



Länder bonds

What drives the spreads between federal bonds and Länder bonds?

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Since the end of the 1990s there has been a discernible change in how most of Germany's *Länder* obtain their funding. Relative to total debt *Länder* bonds have replaced direct loans from banks as the primary source of funding (60% compared with 20% at the start of 2000). Despite the implicit joint liability of the Federation and the *Länder*, in some cases a premium of more than 100 bp is paid for *Länder* bonds compared to federal bonds on the capital markets. Our report analyses the factors that may contribute towards this.

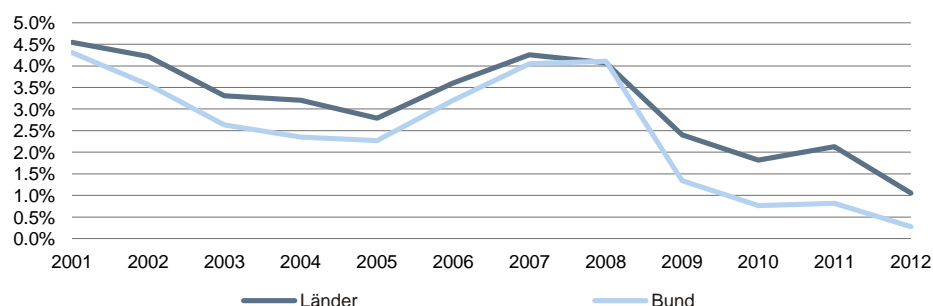
The financial crisis is also having a structural impact on the German *Länder* bond market. Given the changing regulatory environment and the lack of alternative investment opportunities, *Länder* bonds are becoming more important. Their volume of around EUR 350 bn at last count has thus reached that of the Netherlands. The performance of European government bonds shows that since the crisis there has been a change in the part played by fundamental macroeconomic and fiscal variables in investors' assessment of individual country risk. Countries with less sound public-sector finances (higher debt levels) are penalised with higher premia.

The report's findings show that in the periods before and after the Lehman collapse both higher liquidity and lower risk aversion are accompanied by smaller yield spreads between federal and *Länder* bonds. Fiscal variables that focus on direct budgetary discipline (primary surplus and actual revenue generating capacity), however, have no decisive influence on yield spreads in either period.

With regard to the influence of fundamental macroeconomic and fiscal variables on the yield spread, however, there are differences between the periods before and after the Lehman collapse. Up until the Lehman collapse neither the debt level nor relative economic output had a significant impact on the size of the yield spread. Like in the European bond market, however, the economic output and the debt levels of the *Länder* have been major determinants of the yield spread since 2008.

Yield curves for the analysed Bund and *Länder* bonds

Bonds with a maturity of 4 to 7 years, fixed coupon, Euro, annual average



Sources: Deutsche Bank Research calculations, Bloomberg Finance LP

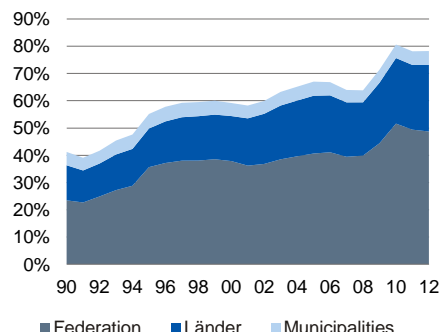


Länder bonds

Debt by level of government

1

Debt as % of GDP, financial statistics

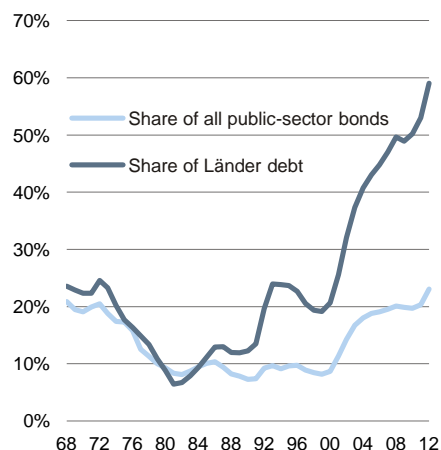


Sources: Deutsche Bank Research calculations, Federal Statistical Office

Importance of bond financing for Länder has increased exponentially

2

Share of Länder bonds in Länder debt and all public-sector bonds outstanding

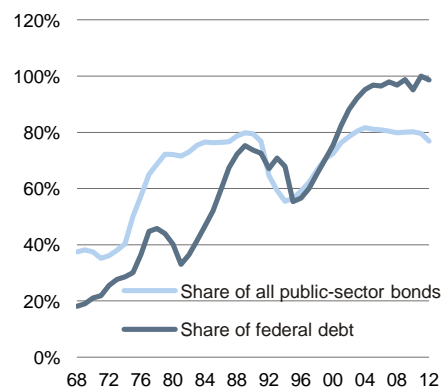


Sources: Deutsche Bank Research calculations, Bundesbank, Federal Statistical Office

Federation has obtained nearly all its funding via bonds for years

3

Federal bond share of federal debt and of all public debt outstanding



Sources: Deutsche Bank Research calculations, Bundesbank, Federal Statistical Office

The current situation: Pronounced fiscal solidarity between the federal and Länder governments

The characteristic features of Germany's federal system include not only the close financial ties between the different levels of governments, but also the general "Bündisches Prinzip" (i.e. the principle of mutual support between the Federation and the Länder and between the Länder and the municipalities). The primary material reflection of this fiscal solidarity is the financial integration of the Federation and the Länder. Under this arrangement some 70% of tax revenues in Germany are divided between the different levels of government and a part of this is redistributed via the Länder financial equalisation system.¹ The system of fiscal equalisation enables the practical anchoring of the solidarity principle and mutual support (and thus bail-outs) in the federal state.

