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Moral suasion in regional government bond markets

Jana Ohls

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Deutsche Bundesbank, Wilhelm-Epstein-Straße 14, 60431 Frankfurt am Main,
Postfach 10 06 02, 60006 Frankfurt am Main

Tel +49 69 9566-0

Please address all orders in writing to: Deutsche Bundesbank,
Press and Public Relations Division, at the above address or via fax +49 69 9566-3077

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Non-technical summary

Research Question

There is an ongoing debate among policy makers and academics on banks' incentives to invest in home government debt. One hypothesis is that governments use moral suasion to persuade home government-owned banks to hold more home government debt. This paper tests the moral suasion hypothesis in the context of German banks' state (i.e. "Laender") government bond holdings.

Contribution

This study contributes to the literature by testing for moral suasion on the regional instead of the national (consolidated) government level. This helps to better identify direct links between governments and banks and control for banks' other incentives to hold home government debt. The paper makes use of a detailed bank-level dataset on German banks' state bond holdings (security-by-security) for the time period 2005-2014.

Results

Findings are in line with the hypothesis that state governments use moral suasion on banks that are fully or partially owned by the state, i.e. regional development banks and Landesbanken. These banks hold more bonds issued by the state that the bank is located in than all other banks. This effect becomes stronger if the state is performing poorly with respect to the fiscal criteria of the German Stability Council.

Nichttechnische Zusammenfassung

Fragestellung

In Politik und Wissenschaft wird über die Anreize für Banken diskutiert, in heimische Staatsanleihen zu investieren. Eine Hypothese ist, dass Regierungen über einen moralischen Appell ("moral suasion") an die heimischen staatlichen Banken dazu beitragen, dass diese Banken verstärkt heimische Staatsanleihen halten. Dieses Papier untersucht die Hypothese des moralischen Appells im Kontext der Bestände von deutschen Banken an Bundesländeranleihen.

Beitrag

Die Studie trägt zur Literatur bei, indem sie die Hypothese eines moralischen Appells der Regierungen auf der regionalen anstelle der nationalen Ebene testet. So können die Verbindungen zwischen Regierungen und Banken besser identifiziert werden und für Gründe, aus denen Banken heimische Staatsanleihen halten, kontrolliert werden. Dieses Papier verwendet einen detaillierten Datensatz zu den Beständen an Bundesländeranleihen bei den deutschen Banken, und zwar auf der Ebene der einzelnen Banken und einzelnen Anleihen für den Zeitraum 2005-2014.

Ergebnisse

Die Ergebnisse stehen im Einklang mit der Hypothese eines moralischen Appells der Landesregierungen an die Banken, die sich in ihrem Besitz oder Teilbesitz befinden, d.h. Förderbanken und Landesbanken. Diese Banken haben höhere Bestände an Anleihen, die vom Bundesland begeben wurden, in dem die jeweilige Bank ihren Sitz hat, als die übrigen Banken. Dieser Effekt ist stärker ausgeprägt, wenn das betreffende Bundesland, gemessen an den Kriterien des deutschen Stabilitätsrats, fiskalisch schwach aufgestellt ist.

BUNDESBANK DISCUSSION PAPER NO 33/2017

Moral suasion in regional government bond markets[1]

Jana Ohls

Deutsche Bundesbank

Abstract

In the context of the German regional government bond market, this paper studies the hypothesis that governments use moral suasion to persuade home government-owned banks to hold more home government debt. The empirical approach makes use of German banks' ownership structure, heterogeneity in the states' fiscal strength and detailed bank-level panel data on German banks' state bond portfolio on the security- and bank-level for the time period Q4:2005-Q2:2014. Results show that home state-owned banks hold a significantly higher amount of home state bonds than other home banks when fiscal fundamentals of the home state are weak. Banks located in other German states hold fewer state bonds in these situations. These findings are in line with moral suasion by state governments and are robust against controlling for observed and unobserved alternative incentives for banks' (home) state bond holdings such as risk-shifting by banks, lending opportunities or information asymmetries.

Keywords: banks' sovereign bond portfolios, home bias, moral suasion, political economy of banking

JEL-Classification: G11, G18, G21, G28

[1] Contact address: Jana Ohls, Deutsche Bundesbank, Wilhelm-Epstein-Strasse 14, 60314 Frankfurt am Main, Germany. E-mail: jana.ohls@bundesbank.de.
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1 Introduction

During the European sovereign debt crisis, banks' large holdings of home government debt had detrimental consequences for financial stability, bank lending, and the real economy (Acharya, Eisert, Eufinger, and Hirsch, 2016; Becker and Ivashina, 2017). Policy makers and academics are striving for a better understanding of banks' incentives to hold (home) government debt. One hypothesis is that governments use *moral suasion* to persuade home banks to hold more home government bonds (Ongena, Popov and van Horen, 2016; Weidmann, 2013).

The idea of moral suasion is that governments use explicit or implicit threats or the understanding that favours will be reciprocated in the future to persuade private firms to engage in activities that they would not do otherwise (Romans, 1966).[2] Moral suasion is difficult to observe directly but the theoretical literature suggests that governments have an incentive to use moral suasion on home banks to hold home government debt if fiscal fundamentals are weak and other investors are less willing to lend (Chari, Dovis and Kehoe, 2016). The bank's incentive to act upon moral suasion should be particularly high if the bank is owned by the government and/or politicians are members of its supervisory board.

This paper tests the moral suasion hypothesis at the *regional* level in Germany, i.e. for German banks' state ("Laender") bond holdings. The institutional setting in Germany lends itself to the study of moral suasion on the regional level since there are close links between state governments and banks, since states have their own budget that they finance (inter alia) by borrowing in bond markets and since detailed data on German banks' state bond holdings are available. My empirical methodolody uses differences in the fiscal strength between states and over time as reported by the German Stability Council[3] to identify differences in the states' incentives to use moral suasion. Specifically, the Stability Council evaluates the fiscal condition of German states along four stability criteria and I construct an indicator capturing the number of

[2] Moral suasion has been used in a wide array of policy areas, including labour policies and monetary policy (Romans, 1966).

[3] The German Stability Council assesses the risk of an impending budgetary emergency of states and publishes its results annually (for detailed information on the Stability Council, see Section 2.2)

criteria that are breached by a state (i.e. "breaches of stability criteria").[4] In addition, I make use of differences in bank location and bank ownership to identify the incentives of banks for collusion.

This paper applies a Heckman (1979) selection model to account for the impact of moral suasion on a bank's decision whether to hold any state bonds (selection equation), in addition to the impact on the volume of a bank's state bond holdings (outcome equation). It is important to control for the self-selection of banks into holding state bonds as moral suasion might trigger a bank to invest in home state bonds at all. In addition, I study the impact of moral suasion on a *bank's share in outstanding state bonds* by implementing a fractional logit model as proposed by Papke and Wooldridge (1996) and fixed effects regressions.

Overall, my results are in line with moral suasion by state governments on (state-owned) home banks. Home banks (i.e. banks located in the state that issues the bond) are more likely to hold home state bonds and hold larger volumes of these bonds than "out-of-state" banks (i.e. banks located in another German state). The preference for home state bonds increases significantly when the state is in a *weak* fiscal condition and the bank is *directly owned by the state government* (i.e. Landesbanken and regional development banks). State-owned banks located in weak states hold more home state bonds than state-owned banks located in "sound" states.

The key challenge for identifying the impact of moral suasion is to control for banks' alternative incentives to hold home government debt. The regional setting of my analysis mitigates differences in the institutional and regulatory framework that may confound results in cross-country studies. Also, I explicitly control for alternative hypotheses suggested by the literature, such as risk shifting (Farhi and Tirole, 2016), political endearing (Koetter and Popov, 2017), other lending opportunities (Gennaioli et al. 2014), and information asymmetries (Portes, Rey and Oh, 2001). Finally, I make use of variation in state bond holdings *between* banks and *within* banks across different issuers over time to control for unobserved incentives of banks for holding government debt (identification through heterogeneity). To the best of my knowledge, this is the first

[4] The stability criteria are the following: interest expense to tax income, outstanding state debt, structural net lending/borrowing, and the credit funding ratio. They are evaluated in two dimensions, current and future fiscal planning.

study that simultaneously controls for unobserved time-varying heterogeneity at the bank-level and for the time-constant but bank-specific preference for a particular issuer, e.g. for the home state. My findings on moral suasion remain. State-owned banks increase their home state bond holdings more than other banks if the fiscal condition of the home state worsens (i.e. the number of stability criteria that are breached increases).

