with respect to debt management on the basis of the debt management decisions documented.

Appendix

Table A1 Abbreviations of Länder names

code	English	Deutsch
BB	Brandenburg	Brandenburg
BE	Berlin	Berlin
BW	Baden-Wuerttemberg	Baden-Württemberg
BY	Bavaria	Bayern
HB	Bremen	Hansestadt Bremen
HE	Hesse	Hessen
HH	Hamburg	Hansestadt Hamburg
MV	MecklenburgWestern Pomerania	Mecklenburg-Vorpommern
NI	Lower Saxony	Niedersachsen
NW	North Rhine Westphalia	Nordrhein-Westfalen
RP	Rhineland-Palatinate	Rheinland-Pfalz
SD	Saarland	Saarland
SH	Schleswig-Holstein	Schleswig-Holstein
SN	Saxony	Sachsen
ST	Saxony-Anhalt	Sachsen-Anhalt
TH	Thuringia	Thüringen

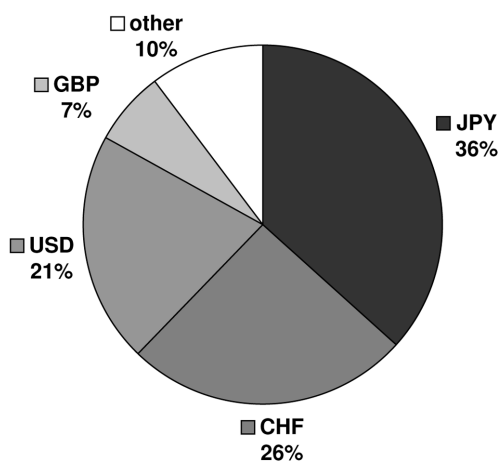


Figure A1 Issue currencies. Others include AUD, CAD, CZK, HKD, HUF, ISK, MXN, NOK, PLN, TRY, ZAR

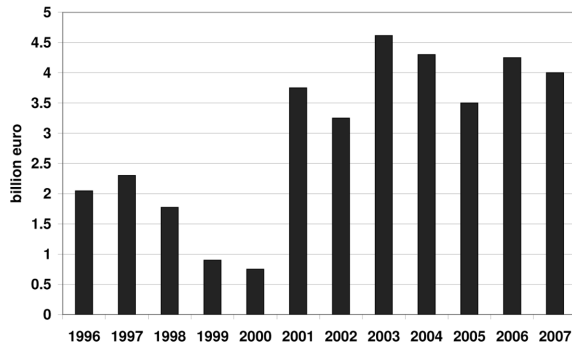


Figure A2 Issues of Länder Jumbos per year, volume

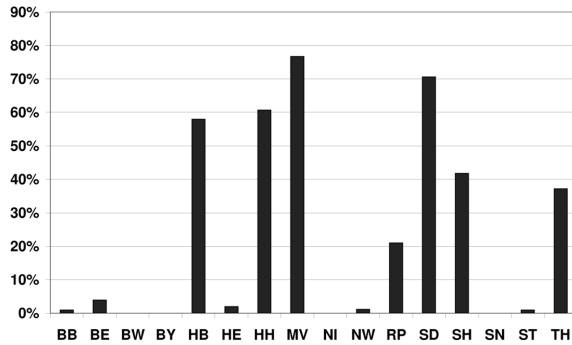


Figure A3 Share of Jumbos in total gross issues per Land, 1996–2007. Jumbos are issued as of 1996

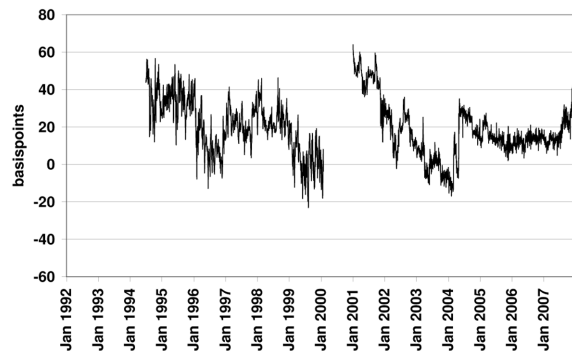


Figure A4 Yieldspread Berlin vs. Bund, maturity class 4–7 years, Bund yield measured by the yield on bonds outstanding (“Umlaufrendite”)