Even though the Länder are, in principle, independent in managing their budgets, as stated in the Basic Law, their autonomy is de facto relatively strictly limited on both the revenue and expenditure sides. The Länder do, however, have considerable leeway in one area of the revenue side, that is with regard to borrowing. However, the longstanding lack of a statutory debt limit (for example in the form of a debt brake) led to a continual increase in overall public-sector debt. The de facto joint liability system between the Federation and the Länder and the "bail-out" guarantees derived from this made it easier for the Länder to indulge in debt-financed overspending in the past. It is therefore particularly interesting when analysing the yield spreads between federal bonds and Länder bonds as well as between the Länder to ascertain whether and to what degree growing public-sector debt – despite joint liability – is penalised by the capital market.

Bond financing has become an important instrument for many Länder

The Länder can avail themselves of other funding instruments apart from straightforward loans. In this regard the instrument of government bond issuance (by the Länder mostly in the form of "Landesschatzanweisungen") assumes a major role. While the Federation has already met 2/3 of its capital requirements since the 1980s by issuing bonds, the picture was different for the Länder until the early 1990s. Loans and cash advances were long the most important funding instruments for the Länder. As the integration of European financial markets has progressed there has been a marked shift in the type of debt procured by most Länder. Since the beginning of the new millennium the share of Länder bonds (in terms of volume outstanding relative to total debt of the Länder) has tripled from 20% to 60% and they have thus replaced direct loans from banks as the primary means of raising capital. In the meantime 20% of all public-sector bonds outstanding have been issued by the Länder. This percentage has doubled since the start of 2000, while the volume has in fact more than quintupled (to around EUR 350 bn at last count). It is notable that the individual Länder avail themselves of the capital market to very differing degrees. While Hesse raises nearly 70% of its debt via securities, this type of debt financing is almost negligible in Saxony at only just under 10%.

¹ For further information on the Länder financial equalisation system see Zipfel, Frank (2011).

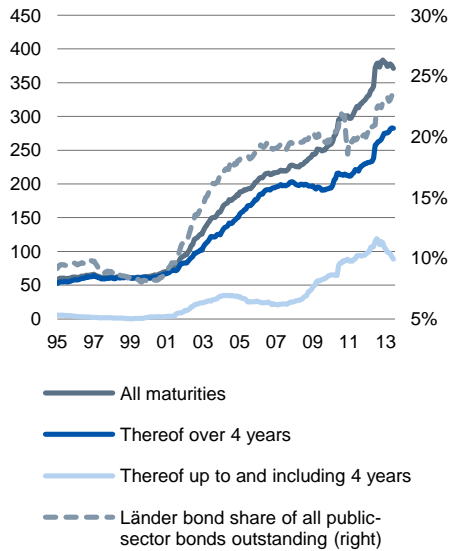


Länder bonds

Bonds increasingly popular

4

Nominal value of Länder bonds outstanding, EUR bn



Sources: Bundesbank, Deutsche Bank Research

Spreads between federal and Länder bonds as well as between Länder bonds?

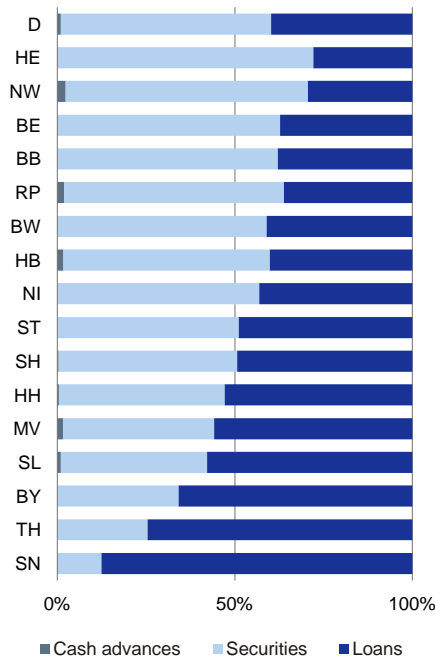
From an economic point of view the fiscal and institutional characteristics of the federal system should have consequences for borrowing on the capital markets. Thanks to implicit bail-out guarantees there should be no differences in credit ratings between the Federation² and the individual Länder or between the individual Länder. The credit rating of a Land should thus be a negligible variable in the assessment of the capital markets concerning the return required for a potential capital-raising. However, things look different when one examines how the yield spread between Länder bonds and comparable federal bonds has developed.³ In some cases the yield spread is substantial and amounts to more than 100 basis points. There are double-digit spreads (in basis points) even between federal bonds and KfW bonds, as well as between joint Länder bonds (“Jumbos”).

There are several possible reasons for the differences in capital market ratings of bonds issued by the various issuers. It is often argued that given the implicit liability of the different levels of government their credit rating should not play a major role. Yet despite the implicit joint liability not only the liquidity of the market but also the credit rating of the issuer appear to play a part. The poorer the two factors, the wider the spread to the benchmark – in this case to federal bonds. In a number of studies⁴ a liquidity premium is often identified as the reason for the spread. In the following we shall therefore use a self-generated data set – average benchmark yields do not exist for the Länder – to investigate which factors could lie behind the yield spread. Our analysis covers the period 2001 to the end of 2012 and thus includes a major portion of the financial crisis.