The empirical analysis is based on a detailed panel dataset constructed from the *Securities Holdings Statistics* (Bade, Flory and Schönberg, 2016)*, Capital Market Statistics, Monthly Balance Sheet Statistics*[5] and bank supervisory data of the Deutsche Bundesbank and data provided by the German Stability Council. My dataset includes all state bond holdings (2,078 state bonds) of each German bank (2,024 banks) for the time period Q4:2005 – Q2:2014 and hence covers tranquil times, the financial crisis and the European debt crisis period. The data suggest that German banks are important for the funding conditions of state governments since they hold 64% of the outstanding volume of German state bonds (Q2:2014). At the same time, German state governments own regional development banks and, partly, Landesbanken, thereby controlling 17% of the German banking system's total assets (*Monthly Balance Sheet Statistic* of the Deutsche Bundesbank).[6] This setting may render moral suasion particularly attractive to state governments.

Governments can exert moral suasion on (state-owned) banks through several channels such as conversations, membership of state politicians in bank supervisory boards, explicit mandates or anticipatory obedience of state-owned banks. I find that a bank's preference for home state bonds is larger if the state owns a larger share of the bank's equity, if the bank is owned by only one instead of several states and if the share of politicians on the supervisory board is higher.

The results on moral suasion are robust to controlling for unobserved time-varying heterogeneity at the issuer level, to different measures of a state's fiscal strength and different clustering of standard errors, to constraining the sample to the period after the

[5] For more information on the *Monthly Balance Sheet Statistics*, see https://www.bundesbank.de/Redaktion/EN/Standardartikel/Service/Reporting_systems/monthly_balance_sheet_statistics.html?https=1

[6] While the relationship between governments and savings banks is close at the municipality level as well, data on bank lending to municipalities is scarce.

introduction of the Stability Council (from 2010 onwards), and to excluding special types of states.

This study is related to several streams of literature, most importantly the recent papers on moral suasion in European government bond markets. These empirical studies on large European banks find that home banks (Horváth, Huizinga and Ioannidou, 2015; Ongena et al., 2016), publicly owned banks (Altavilla, Pagano and Simonelli, 2016; Becker and Ivashina, 2017; De Marco and Macchiavelli, 2016; Ongena et al., 2016) and banks headed by politicians (Becker amd Ivashina, 2017; De Marco and Macchiavelli, 2016) tend to hold more home sovereign debt, especially in risky countries (Altavilla et al., 2016; Horváth et al., 2015) and at times in which governments have high funding needs (Ongena et al., 2016).

This paper contributes to the literature by testing for moral suasion on the regional instead of the consolidated government level which mitigates differences in the institutional framework and helps to better identify the direct links between governments and banks. Also, the empirical approach better accounts for alternative incentives of banks to invest in (home) government debt by controlling for unobserved heterogeneity at the bank-time and issuer-bank level. Finally, the sample extends the evidence for moral suasion beyond large banks and countries that are experiencing a sovereign debt crisis.

The empirical literature has identified several other reasons for banks to hold government debt that I control for in my empirical analysis: Risk-shifting by banks (Horváth et al., 2015), discrimination of foreign bond holders (Brutti and Sauré, 2014), hedging of redenomination risk (Battistini, Pagano, and Simonelli, 2014) and political endearing of banks (Koetter and Popov, 2017). Using a similar dataset as this paper, Koetter and Popov (2017) study the impact of political elections on the political endearing of savings banks. They find that savings banks owned by municipalities that are politically *misaligned* with the state government (i.e. governed by a different political party) have a *higher* exposure to the home state (relative to their assets). While the study by Koetter and Popov (2017) focuses on municipal-owned savings banks, I focus on state-owned Landesbanken and regional development banks that are politically

aligned through direct state ownership. Furthermore, I use the variation between home and out-of-state banks and "sound" and "weak" German states.

This study also relates to the research on the determinants of prices in the German state government bond market. Heppke-Falk and Wolff (2008) and Lemmen (1999) find that yields increase, and thus prices decrease, with higher indebtedness of the state, although only to a limited extent. My findings suggest that it is worthwhile to account for the differences in investors' incentives for holding state bonds when studying the impact of fiscal fundamentals on market prices. Schulz and Wolff (2008) document differences in funding strategies between German states for the time period 1992 – 2007 and a common liquidity event in state bond spreads in 2007. My empirical approach takes that into account by controlling for unobserved heterogeneity at the issuer-time level and, in a robustness check, at the bank-issuer level.

A good understanding of banks' incentives to hold government debt is important since banks' exposures towards risky government bonds have adverse consequences for bank stability (Acharya, Drechsler, and Schnabl, 2014; Buch, Koetter, and Ohls, 2016), bank lending to the private sector (Becker and Ivashina, 2017; Popov and van Horen, 2015) and the real economy (Acharya et al., 2016). Also, a larger home bias in banks' government bond portfolios is associated with higher government debt levels and lower government borrowing costs (Asonuma, Bakhache, and Hesse, 2015). Asonuma et al. (2015) conclude that banks' home bias may give governments more time for consolidation but at the same time pose the risk of delaying necessary reforms.

The remaining part of this paper proceeds as follows. Section 2 derives the hypothesis on moral suasion from the existing theoretical literature and discusses the institutional background in Germany. Section 3 explains the construction of the dataset and shows descriptive evidence on the state bond holdings of German banks. Section 4 discusses the empirical methodology and presents the results. Section 5 concludes.

2 Theoretical hypotheses and institutional background

2.1 Theoretical hypotheses

The theoretical literature offers several hypotheses on why banks invest more in home than in foreign government debt. These include risk-shifting by risky banks (Ari, 2016; Farhi and Tirole, 2016), information asymmetries (Portes et al., 2001), discrimination of foreign borrowers (Broner, Erce, Martin and Venture, 2014), and moral suasion (Chari et al., 2016) which is the focus of this paper. This Section briefly describes the theoretical model and its implications, while the following Section 2.2 discusses how the hypothesis relates to the institutional setting in Germany. The alternative hypotheses are discussed and tested in Section 4.3.2.

Chari et al. (2016) augment a standard neoclassical model with banks in the spirit of Gertler and Kiyotaki (2010) to study the government's incentives for pressuring banks into holding home government debt. Chari et al. (2016) assume a benevolent government that funds expenditures by levying taxes and borrowing in debt markets subject to a borrowing constraint. Banks face a collateral constraint limiting bank borrowing and thus lending by bank's net worth. As a result, higher holdings of home government debt come at the cost of lower private lending (crowding out). Benefits from requiring banks to hold home government debt arise in the model from alleviating the government's borrowing constraint, smoothing taxes and thus consumption.[7] The government's borrowing constraint is relaxed because default is assumed to be strategic and higher government bond holdings of *home* banks serve as a commitment device for the government to repay its debt in order to avoid domestic output costs (Chari et al., 2016).[8]

The model predicts that the government requires home banks to hold home government debt (by means of a regulatory constraint), when the government faces funding needs exceeding its borrowing constraint. This situation may occur when the

[7] While governments in Chari et al. (2016) smooth taxation, German states are generally not able to increase tax rates because these fall into the authority of the German central or municipal governments. However, German states may engage in smoothing government expenditures.

[8] The reason is that a default on home banks would reduce bank lending, and thus domestic investment and growth. Basu (2009), Broner et al. (2014) and Gennaioli et al. (2014) build models with a similar mechanism but study the probability of a sovereign default and not the implications for moral suasion.

government is in a weak fiscal situation and therefore non-home investors are less willing to lend (Chari et al., 2016).

Moral suasion hypothesis part (I): *The government requires home banks to hold home government bonds if it has weak fiscal fundamentals because banks from other states are less willing to hold government bonds in these situations.*

I test this hypothesis using differences in fiscal strength between German states as reported by the Stability Council and by comparing state bond holdings of home versus out-of-state banks.