Source: Deutsche Bundesbank, own calculations

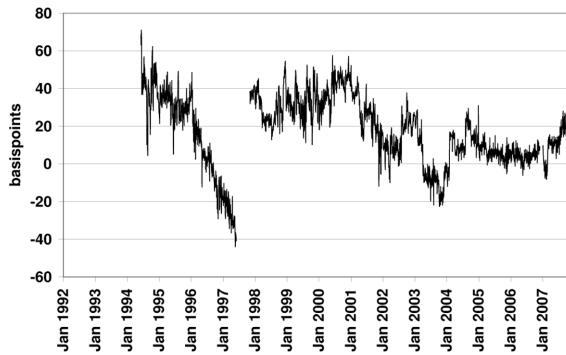


Figure A5 Yieldspread Baden-Wuerttemberg vs. Bund, maturity class 4–7 years, Bund yield measured by the yield on bonds outstanding (“Umlaufrendite”)

Source: Deutsche Bundesbank, own calculations

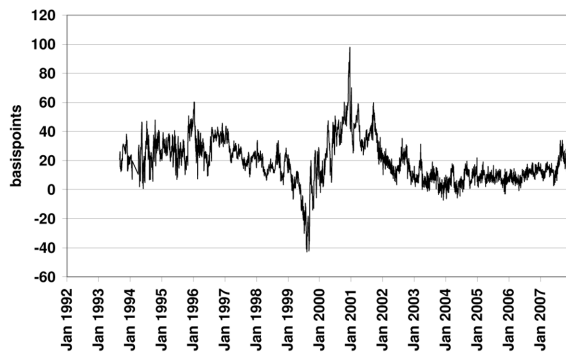


Figure A6 Yieldspread North Rhine Westphalia vs. Bund, maturity class 4–7 years, Bund yield measured by the yield on bonds outstanding (“Umlaufrendite”)

Source: Deutsche Bundesbank, own calculations

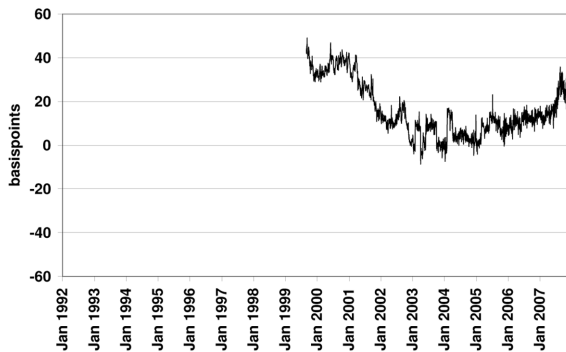


Figure A7 Yieldspread Jumbos vs. Bund, maturity class 4–7 years, Bund yield measured by the yield on bonds outstanding (“Umlaufrendite”)

Source: Deutsche Bundesbank, own calculations

Table A2 Determinants of risk premia: Robustness of liquidity measure

	A	B	C	D	E	F	G	H
lagged dependent variable	0.961*** 559.27	0.960*** 556.32	0.960*** 555.89	0.960*** 553.02	0.960*** 552.72	0.959*** 550.91	0.961*** 553.79	0.961*** 550.82
rav	0.005*** 9.70	0.005*** 8.81	0.005*** 8.62	0.005*** 8.70	0.004*** 8.70	0.005*** 8.44	0.004*** 8.08	0.004*** 7.98
liquidity (outst vol)		-0.000*** -2.51	-0.000*** -2.58	-0.000*** -3.33	-0.000*** -3.40	-0.000*** -3.48	-0.000*** -3.30	-0.000*** -3.28
debt per capita			0.000 0.59	0.000* 1.92	0.000 1.49	0.000 1.60	0.000* 1.72	0.000* 1.74
dummy after ruling				0.271*** 3.17	0.352*** 2.85	-0.339 -0.88	2.290 0.88	2.447 0.89
dummy after ruling * debt per capita					0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
dummy after ruling * rav					0.91	0.90	0.85	0.82
observations end in						1.88	-0.020 -0.79 May07	-0.021 -0.80 Mar07
N	26435	26435	26435	26435	26435	26435	25379	24947
R ²	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94

Notes: Fixed effect regressions. Dependent variable: yield spread measured as spread between yield on bonds of Land *i* and respective Bunds' yield in basis points (excluding Jumbos, $i = 1 \dots 16$). Liquidity of a Land's bonds is measured as the total outstanding bond volume of that Land Daily observations, 1999–2007. t-values reported below coefficients. Significance at 10 %, 5 % and 1 % level is indicated by *, **, ***, respectively

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