Länder differ greatly in their use of bonds and loans

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Respective share of total debt, 2012, securities debt, loans and cash advances in the non-public sector

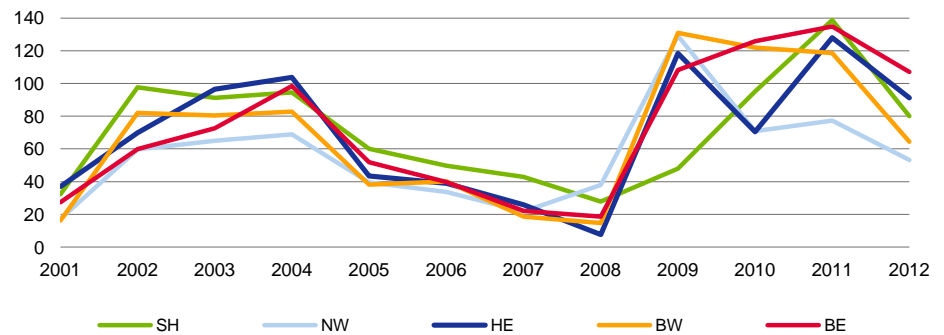


Sources: Deutsche Bank Research, Federal Statistical Office

Marked yield spread between some Länder bonds and federal bonds

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Spread, basis points, annual average yield on all analysed bonds with a maturity of 4 to 7 years relative to federal bonds



Sources: Deutsche Bank Research calculations, Bloomberg Finance LP

² This also applies to stakes held by the Federation such as in the KfW, which are indirectly guaranteed by the Federation, through which the KfW obtains equally good ratings as the Federation.

³ Comparable in terms of maturity.

⁴ See literature review in box 7.



Comprehensive data set generated for analysis

Literature review

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For the US state bond market, numerous studies show a direct relationship between the increase in the yield premium and a deterioration in the fiscal indicators of the respective state (see Bayoumi, Goldstein & Woglom (1995) or Alesina, De Broeck, Prati & Tabellini (1992)). Fiscal indicators have been identified as potential driving forces of yield premia in the euro area, too (see e.g. Bernoth & Wolff (2008)). Furthermore, many studies underscore the positive relationship between risk premium and general risk aversion as well as the degree of liquidity (see Bernoth et al. (2006) or Pagano, von Thadden (2004)). While initial studies addressed the causes of differing yield premia between nation states, current studies increasingly focus on the driving forces at the sub-sovereign levels of government of individual countries (see Lemmen (1999) for Australia, Canada and Germany, Schuknecht et al. (2009) for EMU, Canada and Germany or Schulz & Wolf (2008) for Germany alone). Given the difficulties and limitations of the data situation as well as the minor significance of German Länder bonds in the international capital markets, the number of studies in this area is very limited. In a German context, the studies conducted by Lemmen (1999), Heppke-Falk & Wolff (2008), Schuknecht et al. (2008) and Schulz & Wolff (2008) may be regarded as pioneering works.

While the Lemmen (1999), Heppke-Falk & Wolff (2008) and Schuknecht et al. (2008) studies are based on a rather modest data set, the study conducted by Schulz & Wolff (2008) is anchored in an extensive database. Studies to date on German Länder bonds suggest that yield spreads between Länder bonds and federal bonds mainly depend on the degree of general risk aversion and liquidity, while fiscal and macroeconomic variables contain, if at all, merely a small degree of explanatory power. However, the observation period of the studies to date does not include the performance recorded since the financial crisis.

Not only the volume and structure but also the yield metrics of the individual bonds are very important for analysing the yield gap in the Länder bonds market. Because of the relatively low issue volume and limited frequency with which Länder bonds were issued into the late 1990s making a continuous calculation of the yield spread for this period is by no means straightforward.⁵ That is why our report is based on Länder bonds that were traded on the capital markets between 2001 and 2012. In order to nevertheless generate a sufficiently large data set we focus⁶ not only on bonds of a specific maturity class, but include bonds with maturities of between four and seven years in our analysis.⁷ In addition, only those bonds are included that have both a fixed coupon and a preset maturity date.⁸ Based on yield-to-maturity data from Bloomberg, daily yield time series can thus be generated for 514 Länder bonds, which is considerably more than achieved in a series of previous analyses.

Given the special role that liquidity is assigned in the bond market,⁹ and an increasingly discernible trend in the market of “buying and holding” on the part of (primarily institutional) investors, the days on which a bond is regarded as illiquid are not included in our analysis. Due to the absence of data on the liquidity or trading activity of a bond (such as bid/ask prices), the daily liquidity of a bond cannot be determined at the drop of a hat. An alternative classification is thus required for the days on which a bond is designated as illiquid. We focus¹⁰ on the daily changes in the yield. Accordingly, a bond is deemed to be illiquid as soon as its yield remains unchanged for five consecutive trading days, which can be regarded as an indication of an absence of trading activity. In order to quantify the spreads between federal bonds and Länder bonds on a daily basis we then compare the yields on individual Länder bonds with federal bond yields.

It should be noted here that the size of the yield spread is derived by subtracting the federal bond yield from the Länder bond yield. Given the difficulty in making comparisons we use average yields at the federal level. Combined with our focus on fixed coupons the yield spread may turn out to be slightly wider. Since, however, for all Länder bonds the same constant (average federal bond yield) is subtracted from the Land-specific yield at time t , the actual size of the spread is not a factor in the analysis of the determinants of the yield spread.

⁵ The Bundesbank, for example, does not publish any such data series.

⁶ As did Schulz, Alexander & Guntram Wolff (2008).

⁷ This includes all issue volumes, which can be put down to the modest size of the dataset. The Länder pursue different bond strategies with regard to volume, maturity and interest rate (fixed or floating). The aim of data generation is to collate a dataset that incorporates bonds from all the Länder if possible.

⁸ In keeping with the relevant literature we also employ the standard Winsorising process to strip outliers from the data.

⁹ See for example Schuknecht, Ludger et al. (2009).

¹⁰ Along the lines of Schulz, Alexander & Guntram Wolff (2008).

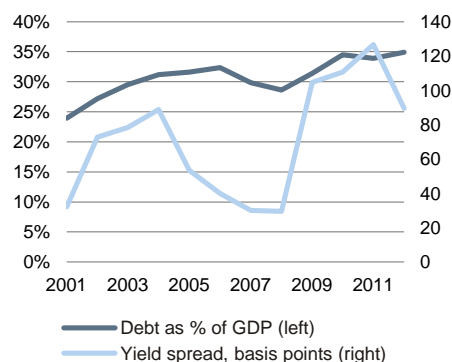


Which factors may be the major determinants of the spread?