While Chari et al. (2016) model the government's ability to impact home banks' investment decisions as a binding regulatory constraint, European banking regulation favours government bonds issued in domestic currency but does not differentiate between government issuers on the regional level. Instead, state governments might impact the investment decisions of home banks through moral suasion (Romans, 1966). Moral suasion should be particularly effective on state-owned banks due to the government's close relationship with these firms. The political view of state-owned firms (Shleifer and Vishny, 1994) suggests that governments might use its control over state-owned firms to pursue private goals. In fact, banks have been shown to engage in politically motivated private lending (see, among others, Dinc, 2005; Khwaja and Mian, 2005; Sapienza, 2004). The second part of my hypothesis on moral suasion therefore refers to the special role of state-owned banks.

Moral suasion hypothesis part (II): *Moral suasion by governments is particularly effective for banks that are directly owned by the state or that have state politicians on the supervisory board as these banks have higher incentives to concede to moral suasion.*

I test this hypothesis using an indicator for state ownership of a bank, using data on the degree of state ownership and on supervisory board members of large banks.

2.2 Institutional background

Germany is a federal republic consisting of 16 states ("Laender"), each of them having their own budget.[9] State debt accounts for 30% of consolidated German government debt (Q2:2014, Deutsche Bundesbank) and the funding structure of German states has shifted from bank loans to bonds in recent years (Figure 1). Due to limited data availability on banks' lending to German states, this analysis focuses on the bond market for which detailed information is available (see Section 3.1).[10]

The fiscal situation varies considerably between states and over time as illustrated, for example, by the distribution of the interest expenses to tax income (in %) and the state government debt (per capita in thsd euro) in the upper panel of Figure 2. The analysis makes use of these differences in states' fiscal situation to identify fiscally weak states that may have a larger incentive to sway home banks into holding home state bonds (see moral suasion hypothesis part (I)).

The German Stability Council

The German Stability Council helps with identifying these fiscally weak states as it increases market transparency on the fiscal situation of states through detailed annual reports. The council was established on April 28, 2010 to strengthen the framework for fiscal sustainability in Germany and is a joint body of the German states and the German federation. It is led by the respective finance ministers and advised by an independent scientific committee. The Stability Council assesses the risk of a budgetary emergency in the German states along four criteria and publishes the results on its website in the fourth quarter of each year. The criteria include structural net lending/borrowing, credit funding ratio (i.e. the degree to which the current budget is financed by net borrowing), interest expense to tax income ratio and outstanding debt. They are evaluated in two dimensions: the current budgetary situation (covering the current and last two years) and future fiscal planning (covering the next four years). For

[9] In order to finance higher expenditures, German states are generally not able to increase tax rates because these are set by the German central and municipal governments. Instead, German states may finance fiscal deficits by borrowing directly from banks as well as in the bond market. Differences in the tax income between states generally reflect differences in economic strength and are largely rebalanced through horizontal and vertical fiscal equalization schemes.

[10] While the credit register in Germany now includes data on bank loans to states, government borrowers were excluded from the reporting requirements until 2014 and a reporting threshold of 1.5mn euro applies.

each of these criteria, the Stability Council reports a threshold that is derived from the average value of all states plus an allowance. A state is marked as "noticeable" (in a negative sense) with respect to a criterion if the state breaches the threshold.[11]

My baseline measure for the fiscal situation of a state is the number of stability criteria that a state breaches. The indicator "breaches of stability criteria" is ordinal and can take values from zero breaches to eight breaches (i.e. four criteria times two dimensions). The advantages of this indicator are that it combines the information from all stability criteria and focuses on observations where the case for moral suasion might be particularly strong since the state has been marked as having a relatively weak fiscal condition. Table 1 shows the cross-sectional variation (i.e. between states) and the time variation (i.e. within states) of the indicator. In a robustness check, I use the underlying *continuous* indicators (i.e. structural net lending/borrowing, credit funding ratio, interest expense to tax income and outstanding debt) to capture the fiscal situation of states.

One concern is whether investors take the differences in states' fiscal situation into account given high credit ratings (varying between AAA and AA for the 11 out of 16 states that are rated) and bailout expectations (Heppke-Falk and Wolff, 2008). However, the German federal government and the states are in principle not liable for the debt burden of each other. Instead, German Basic Constitutional Law guarantees the sole fiscal responsibility of states for their debt (Article 109 Para 1 Basic Constitutional Law). Under certain conditions though, the Constitutional Court may decide on transfers from the German federal government to a state. Even if positive, these court decisions may lead to a delay in the redemption of state bonds. Heppke-Falk and Wolff (2008) and Lemmen (1999) show that state bond spreads reflect differences in state debt ratios, at least to some extent. This means that latent credit risks are highest for states that are in a relatively weak fiscal condition.

Also, while benefits from moral suasion might be lower for German states than for high credit risk countries, costs in terms of crowding out (Chari et al., 2016) might be

[11] If a state breaches more than two criteria, the Stability Council evaluates whether the state is at risk of a budgetary emergency. If so, the state enters a consolidation program. As of 2011 five states (Berlin, Bremen, Saarland, Saxony-Anhalt and Schleswig Holstein) entered a consolidation programme. These state governments have to submit a consolidation plan that is evaluated by a committee and have to ensure the reduction of net borrowing within the next five years. Consolidation members have to report on their progress to the Stability Council on a semi-annual basis.

lower as well due to the eligibility of German state bonds as collateral in interbank and Eurosystem refinancing operations.[12] The net effect is hence unclear. My findings suggest that banks located in other states reduce their bond holdings of states that have a deteriorating fiscal condition (i.e. a larger number of stability criteria that are breached). This supports the case for moral suasion on the German regional government bond market.

Ownership structure of the German banking system

Another institutional feature used in this analysis is the heterogeneity in the ownership structure of German banks. For a general description of the German banking system, see Koetter (2013). Regarding bank ownership, I distinguish four groups: (i) privately-owned banks (such as commercial banks and specialized banks, e.g. mortgage banks); (ii) mutually-owned cooperative banks; (iii) savings banks which are owned by the municipality; and (iv) state-owned banks, i.e. Landesbanken and regional development banks.

Moral suasion is expected to be particularly effective for the latter group of state-owned banks and for banks with state politicians on their supervisory board (hypothesis part II). I use the term "moral suasion" in a broad sense to summarize various means of government influence, including conversations, membership of state politicians in bank supervisory boards, explicit mandates or anticipatory obedience of state-owned banks. The different channels are difficult to disentangle as they are likely to be used complementarily. Table 2 summarizes detailed data on the degree of government control and on supervisory board members that allows me to test for some of these channels.

In total, 20 banks, which account for 17% of the German banking system's total assets, are directly owned by state governments in Q2:2014. During the entire sample period from 2005 to 2014 there are 23 state-owned banks (for more details on these banks, see the Data Appendix to this paper). On average, state governments own 83% of these banks' capital, savings associations own 11%, other public banks own 3% and the remaining share is held by other investors (Table 2). The so-called "regional

[12] Roughly 72% of German state bonds have been eligible as collateral in Eurosystem refinancing operations (see Section 3.2).

development banks" are fully state-owned and their debt is guaranteed by the states.[13] One fifth of state-owned banks are owned by more than one state government. I test whether multiple state owners limit the ability of a state to impact the bank's investment decisions. Table 2 further shows that on average 44% of supervisory board members of state-owned banks are state politicians but there is a large heterogeneity between banks that I will exploit in the empirical analysis.

My main approach uses the extensive margin of state ownership, i.e. the variation between state-owned and other banks to test for moral suasion. State ownership is a structural characteristic of the German banking system that has persisted for a long time. This addresses the concern that the degree of state ownership might be endogenous to banks' state bond holdings (for a detailed discussion on endogeneity issues, see Section 4.2.2). In further tests, I use differences in the intensity of state control as reflected in the (time-varying) state ownership share and the share of state politicians in the supervisory board of banks.

3 Data and descriptive statistics

3.1 Data sources

This Section introduces the datasets and discusses data preparation. A detailed description of the constructed variables can be found in the Data Appendix to this paper.

Securities Holdings Statistics of the Deutsche Bundesbank (Bade et al., 2016)

The German state bond market has a size of 315 bn euro of which 81% (254 bn euro) are included in the *Securities Holdings Statistics* of the Deutsche Bundesbank (Q2:2014). My analysis focuses on state bond holdings by German banks which are available for all German banks on a security-by-security and bank-by-bank level. German banks hold 64% (162 bn euro) of the outstanding volume of state bonds in the *Securities Holdings Statistics* (Q2:2014).The time period runs from Q4:2005 to

[13] There are two development banks that are fully guaranteed by the German central government and are therefore not included in the group of state-owned banks, the Kreditanstalt für Wiederaufbau (KFW) and the Landwirtschaftliche Rentenbank. While the KFW is partly owned by the states (20% of equity), it's liabilities are fully guaranteed by the central government and therefore assigned to the group "Other MFI". Results are robust against treating the KFW as a (partly) state-owned bank.

Q2:2014 and thus covers pre-crisis times, the financial crisis and the European sovereign debt crisis.

The dataset covers the entire German banking system and thus complements earlier studies on moral suasion that focus on large banks only (Horváth et al, 2015; Ongena et al, 2016). I exclude branches of foreign-owned banks, as their investment behavior typically depends on the business model of the parent banks, which I do not have information on. This gives 2,024 banks (unbalanced sample due to mergers, entries and exits). The number of banks per quarter decreases from 1,982 in Q4:2005 to 1,732 in Q2:2014.

I follow the bank supervisory classification of the Deutsche Bundesbank in sampling existing banks. In case of mergers, this implies that the bank that is taking over remains in the sample and reports state bond holdings for both entities together. The asset growth of the absorbing bank is controlled for by including a dummy variable in the estimations. Most mergers have been taken place within the groups of small savings or cooperative banks, but there have been three events within the group of state-owned banks, that are given in the data appendix 2.A.[14] Therefore, Section 4.3.1 checks the robustness of the results to excluding the period before 2010 which encompasses the merger and recapitalization events stemming from losses during the financial crisis (Puri, Rocholl, and Steffen, 2011).

I include only banks' bond holdings on their own account and not those on behalf of bank customers since banks cannot actively manage the latter. Furthermore, I use notional values of bond holdings to focus on quantity and not price effects.

Information on the issuer of the bond is obtained from Bloomberg and merged to the securities holdings data using the ISIN of each security. I include bonds issued by German states only. Specifically, I exclude banks' holdings of bonds issued by bad banks, such as "Erste Abwicklungsanstalt", because the state is liable only for part of the bond. Also, I exclude 41 bonds issued jointly by several German states

[14] While WestLB AG exited in 2012, Portigon AG became its legal successor and thus the identifier of the bank did not change, following banking supervisory classifications. The size of the bank did only decrease slightly. Furthermore, there has been a merger between two regional banks in the same state in 2011. While the owner did not change, the merger had a scale effect on the absorbing bank that is controlled for through a dummy.

("Gemeinsame Laender Anleihe")[15] because I am not able to identify the share and participation of individual states in these bonds (German banks' holdings equal 8 bn euro). Finally, I exclude one security issued jointly by German states and the central government. As a result, my dataset includes 2,078 securities with aggregate holdings by German banks worth 162 bn euro.

For the estimations, I aggregate security holdings of bank *i* in quarter *t* to the issuer (i.e. state) level. To account for the right-skewed distribution of the dependent variable, I take natural logarithms of state bonds holdings.[16] The inflated dataset that includes all bank-issuer-time combinations has 1,031,203 observations and 89,171 non-zero observations. This allows me to study the impact of bank and issuer characteristics on the extensive and intensive margin of banks' state bond holdings.

Capital Market Statistics of the Deutsche Bundesbank

Data on security characteristics such as amount outstanding, amount issued, issue and redemption date are taken from the *Capital Market Statistics* of the Deutsche Bundesbank. These variables are used to clean the data suc as reported holdings prior to the placement of the security or after redemption (111 observations are dropped).

Data on the initial price, coupon type and rate are in principle also available, but around half of the state bonds are floating coupon bonds with no further details on the coupon rate.

Bank supervisory and statistical data of the Deutsche Bundesbank

Bank control variables including size (i.e. log total assets), capitalization, deposit ratio and commitment ratio are constructed from the *Monthly Balance Sheet Statistics* of the Deutsche Bundesbank (for a definition of variables, see 2.A).[17] These variables are available at a quarterly frequency; the information on banks' non-performing loans (NPL) obtained from the annual financial statements submitted to the Deutsche

[15] Federal states that regularly participate in these joint issuances are Bremen, Hamburg, Mecklenburg-West Pomerania, Rhineland-Palatinate, Saarland, Schleswig-Holstein and Thuringia.
[16] Due to technical reasons, mainly, 4% of observations on the security level are negative positions, but the majority cancels out on the issuer level. Merely 0.3% of observations need to be dropped in order to take logs.
[17] For more information on the *Monthly Balance Sheet Statistics* of the Deutsche Bundesbank, see https://www.bundesbank.de/Redaktion/EN/Standardartikel/Service/Reporting_systems/monthly_balance_sheet_statistics.html?https=1

Bundesbank is available at an annual frequency. To account for the statistical breaks in the prudential definitions of NPL, I use a relative NPL indicator that is equal to one for banks in the highest quartile of the NPL distribution of the respective year (the indicator remains unchanged within one year). These control variables account for differences in the size and business models between banks that may affect the banks' demand for government bonds (for a detailed discussion, see Buch et al., 2016).

Information on bank type, state ownership and the location of the banks' headquarters is taken from bank supervisory data of the Deutsche Bundesbank. I construct an indicator "state-owned" that is equal to one for banks that are directly owned by the state government.

Public (financial) reports and supervisory data on the 23 state-owned banks and 16 other large German banks have been used to identify time-varying ownership shares of state governments and other owners (such as the federal government or banking associations) and to collect information on the supervisory board members of these banks. These data have been gathered for the largest German banks due to data availaibility.

State variables

Macroeconomic data on German states (including state debt and population) is collected from the German Federal Statistical Office. I use annual core state debt per capita as measure for the state debt burden and interpolate it to quarterly frequency. Further information on the fiscal situation of the state is taken from the online publications of the German Stability Council.[18] I construct the composite, ordinal indicator "breaches of stability criteria" as defined in Section 2.2. The assessments of the Stability Council are available since Q4:2010 and updated in the fourth quarter of each year (remaining constant throughout the year).

[18] For more information on the Stability Council, see http://www.stabilitaetsrat.de/EN/Home/home_node.html

3.2 Descriptive statistics

The structure of the German state bond market

The following descriptive statistics and regressions are based on 2,078 state bonds included in the *Securities Holdings Statistics* (without joint state bonds) with an aggregate volume of 254 bn euro of which 64% (162 bn euro) are held by German banks (Q2:2014).

Between Q4:2005 and Q2:2014, German states have placed 1,456 new state bonds (excluding joint state bonds). State bonds are often privately placed (Koetter and Popov, 2017) and have a much smaller bond size (260 mn euro on average) than central government bonds (6,960 mn euro on average) that are publically auctioned to a group of eligible financial institutions. With respect to other bond characteristics, the state bond market consists mainly of coupon bonds (57%) and floaters (42%), while the central government bond market is dominated by zero coupon bonds (57%), followed by coupon bonds (42%) and only a few floaters (1%). The average maturity of a state bond in my sample is 6.2 years and thus below the maturity of central government bonds which is 8.3 years on average. Foreign currency denomination plays a minor role in the state bond market (2.5% of state bonds). Schulz and Wolff (2008) document differences in the volume and frequency of bond placements between German states. My empirical approach accounts for these differences in funding strategies between states through issuer-time and bank-issuer fixed effects.

Given private placements, my results are not likely to be driven by the potential role of dealer banks that redistribute state bonds in the secondary market. In fact, the data shows that changes in the investor base of a particular security are not more frequent in the quarters immediately after a bond's placements than later during the bond's life. Overall, the average state bond is traded at least 9 times within my sample period (Q4:2005 – Q2:2014; based on quarter-on-quarter changes).[19]

The holder structure on the security level is rather concentrated in the German state bond market. One-third of all bonds are held by one bank only. These bonds tend to have a 50% smaller volume than other state bonds but a similar maturity and

[19] I can only approximate the trading pattern by quarter-on-quarter changes in the ownership of a particular bond since flow data are not available.

Eurosystem eligibility. The average state bond is held by 7 German banks simultaneously, while 10% of German state bonds are held by more than 21 banks in the average quarter. Section 4.2.2 studies the share of a bank in outstanding state bonds at the issuer level in greater detail.