Yield spread and debt level

8

Average Länder debt, average yield spread between federal and Länder bonds



Sources: Deutsche Bank Research calculations, Bloomberg, Federal Statistical Office

At the international level the general risk appetite of the capital markets as well as the exchange rate, credit and liquidity risk are key factors in determining the yield spread. In the context of the yield spread between Länder bonds and federal bonds the exchange rate is not, however, a factor. Apart from the standard metrics – risk appetite of the capital markets, credit and liquidity risks – we also include fiscal/macro-economic variables in our analysis. These are:

- Debt to GDP ratio
- Government expenditures
- Relative economic output (GDP per capita)
- Revenue generating capacity
- Primary surplus
- Unemployment rate
- Inflation rate
- Growth rate

Numerous analyses show that at the national level especially sovereign debt relative to gross domestic product has a positive, though in some cases not very highly pronounced, correlation with the yield spread. This means that as debt rises so does the yield spread.¹¹ This variable therefore plays a key role in our analysis. The descriptive analysis at the Länder level already indicates certain parallels between the development of average Länder debt relative to GDP and the change in the average Länder/federal bond yield spread.

Database

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We use data provided by the Federal Statistical Office on Länder debt levels (Fachserie 14 Reihe 5), Länder inflation rates (Fachserie 17 Reihe 7), adjusted government expenditures (Fachserie 14 Reihe 2) as well as tax revenues after redistribution (Fachserie 14 Reihe 4). The information on the Länder financial equalisation system payments and so-called supplementary federal grants are based on the respective data of the federal finance ministry. For Länder GDP and for the calculation of growth rates we use information from the national accounts as drawn up by the Länder. The population figures also come from the Länder national accounts (before the 2011 census). Unemployment figures are from the Federal Employment Service. No separate inflation rates are collected for the Länder Hamburg and Schleswig-Holstein. For them we use the inflation rate of Lower Saxony as an approximation.

Revenue generating capacity: A new fiscal variable

In addition to debt, we also examine another fiscal indicator in the form of the actual revenue generating capacity of the individual Land. In other comparable previous analyses¹² it is emphasised that investors' strong confidence in the German financial equalisation system is one of the reasons why fiscal discipline ultimately only has a very minor effect on yield spreads. The ongoing political debate about the existence/structuring of equalisation payments beyond 2020 and the very diverse fiscal challenges facing the individual Länder to comply with the debt brake could, however, result in greater attention being paid to the differences in their fiscal situations. The actual fiscal capacity of a Land is thus becoming more important. Unlike in previous analyses we therefore supplement the primary surplus "standard variable" by also using an indicator that enables the potential revenue generating capacity of an individual Land to be factored into the analysis.

For this, the corresponding Länder financial equalisation payments ('Länderfinanzausgleich') and supplementary federal grants ('Bundesergänzungszuweisungen') of the respective Land (i) are deducted from tax revenues at time (t) (where tax revenues are tax revenues after apportionment on the different levels of government).

$$fiscal\ indicator_{i,t} = \frac{taxes\ revenues_{i,t} - equalisation\ payments_{i,t} - federal\ grants_{i,t}}{expenditures_{i,t}} \quad (1)$$

¹¹ See Bayoumi, Tamim et al. (1995) or Alesina, Alberto et al. (1992).

¹² See Schuknecht, Ludger et al. (2009).

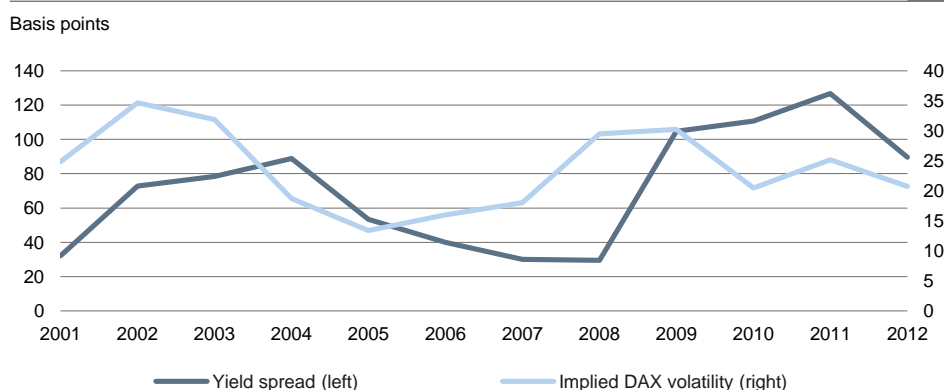


General risk appetite in the market plays an important part

On account of the hitherto very nationally dominated investor structure in the Länder bonds market segment we use “implied DAX volatility” in our starting analysis as an indicator of risk aversion in the capital markets.¹³ This indicator is geared more heavily to the risk aversion of the German capital market. A higher figure reflects a generally higher level of risk aversion in the financial markets. Chart 10 plots the development over time of implied DAX volatility and the average yield spread between Länder and federal bonds. This shows that implied DAX volatility can be ascribed the function of a leading variable.