The role of German banks in the state bond market

German banks are the most important investors in the state bond market. They hold on aggregate 64% of the outstanding volume of these bonds (Q2:2014). By comparison, German banks hold only 1.1% of the outstanding volume of German central government bonds (i.e. "bunds"). Instead, foreign investors (incl. foreign central banks) are primarily active in the bund market due to the larger bond sizes and the availability of ratings. Public information on credit risk is less easily available in the state bond market. Only 11 out of 16 states have a rating from a major rating agency, which might constrain some types of investors. As a result, German banks focus on the regional rather than the central government bond market and invest on average 41% of their total government bond portfolio in German state bonds and only 3% in "bunds" (Table 3).

Within the German banking system, state-owned banks are the largest creditors in the state bond market. While the average German bank holds only 0.09 bn euro in state bonds, an average state-owned bank holds state bonds worth 2.06 bn euro (Table 3). The picture remains similar after controlling for bank size. State-owned banks invest more than 3% of their assets in state bonds, while commercial banks invest a mere 1% and savings and cooperative banks 2% of their assets (Q2:2014). Consequently, the group of state-owned banks hold 16% of the outstanding volume of German state bonds which is a larger market share compared to the other banking groups, despite the relatively small number of state-owned banks. Investment decisions by state-owned banks are thus particularly relevant for the funding conditions of states, which may increase the governments' incentives for using moral suasion.

Despite the general importance of state bonds for German banks, about 26% of them do not hold any state bonds at all during my sample period. Probit estimations on the banks' likelihood of not holding any state bonds show that these banks tend to be smaller, have a lower deposit ratio and a higher capital ratio (relative to unweighted assets) (results available upon request). These banks might be less in need for zero risk

weighted assets, such as state bonds, to support their regulatory capital ratio. Many banks enter and exit the state bond market frequently such that only about 45% of German banks hold some state bonds in the average quarter. This self-selection of banks into holding state bonds needs to be taken into account in the empirical approach, which I do by applying a Heckman model.

The degree of "home bias" in German banks' state bond portfolios

In order to derive a descriptive measure for a banks' preference of home state bonds which takes into account the size of the home state, I follow Coeurdacier and Rey (2013). Based on the standard Capital Asset Pricing Model (CAPM), they measure home bias as the deviation of an investor's share of home assets in the portfolio from the share of home assets in the market portfolio. Transferring this idea to the subnational level, the "home bias" in the state bond portfolio of a bank *i* in quarter *t* can then be calculated as follows:

$$HomeBias_{it} = 1 - \frac{Share\ of\ "non\ home"\ state\ bonds\ in\ portfolio_{it}}{Share\ of\ "non\ home"\ \ bonds\ in\ German\ state\ bond\ markets_t}$$

A value of the $HomeBias_{it}$ equal to one reflects complete home bias while a value of zero indicates perfect diversification according to the CAPM. A negative value is associated with an underrepresentation of home assets in the portfolio.

Table 4 shows the $HomeBias_{it}$ in the state bond portfolios of banks that hold some investment in state bonds (by banking group for 2014Q2, excluding banks with zero holdings). On average, state-owned banks exhibit the largest home bias with a value of 0.19. Savings and cooperative banks have a home bias in state bond portfolios of 0.07 and 0.08 respectively. Mortgage banks are fully diversified, arguably reflecting their sophisticated investment strategies in government bond markets. However, the variation within banking groups is large which renders the home bias insignificant at conventional levels (Table 4). One reason for this may be the impact of the states' fiscal situation on the banks' home bias. The empirical approach tests this hypothesis, among others, and controls for unobserved differences between states and / or between banks that may drive the descriptive figures.

4 Empirical methodology and results

4.1 Empirical methodology

To test for moral suasion, I employ heterogeneity between banks with respect to state ownership, within banks with respect to bond holdings from home versus other state issuers and between states over time with respect to the Stability Council indicators. I extend the methodology of existing studies by De Marco and Macchiavelli (2016), Horváth et al. (2015), Koetter and Popov (2017), and Ongena et al. (2016) in two dimensions.

First, I analyse the impact of moral suasion on the bank's decision whether or not to hold any bonds from a specific state (extensive margin), in addition to analysing the volume of the bank's state bond holdings. To this end I apply a Heckman (1979) model and fractional logit model as proposed by Papke and Wooldridge (1996). While previous studies on moral suasion have analysed the intensive margin only (due to their focus on large banks), governments may also use moral suasion to persuade banks to hold asset classes that they would not hold otherwise and therefore affect the extensive margin of banks' state bond holdings.

Second, I use not only banks' bond holdings of the home state but also that of other states on an issuer level. This allows me to control for unobserved heterogeneity between states over time through issuer-time dummies in the baseline specification, and to additionally control for alternative investment incentives of banks by bank-time and bank-issuer fixed effects in the augmented regressions (using high-dimensional fixed effects regressions). Existing studies do not use heterogeneity within banks, but only between banks and states over time (De Marco and Macchiavelli, 2016; Horváth et al., 2015; Koetter and Popov, 2017; Ongena et al., 2016).

Similar to De Marco and Macchiavelli (2016), Horváth et al. (2015), and Koetter and Popov (2017), I study banks' *holdings* of state bonds instead of purchases of state bonds. This allows me to use the *cross-sectional* variation between the states' fiscal condition in addition to the variation within states over time. Also, the dataset does not allow a clear identification of flows (unlike the dataset on large European Banks by Ongena et al., 2016). In an augmented fixed effects regression, I check that my results

on moral suasion are not only driven by the cross-sectional variation by including bank-issuer fixed effects (along with bank-time and issuer-time fixed effects, Table 8). Results from this estimation are driven by the variation over time and the findings remain in line with moral suasion.

Heckman model

My baseline empirical approach applies a Heckman (1979) model to account for the self-selection of banks into holding state bonds. Buch et al. (2016) apply a similar approach to studying German banks' holdings of OECD government bonds. The model proceeds in two steps. First, it analyses the bank's decision whether to hold bonds from state *j* in quarter *q* using a probit model (selection equation, i.e. extensive margin). And second, if yes, it analyses the bank's decision on how much to hold (outcome equation, i.e. intensive margin). The inverse Mills ratio (*IMR*) calculated from the predicted likelihood of observing an exposure of bank *i* in state *j* at quarter *q* in the first stage corrects for self-selection of banks. In this set-up, the selection equation (1) and outcome equation (2) are specified as follows:

$$(1)\ \Pr\left(EXP_{ijq}=1\right)=\Phi(\alpha_1+\alpha_{1j}+\alpha_{1q}+\beta_{11}X'_{iq-1}+\beta_{12}X'_{jq}+\beta_{1h}home_{ij}+\beta_{1h}home_{ij}*Interaction_{ijq})$$

$$(2)\ Sov_{ijq}=\alpha_2+\alpha_{2jq}+\beta_{21}X'_{iq-1}+\beta_{2h}home_{ij}+\beta_{2h}home_{ij}*Interaction_{ijq}+\eta IMR+\varepsilon_{ijq}$$

Where EXP_{ijq} is an indicator variable equal to one if bank *i* (2,024 German banks) holds government bonds issued by a specific state *j* (16 states) at the end of quarter *q* (quarterly data from Q4:2005 to Q2:2014) and zero otherwise. Sov_{ijq} gives the corresponding log amount of banks *i*'s bond holdings of state *j* at quarter *q*. **Φ**(.) is the standard normal distribution function.

The variable $home_{ij}$ is an indicator variable that is equal to one if the issuer state is the state where the bank's headquarters is located. If a bank has more than one

headquarters (in the case of a few Landesbanken), I treat all headquarters locations as home states.

The main variable of interest is the interaction effect of the home indicator with bank variables and/or issuer specific variables $home_{ij} * Interaction_{ijq}$. These interactions give bank-issuer-time specific variables that allow testing for the moral suasion hypothesis. In the baseline specification in Table 6, the "home" indicator is interacted with an issuer-specific variable, the number of Stability Council criteria that a state breaches ("breaches of stability criteria") to test for the moral suasion hypothesis part (I).[20] In Section 4.2.2, the term is additionally interacted with the bank specific variable on state ownership ("state-owned") to test for the second part of the moral suasion hypothesis. All underlying (two-way) interaction effects are included for correct interpretation but usually not reported for the sake of brevity.

Since in principle all banks are able to hold home state debt and moral suasion may affect the extensive as well as the intensive margin, there is no obvious exclusion restriction for the Heckman model. Instead, it is identified based on functional form and on differences in the set of included dummies. The coefficient η on the IMR is significant in all specifications, confirming that it is important to control for self-selection of banks into holding state debt. Differences between state issuers over time, such as differences in placement activity or economic conditions, are controlled for by issuer-time fixed effects α_{2jq} in the outcome equation; only the differential effect between home and out-of-state banks can thus be identified.[21] The selection equation includes one-way issuer and time dummies only in order to avoid the incidental parameters problem in probit estimations.

At the same time, I control for the impact of bank-time specific variables that capture different business models of banks and variations in banks' demand for state bonds over time. These bank-specific control variables X_{iq-1} are lagged by one quarter and include

[20] As assessments by the Stability Council are available only from 2010Q4 onwards, all specifications include an indicator equal to one from 2010Q4 onwards (and interaction effects with this indicator are included where appropriate). While this is necessary to correctly interpret the interaction effects with the variable "Breaches of stability criteria", it is generally not reported for the sake of brevity. In a robustness test, I exclude the period before the establishment of the Stability Council in 2010Q4.

[21] The baseline impact of issuer-time variables could not be identified even in the absence of issuer-time fixed effect since, by construction, an increase in holdings of one bank has to result from a decrease in holdings from other banks (controlling for the amount outstanding and abstracting from non-bank or foreign investors which are of minor relevance in this market).

total assets, capitalization, deposit ratio, commitment ratio and a non-performing loan indicator. I control for mergers between banks using an indicator that is equal to 1 for the surviving bank in the quarter of the merger. The indicator is significantly positive in most specifications, reflecting a size effect for the surviving bank, and is not reported. For more information on the bank mergers and exits, see Section 3.1. Summary statistics of the variables are given in Table 5.

Fractional logit and fixed effects regressions

The Heckman specification studies the impact of moral suasion on banks' state bond holdings *in absolute terms*. Moral suasion behavior might also be reflected in large bond holdings of home state-owned banks *relative to the outstanding state bonds.* This approach focuses on the state's creditor structure and captures diversification in a state's investor base (Asonuma et al., 2015).

In an alternative specification I therefore use the bank's state bond holdings relative to the outstanding amount on an issuer level as the dependent variable. Since it is a proportion and does include a corner solution (i.e. the value zero), I use the pooled fractional logit model as proposed by Papke and Wooldridge (1996). The advantage of the fractional logit which uses the logistic link function is that it is fairly robust against misspecification (Papke and Wooldrige, 1996). The explanatory variables are specified as in Equation (1). Due to the incidental parameters problem in non-linear models, I do not include issuer-time dummies in these specifications. In a robustness check, I introduce one-way issuer and time dummies, which are less problematic as there are many banks per issuer and time (Papke and Wooldridge, 2008). Standard errors are clustered on the issuer-time level to account for the fact that the shares of banks in outstanding state bonds are negatively correlated.

I cross-check the results of the fractional logit model with ordinary least squares (OLS) regressions that do not account for the bounded nature of the dependent variable but can provide a good approximation (Papke and Wooldridge, 2008). Also, OLS regressions allow for the inclusion of high dimensional fixed effects and offer a straightforward interpretation of parameters as marginal effects(Papke and Wooldridge, 2008). Specifically, I use issuer-time, bank-time and bank-issuer fixed effects to control for unobserved heterogeneity between and within banks and the structural preference of

a bank for a specific state (identification through heterogeneity following Khwaja and Mian, 2005). The dependent and independent variables are the same as in the fractional logit case except that the dependent variable is multiplied by 100 (i.e. given in %) to transform the scale of the estimated coefficients. This specification allows me to identify the bank-issuer-time specific moral suasion effect.

4.2 Main Results

4.2.1 Differences between home and out-of-state banks

Results of the baseline Heckman model are shown in Table 6; for both specifications the first column gives the outcome equation and the second column the selection equation of the Heckman model. Column 3 includes two-way fixed effects at the issuer-time level that captures the heterogeneity at the state level such as differences in funding strategies of states and in economic conditions as well as events that are common to all states such as changes in the bund yield. Column 4 of Table 6 gives marginal effects for the selection equation to ease the economic interpretation of the coefficients.

The main results are threefold. First, home banks hold significantly more bonds issued by the state than out-of-state banks. Quantitatively, the volume of bond holdings is by about 49% larger if the bank is located in the issuer state (column 3).

Second, and in support of the moral suasion hypothesis, the state's fiscal condition has an opposite effect on the state bond holdings of home versus out-of-state banks. The latter hold fewer bonds issued by states that breach criteria of the Stability Council (see negatively significant parameter on "Breaches of stability criteria" in column 1). Home banks however hold more bonds if the home state breaches criteria of the Stability Council (see positively significant parameter on the interaction effect of "Home * Breaches of stability criteria" in columns 1 and 3). In fact, banks increase their home state bond holdings by 16% for each stability criterion that the home state breaches (column 3). Similarly, home banks are more likely to hold bonds when the state breaches stability criteria (column 4), while out-of-state banks tend to avoid exposure in these situations (column 2). This is in line with an effect of moral suasion on the extensive margin of banks' state bond holdings.

Third, Table 6 shows that bank characteristics matter in explaining banks' state bond holdings. Not surprisingly, there is a scale effect, as larger banks tend to hold more state bonds (in line with Buch et al., 2016, and Acharya and Steffen, 2015). Better capitalized banks, measured as balance sheet equity over unweighted assets, hold fewer state bonds. An increase in capitalization by one percentage point decreases the volume of bonds held by 5% (column 3). This might reflect lower incentives for well-capitalized banks (measured in unweighted terms) to load up on zero risk-weighted assets to support their regulatory capital ratio and is in line with findings by Acharya and Steffen (2015) for European banks. Contrary to the intuition that banks with a large deposit base rely less on state bonds as collateral for wholesale funding (Buch et al., 2016), I find that high deposit ratios are associated with higher state bond holdings of banks. One explanation could be that deposit-funded banks are more risk-averse and therefore favour comparatively safe assets such as German state bonds. This matches the result that riskier banks in terms of having a comparatively high non-performing loans ratio (upper quartile) hold fewer state bonds. The parameters on bank control variables remain very similar in all regressions and are therefore no longer reported in the following tables.

4.2.2 The impact of state ownership

This Section gives results on the impact of state ownership on banks' state bond holdings using a Heckman model in Table 7 and a fractional logit model as well as a high-dimensional fixed effects model in Table 8. All specifications include a set of bank control variables as specified in Table 6 (not reported) and control for unobserved heterogeneity at the issuer-time level (Table 7), at the issuer and time level (column 2 of Table 8) and at the issuer-time, bank-time and bank-issuer level (column 3 of Table 8).

The results from Tables 7 and 8 support the moral suasion hypotheses (part I and II) developed in Section 2.1. Home banks that are directly owned by the state are significantly more invested in their home state than other home banks. Column 1 of Table 7 shows that state bond holdings of state-owned home banks are about 89% higher than those of other home banks. Also, *state-owned* home banks hold a higher share of outstanding bonds compared to other home banks (columns 1 and 2 of Table 8).

In line with moral suasion, state-owned home banks hold even more home state bonds when the state breaches some criteria of the Stability Council (see positively significant parameter on "Home * State-owned * Breaches of stability criteria" in Tables 7 and 8). In economic terms, state-owned banks hold a 14% larger amount of home state bonds than other home banks and than state-owned banks from other states per breach of stability criteria (column 3 of Table 7). Relative to the outstanding amount of home state bonds, the share of state-owned banks in states that breach a stability criterion is 29 percentage points higher than the share of other home banks or state-owned banks from other states (column 3 of Table 8). Also, state-owned banks are more likely to hold home state bonds in these situations (column 4 of Table 7).

The underlying two-way interaction effect ("State-owned * Breaches of stability criteria" in column 3 of Table 7) shows that state-owned banks generally hold more bonds from states that breach stability criteria, not only from the home state. In terms of magnitude though, the effect is only one-third of the incremental *home* effect for state-owned banks (5% compared to 14%) and it is insignificant on the extensive margin. These findings suggest that moral suasion plays an important role in the decision of state-owned banks to hold any home state bonds when fiscal conditions are weak.

After controlling for the special role of state-ownership, home and out-of-state banks differ less in their holdings of bonds issued by weak states which is consistent with the hypothesis that moral suasion is more effective on state-owned banks (part II of the moral suasion hypothesis). In fact, the difference between home and out-of-state banks that are not state-owned becomes insignificant on the extensive margin of state bond holdings (column 4 of Table 7) and in the fractional logit model (columns 1 and 2 of Table 8).