Yield spread and implied DAX volatility

10



Sources: Deutsche Bank Research calculations, Bloomberg Finance LP

Liquidity premium: Another potential determinant

Numerous studies underline the special significance of the liquidity of a bond as a determinant of the yield spread.¹⁴ A perfectly liquid market is characterised by the fact that at any time an extensive supply and demand for a bond exists, so that at any time any desired amount of the bonds can be sold. The rule that applies is that the more liquid a bond, the smaller the liquidity premium demanded by investors. Since there is, however, no accurate means of measuring liquidity, we find in the economic literature that a variety of indicators are utilised to measure the liquidity of bond markets.¹⁵ A frequently used liquidity measurement is the bid/ask spread. Since this data is not available for the majority of Länder bonds an alternative measure is required. In this study we therefore devise our own liquidity measure:¹⁶ It is based on a comparison of the spreads on bonds with identical default risks. According to rational criteria, investors should factor into their assessment an identical default risk for different bonds from the same issuer. If we also disregard arbitrage opportunities, then the implication of the concept of the law of one price is that the bonds from a single issuer should have identical effective yields at all times. If there are differences between the yields on individual bonds from the same issuer (in this case a Land), then this reflects differences in liquidity.

To calculate our illiquidity measure the yields on the traded bonds (j) of a Land (i) are compared at the daily level (t). The bond with the lowest effective yield

¹³ In analyses, the widely used Volatility Index of the Chicago Board Options Exchange (VIX index) is usually utilised as an indicator of global risk aversion (see Table 2A). We have only used it to verify the findings.

¹⁴ See for example Amihud, Yakov and Haim Mendelson (1991).

¹⁵ In addition to volume-based approaches there are also price-based evaluations, for more detailed information see Bundesbank (2008).

¹⁶ Modelled on Longstaff, Francis (2004).



$(yield_{min\ i,t})$ can thus be regarded as the most liquid bond of this issuer on this particular trading day. It applies to every issuer that the bigger the squared difference between the yield on a bond ($yield_{i,j,t}$) and the yield on the most liquid bond ($yield_{min\ i,t}$) on one day, the higher the relative illiquidity of this bond at this time. Accordingly, our illiquidity measures can be defined as follows.

$$illiquidity_{i,j,t} = (yield_{i,j,t} - yield_{min\ i,t})^2 \quad (2)$$

Panel data analysis – estimation methodology

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The analysis is based on a non-balanced panel data set which covers the 2001-2012 period for the 16 Länder. The dependent variable is the yield spread between Länder bonds and federal bonds. While we take account of yield data from 2001 for 15 Länder, these data are not available for Bremen until 2004. Thanks to country fixed effects and the error term corrected for autocorrelation we can control for the most important variation in respect of Länder risk. Since our data selection is based on Länder bonds of similar maturities, we disregard the arbitrage opportunities that can result from switching between bonds of differing maturities. For this reason, we do not control separately for the residual time to maturity of the bonds.

Our analysis is based on daily spread data; however, macroeconomic and fiscal variables for the individual Länder are usually only available on an annual basis. Furthermore, it is very likely that the yield spreads at time “t” show a high autocorrelation with the yield spreads of the preceding period (t-1). In order to take account of this high autocorrelation in our analysis, we set up a dynamic panel model and use the dependent variable time-lagged by one year as an additional explanatory variable. Given the large number of observation values, however, potential distortions lose relevance.

Notes on the model equation

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Apart from the dynamic component, risk aversion and liquidity, we factor in with the aid of the vector $V_{i,t}$ macroeconomic and fiscal variables. In this context, $V_{i,t}$ contains, depending on the model specification, the variables inflation spread, unemployment spread, growth spread, fiscal indicator, primary surplus or GDP per capita (measured in EUR '000) as well as debt level of the preceding period in relation to GDP of the preceding period. In our model, c_i is a country fixed effect and $u_{i,j,t}$ is an error term with the usual characteristics.

Empirical analysis – the periods before and after Lehman: Does the fiscal situation play a part?

In the course of the financial crisis there was strong demand from international and institutional investors for German government bonds as a safe investment option. Especially against the background of the drastic tightening of banking regulation (for instance to comply with Basel III) and the occasionally negative yields on federal bonds, Länder bonds (for lack of alternatives) became considerably more important as a “safe haven” among institutional (primarily domestic) investors. If we look at the development of the European government bond market, there has undoubtedly been a discernible change in the part played by fundamental macroeconomic and fiscal variables in investors’ assessment of individual country risk since the crisis. Since September 2008 fiscal imbalances have been punished much more heavily by the capital markets in the form of huge premia.¹⁷

Given the crisis-driven structural changes in the government bond markets we analyse the determinants of the yield gap between federal bonds and Länder bonds for two different periods: before and after the collapse of Lehman Brothers.¹⁸ In the framework of the starting analysis we classify the period prior to September 16, 2008 as the pre-Lehman period and the period from September 16 onwards as the post-Lehman period. In view of the increasing significance of government debt as an important criterion in the assessment of sovereign risk, especially at the European level, the degree of importance of the debt level of the Länder as a determinant of the yield gaps in both periods is therefore of particular interest. In order to empirically investigate the determinants of the yield gap between Länder and federal bonds we estimate differing variants of the following equation for the respective periods:

$$Spread_{i,j,t} = \beta_0 + \beta_1 Spread_{i,j,t-1} + \beta_2 Risk_t + \beta_3 Illiq_{i,j,t} + V_{i,t} + c_i + u_{i,j,t} \quad (3)$$

¹⁷ For a detailed description see Sgherri, Silvia & Edda Zoli (2009).

¹⁸ From an empirical point of view the inclusion of an interaction term is desirable. On account of the data characteristics we do not, however, use any interaction term in our analysis, but look at the two sub-samples separately.