Hence, home banks have larger holdings of home state bonds if the bank is directly owned by the state government and the state is breaching criteria of the Stability Council. Column 3 of Table 8 shows that this finding remains significant after controlling for unobserved heterogeneity at the bank-time level (e.g. time-varying demand of a bank for state bonds), at the issuer-time level (e.g. time-varying differences in issuing strategies or economic and fiscal conditions between states) and at the bank-issuer level (e.g. bank-specific preferences for the home state or for a particular issuer).

I find that home state-owned banks increase their state bond holdings more than other home banks or state-owned banks located in other states when the fiscal condition of the home state deteriorates (in terms of the number of stability criteria that are breached). Overall, the results are in line with moral suasion of home state-owned banks by state governments.

Discussion of endogeneity concerns

One potential concern is that state ownership might be endogenous to banks' holdings of state bonds if ownership by states is conditional on the importance of a bank for state funding. Several arguments mitigate this concern in this case. First, my baseline approach uses only the extensive margin of state ownership, i.e. an indicator whether a bank is owned by the state or not. State ownership of regional development banks and Landesbanken is a structural characteristic of the German banking system that persisted for a long time (De Marco and Macchiavelli, 2016). In contrast, banks adjust their state bond holdings frequently. It is thus unlikely that state ownership is a function of banks' state bond holdings.

Second, regional development banks are fully state-owned and their debt is guaranteed by the state such that further increases in the intensity of state ownership conditional on state bond holdings are not possible.

Third, I test for moral suasion using a restricted sample period from 2010 onwards (see Section 4.3.1). This smaller sample excludes the financial crisis, during which some Landesbanken have suffered large losses to their wholesale activities and have had to be recapitalized by their owners, i.e. the states and the savings banks associations (Puri et al., 2011). Excluding the financial crisis eliminates all changes in the state ownership indicator making it pre-determined for the subsequent sample. Results on moral suasion remain robust.

Finally, to further corroborate this argument, I test whether weakly capitalized state-owned banks hold more home state bonds presumably to increase bailout probability (see Section 4.3.2 and column 1 of Table 13). I find that capitalization has no significant effect on home state bond holdings of state-owned banks. In fact, *highly* capitalized state-owned banks generally hold more state bonds, irrespective of the issuer.

The intensity of state control

Based on these arguments, I extend the analysis beyond the binary state ownership indicator and account for differences in the intensity of government control within the group of state-owned banks (for descriptive statistics, see Table 2). Table 9 gives the results from a Heckman model using a sample of state-owned banks only in columns 1 to 3 and on 39 large banks (including the 23 state-owned banks) in column 4 for which data on supervisory board members could be gathered. Bank control variables (as specified in Table 6) and issuer-time dummies are included.

State-owned banks hold more bonds issued by the home than by other states (column 1 of Table 9) but this preference for home bonds is smaller for banks that are owned by more than one state (column 2 of Table 9). The latter result is in line with a stronger influence of political agents that are homogenous. Column 3 of Table 9 shows that the *degree* of state ownership matters. Banks hold more home state bonds if a larger share of bank equity is owned by the home state. Finally, banks with a larger share of state politicians in their supervisory boards also hold more home state bonds. To sum up, the preference for home state bonds increases with the degree of state control over a bank.

4.3 Additional results

4.3.1 Robustness tests

My main findings remain robust to different measures for a state's fiscal situation, different computation methods of standard errors, to constraining the sample to the period after the introduction of the Stability Council, and to excluding city states.

Table 10 shows results from the intensive margin of a Heckman model using alternative measures for a state's fiscal condition. Columns 1 to 4 of Table 10 use the structural net lending / borrowing, the credit funding ratio, the interest expense to tax income ratio and the outstanding state debt respectively. In contrast to the composite, baseline measure "breaches of stability criteria", these indicators measure the fiscal strength of each state on a continuous scale and thus address the concern that the findings rely on relatively few breaches only. All four fiscal measures confirm the findings on moral suasion from the baseline results: state-owned banks hold more home bonds than other home banks or state-owned banks located in other states, if the home

state is in a weak fiscal condition (columns 1 to 4 of Table 10). Furthermore, the information whether a state breaches the stability criteria has explanatory power for banks' state bond holdings even after controlling for the state debt burden (column 5 of Table 10). This supports the use of my baseline fiscal measure.

In the baseline estimations, I use heteroscedasticity-robust standard errors. The idea behind this is that banks decide whether they want to invest in a particular state bond or not without having a binding portfolio constraint. The portfolio constraint is alleviated since German state bonds can be used as collateral with the Eurosystem or in the interbank market to obtain additional funding. If, however, banks target a fixed size of their total state bond portfolio, the decision to invest in a particular bond depends on all other state bonds. As a result, a bank's bond holdings might be correlated between states. In a robustness test I allow for this by clustering on the bank-time level and results remain robust (column 1 of Table 11). Furthermore, if banks hold state bonds until maturity, there is persistence in state bond holdings over time. In column 2 of Table 11, I therefore cluster on the bank-issuer level and find that parameter estimates remain similar but standard errors increase and thus effects become insignificant.[22]

Next, assessments of stability criteria are only available after the introduction of the Stability Council. In my baseline specifications, I account for this through interaction effects with an indicator that is equal to one from the establishment of the Stability Council onwards. Results are also robust against excluding the period before the Stability Council (column 3 of Table 11).

Finally, I test whether my results are driven by state-owned banks located in the so-called "city states" (i.e. Berlin, Bremen and Hamburg). These states are special since they consist of cities only. If their fiscal situation is structurally weaker due to larger expenditures per capita and if, at the same time, state-owned banks in these states are large relative to the outstanding volume of state bonds, banks located in city states might be driving my results. However, columns 4 and 5 of Table 11 show that the findings on moral suasion remain nearly unchanged when I exclude banks located in city states or restrict the sample to banks from city states respectively. More generally, my findings cannot be explained by large banks that happen to be located in weak

[22] Due to lower degrees of freedom, I do not include any fixed effects in this specification but follow the baseline specification from column 1 of Table 6.

states, since my results hold after controlling for bank-issuer unobserved heterogeneity in Table 8.

4.3.2 Alternative hypotheses

Besides moral suasion, the theoretical literature suggests further incentives for banks to invest in home government debt which I address below.

First, banks might hold more home government bonds in order to shift risks from bank owners to debtors (Ari, 2016) or taxpayers (Farhi and Tirole, 2016). In the model of Farhi and Tirole (2016), weak banks load up on risky home sovereign debt in order to maximize the value of the "bailout put", i.e. the taxpayers' money that banks can extract in a bailout. While asset classes other than German state bonds seem more apt to engage in risk taking, the bailout probability of a bank may increase with home government bond holdings as long as the bailout capacity of the government is sufficient (Farhi and Tirole, 2016). In fact, Koetter and Popov (2017) show that German savings banks are more likely to receive a bailout when they have higher holdings of home state bonds. Therefore, Table 12 tests whether weakly capitalized banks or "high credit risk" banks have higher holdings of home government bonds, especially in fiscally weak states. Bank capitalization is measured as capital over unweighted assets to ensure that it is not affected by the zero risk weights of state bonds. "High credit risk" banks are banks in the upper quartile of the non-performing loan ratio distribution in the respective year.

I do not find evidence for the hypothesis on increasing bailout probability, since bank capitalization and credit risk does not significantly affect the bank's home state bond holdings (columns 1 and 3 of Table 12 respectively). Furthermore, *well capitalized* banks - not weakly capitalized banks - have larger bond holdings when the state breaches stability criteria, irrespective of whether it is the home or another state (see significantly positive coefficient on "Capitalization (%) * Breaches of stability criteria" and insignificant coefficient on "Home * Capitalization (%) * Breaches of stability criteria" in column 2 of Table 12). This result is in line with findings by Ongena et al. (2016) on large European banks from countries experiencing a sovereign debt crisis. Focusing on home government debt only, they show that well capitalized banks – not weakly capitalized banks – lend more when the government is faced with a high funding need.

Overall, after controlling for bank riskiness, my results remain in line with moral suasion as reflected in the positively significant parameter on the interaction effect "Home * State-owned * Breaches of stability criteria" in columns 2 and 4 of Table 12.