Growing risk aversion and lack of liquidity widen the yield spread in the period as a whole

Table 13 shows the results for different periods, with the macroeconomic and fiscal variables that are not significant or whose economic impact is only marginal not being stated here.¹⁹

Yield spread analysis – regression results

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Variables	Dependent variable: yield spread					
	(I)		(II)		(III)	
	Total		Pre-Lehman		Post-Lehman	
Risk aversion	0.00059 (6.04)	***	0.00098 (6.95)	***	0.00041 (3.07)	***
Illiquidity	0.02231 (6.64)	***	0.02516 (2.76)	**	0.01966 (4.38)	***
Relative economic output	-0.00001 (-4.40)	***	-0.00006 (-0.96)		-0.00077 (-4.74)	***
Debt/GDP from previous period	0.00023 (-0.84)		0.00044 (1.35)		0.00163 (2.53)	***
Crisis dummy	-0.00036 (-7.80)	***				
Country fixed effects	Yes		Yes		Yes	
R ²	0.9588		0.9077		0.9706	
Observations	321562		138714		182848	

Notes on the regression results

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All regressions contain country fixed effects that are not listed separately. The data set is not balanced. (I) spans the years 2008 – 2012. Column (II) covers the period from 2001 to Lehman's collapse. Column (III) covers the period between Lehman's collapse and 2012. The "t" values are given in brackets and are corrected for heteroscedasticity and serial correlation in the error terms.

"*", "**" and "****" indicate significance at the 10, 5 and 1 percent confidence levels.

Unemployment spread, inflation spread, growth spread and yield spread are calculated as the difference between the respective Land and the federal government.

In column (I) we analyse the driving forces behind the yield spread between Länder bonds and federal bonds for the entire period available to us (2001 – 2012). We find that the risk aversion indicator has a systematic and statistically highly significant influence on the size of the yield premium. According to our findings, increasing risk aversion in the period under review leads to a widening of the yield spread. Apart from the risk aversion of the finance investors the result also underlines the role of liquidity as a major determinant of the yield spread. Higher liquidity thus appears to lead to smaller yield premia. Whereas for the entire period a higher national economic output (higher GDP per capita) is accompanied by lower yield spread, the debt level of the respective Land has no significant influence on the yield gap. In the regression for the whole period the crisis dummy, which is given the value of 1 for the pre-Lehman period, is negative and highly significant. This suggests the periods prior to and following the Lehman meltdown should be analysed separately.²⁰

Prior to Lehman debt had no statistical influence on yield spread

In the pre-Lehman period debt has no impact on yield spread

Column (II) shows the estimates for the period from 2001 until the Lehman collapse in September 2008. The result shows that in the pre-Lehman period risk aversion has a systematic impact on the size of the yield spread. In other words, in times of increasing risk aversion, yield spreads between Länder bonds and federal bonds widen significantly. This indicates that in times of high risk aversion investors' preferred safe haven is federal bonds rather than Länder bonds. The economic justification for this could under certain circumstances be seen in the greater liquidity of federal bonds. In the capital markets there is a well-known phenomenon that even wholly owned subsidiaries of the Federation

¹⁹ The appendix contains the detailed regression table (1A).

²⁰ Along the lines of Schuknecht, Ludger et al. (2009) we analyse the determinants of the yield spreads between Länder bonds and federal bonds for two separate samples.



Länder bonds

Prior to Lehman risk aversion and illiquidity were the main determinants of yield spread

(the KfW) have to pay a liquidity premium. This effect of illiquidity is underlined in column (II) by a positive and highly significant coefficient of illiquidity. A rise in the indicator of illiquidity significantly widens the yield spread between Länder bonds and federal bonds. This result tallies with previous studies²¹ that have identified a negative correlation (albeit in some cases only weak) between rising illiquidity and the size of the yield spread. By contrast, the outcome in column (II) suggests that neither the economic output nor the level of debt of a Land is an important consideration in an investor's assessment. We find that for the period from 2001 until the Lehman collapse, neither a rise in the debt nor an increase in the economic output of a Land had a significant impact on the size of the yield spread.²² This can be observed in line with the developments in the European government bond market. Studies²³ of this confirm that prior to the Lehman meltdown capital markets paid only little attention to the debt level when making their sovereign risk assessment. The other variables monitored are also economically or statistically negligible.

Since Lehman massive changes also noticeable in the German Länder bond market

Debt a significant determinant of the spread in the post-Lehman period

Given the structural change in the government bond markets we analyse in column (III) whether capital markets have more frequently imposed higher yield premia on Länder with higher debt levels since the Lehman collapse. Column (III) shows the regression results for the period following the Lehman meltdown until 2012. The coefficient for risk aversion is positive and significant. Both the economic and the statistical significance have, however, declined. The size of this coefficient has halved compared to the pre-Lehman period. This could indicate that the importance of Länder bonds as a safe haven has increased relative to federal bonds since September 2008. Differences in liquidity between Länder bonds and federal bonds are major determinants of the yield spread for investors also following the Lehman collapse. The coefficient of illiquidity is positive and significant at the 1% level. At the same time the quantitative effect of increasing illiquidity on the yield spread has, however, declined by 25% compared to the pre-Lehman period. The reason for this could be the structural change in demand in the market for German Länder bonds. Given the changing regulatory environment Länder bonds have become hugely more important as a comparatively liquid and safe investment for investors (especially institutionals). Due to the lack of alternative investment options, investors are therefore increasingly pursuing a "buy and hold" strategy in this market segment. An immediate consequence that can be drawn from this investment strategy is that differences in liquidity between Länder bonds and federal bonds are of declining, but still major, importance for an investor's assessment.

Since Lehman relative economic output and debt level of the Länder have been relevant variables

In contrast to the pre-Lehman period the economic output of a Land is becoming more important as a determinant of the yield spread (negative and highly significant coefficient). A rise in per capita GDP of EUR 1,000 is thus associated with a 7.6 basis point smaller yield spread. This would mean Berlin (approx. EUR 29,000 per capita) having to pay a yield premium of nearly 50 basis points compared with Baden-Württemberg (approx. EUR 36,000 GDP per capita). While relative differences²⁴ in unemployment, inflation and growth between the Länder and the Federation are of negligible importance as drivers of the yield spread – either statistically and/or economically – column (III) suggests that since the Lehman meltdown the debt of the Länder has become more

Differences in unemployment, inflation and growth between Länder and Federation not relevant

²¹ See Schulz, Andreas & Guntram Wolff, 2008 or Bernoth, Kerstin et al., 2004).

²² Our findings thus underline the results of Schulz, Andreas & Guntram Wolff (2008) that could not identify any correlation between rising debt and rising yield premia between 1992 and 2007.

²³ See Serghi, Silvia & Edda Zoli (2009).

²⁴ The difference between the respective Länder readings and the Federation reading goes into the regression equation.



important.²⁵ This can be regarded as an indication that even at the Länder level in the wake of the debt crisis investors are scrutinising the fiscal situation of the issuer as part of their risk assessment. Thus in line with the developments in the European government bond market the German Länder with less sound public finances (higher debt levels) are also deemed to be at a higher risk of default and are penalised with higher yield premia.²⁶ Accordingly, a 10 percentage point increase in debt (relative to GDP) widens the yield spread by 1.6 basis points.

While the results we calculated for the post-Lehman period correspond with the general trends in the European government bond markets, doubts may nonetheless arise over the validity (robustness) of these findings if variations are made to the model framework (e.g. alternative specifications). The results from a broad range of alternative specifications (see appendix) underline the findings to date that economic output and debt of the Länder have been important as determinants of the yield spread between Länder bonds and federal bonds since September 2008. Conversely, the study shows, however, that fiscal indicators – such as primary surplus or revenue generating capacity – which are geared to direct budgetary discipline are negligible determinants of the yield spread (at least statistically). The reason could be investor confidence in the financial equalisation systems.

Fiscal indicators that focus on direct budgetary discipline have negligible influence

Conclusion

Importance of Länder bonds has increased over the last ten years

As the integration of European financial markets has progressed there has been a shift in the funding instruments used by most Länder. Relative to total debt Länder bonds have replaced direct loans from banks as the primary source of funding. The growing importance of this market segment is also reflected in the form of the high volume of Länder bonds outstanding (as of end-2012: EUR 380 bn). Despite the implicit joint liability capital markets demand sizeable yield premia for Länder bonds relative to federal bonds.

As a result of the financial crisis massive changes in the international sovereign bond market are perceptible, and they are also having a structural impact on the German Länder bond market. Given the changing regulatory environment and the lack of alternative investment opportunities Länder bonds are becoming hugely more important for investors (especially institutionals). Motivated by developments in the European government bond market we have closely analysed the influence of macroeconomic and fiscal variables on the yield spread between Länder bonds and federal bonds. Given the crisis-driven structural changes we have analysed the determinants of the yield gap in the periods before and after the Lehman collapse. Our findings tally with previous studies²⁷ by showing that illiquidity and investors' risk aversion have a systematic impact on the size of the yield spread. They show that higher liquidity is accompanied by a smaller yield spread. The results also show that following the Lehman collapse risk aversion has become less important as a determinant

Illiquidity and risk aversion in the market have systematic impact on spread

²⁵ With the aid a "Wald test" we test for the parity of the coefficients of debt and GDP per capita in the periods before and after Lehman. The results indicate significant differences between the coefficients at the 5% level (debt) and the 1% level (GDP per capita).

²⁶ Besides this "penalisation channel" there could, however, also be another transmission channel in operation. Internal regulatory requirements to diversify risk could prompt institutional investors to hold only a limited number of Länder bonds in their portfolios. In order to avert cluster risk it is not improbable that the individual share (the number) of individual Länder in such a portfolio will be determined by a Land-specific risk assessment conducted by investors. It is conceivable that the debt of the Länder will be one focal area in the internal risk models. This would mean that a correlation between debt and an institutionally regulated demand for the bonds of an individual Land would be possible. Given the generally limited supply the consequence would be that debt would impact the yield spread *between* the individual Länder indirectly (via the institutional risk models).

²⁷ See Bernoth, Kerstin et al. (2004) or Schulz, Andreas & Guntram Wolff (2008).



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of the yield spread between Länder bonds and federal bonds, both economically and statistically. This can be interpreted as an indication that since 2008 the importance of Länder bonds as a safe haven has increased relative to federal bonds. Furthermore, the findings suggest that for the period from 2001 until the Lehman collapse, neither an increase in the debt level nor a decline in the economic output of a Land had a significant impact on the size of the yield spread.

From end-2008 economic output and debt also important determinants

By contrast, we find that for the period from September 2008 in addition to risk aversion and liquidity the economic output and the debt level of the Länder are major determinants of the yield spread – despite implicit joint liability. Fiscal metrics such as primary surplus or actual revenue generating capacity do not, however, influence the yield spread (at least statistically) – either prior to the Lehman meltdown or subsequently. This also applies to relative differences in unemployment figures, inflation and growth between the Länder and the Federation. Differing economic output and diverging debt levels are also major determinants of the yield spread between federal bonds and Länder bonds, as is the case with the European bond markets. The introduction of the debt brake should therefore be regarded as positive in the context of our findings with regard to reducing interest expenditure (in the form of lower yield premia).

Fiscal metrics such as revenue generating capacity and primary surplus not statistically significant

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Appendix

Detailed regression table

Yield spread analysis – regression results

1A

Variables	Dependent variable: Yield spread					
	(I)		(II)		(III)	
	Total		Pre-Lehman		Post-Lehman	
Dynamic component	0.97090 (500.53)	***	0.94470 (118.41)	***	0.98048 (476.69)	***
DAX volatility	0.00059 (6.04)	***	0.00098 (6.95)	***	0.00041 (3.07)	***
Illiquidity	0.02231 (6.64)	***	0.02516 (2.76)	**	0.01966 (4.38)	***
Relative economic output	-0.00001 (-4.40)	***	-0.00006 (-0.96)		-0.00077 (-4.74)	***
Unemployment spread	-0.00005 (-4.41)	***	-0.00008 (-4.11)	***	-0.00008 (-1.78)	*
Inflation spread	-0.00012 (-0.30)		0.01366 (1.88)	*	-0.01224 (-1.21)	
Growth spread	-0.00030 (-0.38)		-0.00140 (-0.51)		-0.00024 (-0.33)	
Fiscal indicator	-0.00017 (-0.73)		-0.00004 (-0.51)		0.00019 (0.31)	
Debt/GDP in preceding period	0.00023 (-0.84)		0.00044 (1.35)		0.00163 (2.53)	***
Crisis dummy	-0.00036 (-7.80)	***				
Country fixed effects	Yes		Yes		Yes	
R ²	0.9588		0.9077		0.9706	
Observations	321562		138714		182848	

Note: All regressions contain country fixed effects that are not listed separately. The data set is not balanced. Column I spans the years 2001 – 2012. Column II covers the period from 2001 to September 15, 2008. Column III embraces the period from September 16, 2008 to 2012. "t" values are given in brackets and are corrected for heteroscedasticity and serial correlation in the error terms. ***, ** and * indicate significance at the 1, 5 and 10 percent confidence levels. Inflation spread, growth spread and yield spread are calculated as the difference between the respective Land and the federal government. Relative economic output measured in GDP per capita (EUR '000).

Robustness of the model

While the results we calculated for the post-crisis period correspond with the general trends in the European government bond markets, doubts may nonetheless arise over the robustness of these findings. On the one hand, such doubts may be based on the choice of cut-off date as well as the use of indicators for risk aversion and for the potential revenue generating capacity of the Länder. The indicator for the potential revenue generating capacity of the Länder in particular may not adequately reflect the actual influence of fiscal variables.



To test the robustness of our findings on the sensitivity of the cut-off date, in the following we look at two alternative cut-off dates. The pre-crisis period is hence defined as lasting until year-end 2008 (in Column I) and until year-end 2009 (in Column II). Table 1A reflects the regression results for the two alternative pre-crisis periods. The findings show that the coefficients that are of particular significance (GDP per capita and debt) remain unaffected by the alternative classification of the pre-crisis period (Columns I and II). The findings for the alternative post-crisis periods (Columns III and IV) underpin the results to date to the extent that since the outbreak of the economic crisis investors' increasing risk aversion has been losing relevance – in both economic and statistical terms – as a determinant of the yield spread between Länder and federal government paper. In Column IV, the coefficient is insignificant. This could be an indication that the importance of Länder bonds as a safe haven has increased relative to federal bonds since the financial crisis erupted. The sensitivity of the yield spread to economic efficiency remains significant even after the alternative classification of the cut-off date. However, the economic effect in this specification has decreased. Columns III and IV underscore the special significance of the debt-to-GDP ratio as a determinant of the yield spread. The significance of the coefficient has fallen slightly, though.²⁸ This suggests that our core assertion – that the economic efficiency and debt of the Länder have assumed key significance as determinants of the yield spread between Länder and federal government paper since the financial crisis – is robust in respect of changes in the cut-off date.

Going one step further, we analyse whether the use of an alternative risk aversion yardstick and of an alternative fiscal indicator have had an influence on the findings to date. To this end, we apply, on the one hand, the widely used Volatility Index of the Chicago Board Options Exchange (VIX index) as an indicator for global risk aversion (see Table 2A). On the other, we use the primary surplus of the preceding period as our alternative fiscal indicator²⁹. Neither of the two specification changes has an impact on the results. While the coefficients for economic efficiency and the debt ratio are insignificant in the pre-crisis period, the coefficients in the post-crisis period are highly significant. Similar to Hallerberg and Wolff (2006), we devised a fixed effects model without taking into consideration the dependent variables time-lagged by one period. The findings (Table 3A) are in keeping with those of the dynamic panel estimate.

²⁸ Given the relatively short post-Lehman period, the findings in Columns II and IV should be interpreted with caution, though.

²⁹ Results are not listed separately but may be obtained from the authors if required.



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Yield spread analysis – regression results (excluding dynamic component)

4A

Variables	Dependent variable: Yield spread					
	(I)		(II)		(III)	
	Total		Pre-Lehman		Post-Lehman	
Dynamic component	0.01460 (9.36)	***	0.01317 (7.29)	***	0.01631 (6.96)	***
Illiquidity	0.60856 (8.78)	***	0.31412 (2.63)	**	0.78504 (14.86)	***
Relative economic output	-0.00033 (-3.78)	***	-0.00010 (-0.87)		-0.00212 (-5.27)	***
Unemployment spread	-0.00075 (-3.99)	***	-0.00091 (-2.11)	**	-0.00028 (-0.20)	
Inflation spread	-0.11923 (-0.96)		0.12616 (0.97)		-0.35147 (-2.00)	*
Growth spread	-0.01106 (-0.50)		-0.00680 (-0.19)		-0.01977 (-0.98)	
Fiscal indicator	-0.01406 (-1.26)		-0.03308 (-1.37)		0.04062 (0.35)	
Debt/GDP in preceding period	-0.00323 (-0.35)		0.01469 (1.61)		0.05019 (2.76)	**
Crisis dummy	-0.00874 (-8.75)	***				
Country fixed effects	Yes		Yes		Yes	
R ²	0.2486		0.1083		0.1872	
Observations	321563		138715		182848	

Note: All regressions contain country fixed effects that are not listed separately. The data set is not balanced. Column I spans the years 2001 – 2012. Column II covers the period from 2001 to September 15, 2008. Column III embraces the period from September 16, 2008 to 2012. "t" values are given in brackets and are corrected for heteroscedasticity and serial correlation in the error terms. ***, ** and * indicate significance at the 10, 5 and 1 percent confidence levels. Inflation spread, growth spread and yield spread are calculated as the difference between the respective Land and the federal government. Relative economic output measured in GDP per capita (EUR '000).

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