Second, I test whether state-owned banks hold more home state bonds when their capitalization (measured as bank equity over unweighted assets) is low. The idea behind this is that lowly-capitalized banks could engage in political endearing by financing the home state and thereby increase the likelihood of being bailed out. As discussed in Section 4.2.2 and due to direct state ownership or full-fledged state guarantees (for development banks), the incentives for state-owned banks to engage in such behavior should be lower than for savings banks that may need to bridge a political gap (Koetter and Popov, 2017). Still, I check whether weakly capitalized state-owned banks drive my results and find that the level of a state-owned bank's capitalization does not significantly affect its home state bond holdings (see insignificant coefficient on "Home * State-owned * Capitalization (%)" in column 1 of Table 13). Generally, *highly* capitalized state-owned banks hold more (home and other) state bonds (see positive coefficient on "State-owned * Capitalization (%)"). In this respect, state-owned banks do not differ from the average German bank that shows no sign of risk-shifting through state bonds (Table 12).

Third, the lack of good private lending opportunities rather than moral suasion could be behind banks' large home state bond holdings in times of weak fiscal conditions (for a theoretical model, see Gennaioli et al., 2014). Since the home economy is likely to be in a bad state when fiscal fundamentals are weak, home government bonds may be used to store liquidity for future profitable lending opportunities (Gennaioli et al., 2014). In column 2 of Table 13, I test whether German banks hold more home state bonds when their lending to the private sector is low (i.e. their claims on banks and non-banks relative to total assets are low). Contrary to the lending opportunity hypothesis though, banks with a *higher* loan ratio hold more home than other state bonds.

One explanation for this finding might be that state-owned banks expand their private lending activities in weak fiscal situations in order to fulfil their mandate to promote the economic and social development within their home state. At the same

time, these banks may also increase their holdings of home government bonds in weak fiscal situations to support the state government that is in need of funding.

Furthermore, a preference for home over foreign assets has often been explained by information asymmetries (Portes et al., 2001). Information costs for the regional government bond market are likely to be higher than for the federal government level given the absence of a rating for 5 out of 16 German states (Q4:2013) and the lower availability of macroeconomic and fiscal data. When testing for the impact of information asymmetries between home and out-of-state banks, I make use of the establishment of the Stability Council in 2010. Column 3 of Table 13 shows that an increase in public information through the establishment of the Stability Council reduced the home preference only in "sound" states. In "weak" states the home effects gets larger when negative information is available through the publications of the Stability Council (the positive significant parameter on "Home * Breaches of stability criteria" is larger than the negative parameter on "Home * Stability Council"). Out-of-state banks have lower state bond holdings in these situations. Hence, while potential information advantages of home banks are reduced through the publications of the Stability Council, home banks in weak states hold *more* state bonds than out-of-state banks.

Finally, since my analysis is on the regional instead of the national level, I can exclude two other hypotheses that have been suggested in the literature: banking supervision (Farhi and Tirole, 2016) and redenomination risk (Battistini et al., 2014). German state governments do not have any bank supervisory powers that they could use to increase home bias. And while the perceived risk of a break-up of the euro area might have driven the home bias at the national level in European sovereign debt markets (Battistini et al., 2014), this would not have introduced redenomination risk in the German subnational state government bond market.

All in all, after testing for alternative hypotheses, evidence remains in line with moral suasion by state governments on home state-owned banks.

5 Conclusion

This study tests the hypothesis that governments use moral suasion on home (state-owned) banks to hold home government debt in the context of the German regional government bond market. Thereby, it makes use of differences in the states' fiscal condition as measured by the stability criteria of the German Stability Council as well as differences in bank location and ownership. This paper is complementary to recent cross-country studies on moral suasion and mitigates differences in the institutional and regulatory framework by focusing on the regional level. The empirical methodology controls for self-selection of banks into holding state bonds and uses the variation in state bond holdings between banks and within banks across different issuers over time to control for alternative incentives of banks to hold (home) state bonds.

The main findings are the following. Home banks are more likely to hold home state bonds and hold a significantly larger volume of these bonds if the home state breaches criteria of the Stability Council. In contrast, banks located in other states (out-of-state banks) hold fewer state bonds in this situation. Banks directly owned by the state government (i.e. Landesbanken and regional development banks) have larger home state bond holdings than other home banks and state-owned banks located in other states. Within the group of state-owned banks, the preference for home state bonds is larger if the state owns a larger share of the bank's equity and if there are more state politicians on the supervisory board. Finally, state-owned banks that are located in states that breach criteria of the Stability Council hold more home state bonds than their counterparts in fiscally sound states. These results are in line with moral suasion by state governments on home state-owned banks.

The findings remain after controlling for bank characteristics such as size, capitalization, deposit ratio and credit risk, for unobserved time-varying heterogeneity at the issuer level, and for several alternative hypotheses such as risk-shifting by banks (Farhi and Tirole, 2016), information asymmetries (Portes et al., 2001) or alternative lending opportunities (Gennaioli et al., 2014). The results are robust to using different empirical models, different measures of fiscal strength and controlling for unobserved time-varying heterogeneity at the issuer and at the bank level and time-constant heterogeneity at the bank-issuer level.

My findings have implications for risk-sharing between German states. I find that state-owned banks hold more bonds issued by (home and other) states that breach the criteria of the Stability Council. While the effect is largest for home state bonds, it is significantly positive for other states as well. As a result, exposures of state-owned banks may introduce another channel of contagion between German states beyond the institutional channels such as the fiscal equalization scheme. For the European context, Kirschenmann, Korte and Steffen (2016) show that banks' cross-border exposures increase correlation between default risks of sovereigns.

Finally, soft borrowing constraints for regional governments are a major issue in federal unions, including Germany (Baskaran, 2012). The publications of the German Stability Council can reinforce fiscal discipline if bond market participants take differences in the states' fiscal strength into account. Indeed, I find that out-of-state banks that are not state-owned hold fewer bonds from states that breach criteria of the Stability Council. However, home (state-owned) banks hold more state bonds in these situations and thereby potentially mitigate market discipline. The research on the role of market discipline in federal systems (Heppke-Falk and Wolff 2008; Lemmen, 1999) could benefit from taking the heterogeneity in the investment incentives of market participants into account.

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Data Appendix

List of state-owned banks

This list gives the names of German banks that are directly owned by a state government (fully or only a fraction of bank equity) and are included in my analysis as "state-owned".

Bayerische Landesbank
Bremer Aufbau-Bank
Bremer Landesbank
Hamburgische Investitions- und Foerderbank (prev: Hamburgische Wohnungsbaukreditanstalt)
HSH Nordbank
Investitions- und Strukturbank Rheinland-Pfalz (ISB)
Investitionsbank Berlin
Investitionsbank des Landes Brandenburg
Investitionsbank Schleswig-Holstein
Landesbank Baden-Wuerttemberg
Landesbank Berlin (until 2007; then owned by savings association)
Landesbank Hessen-Thueringen
Landesbank Saar
Landesbank Sachsen (until 2008, then susidiary of LBBW)
Landeskreditbank Baden-Wuerttemberg
LfA Foederbank Bayern
Norddeutsche Landesbank
NRW.Bank
Saarlaendische Investitionskreditbank
Saechsische Aufbaubank
Thueringer Aufbaubank
WestLB (until mid 2012; then Portigon as legal sucessor)
Landestreuhandbank Rheinland-Pfalz (until end 2011; then merged with ISB Rheinland-Pfalz)

Definitions of variables and data sources

Sovereign bond portfolios

Exposure to issuer state EXP: a dummy variable which is equal to one if the bank *i* holds bonds issued by state *j* in quarter *t* and zero otherwise. The information is based on the *Securities Holdings Statistics* of the Deutsche Bundesbank.

State Bond Holdings SOV: notional value of a bank's state bond holdings of state *j* in quarter *t*. Data are obtained from the *Securities Holdings Statistics* of the Deutsche Bundesbank. Individual security data are aggregated to the issuer state level by summing up overall ISINs per state, bank and quarter. Only state bonds held on banks' own accounts are included, covering both the banking book and the trading book.

Political economy variables

Home: a dummy variable which is equal to one if the bank's headquarters is located in the issuer state. If a bank has more than one headquarters (in the case of a few Landesbanken), I treat all headquarters locations as home states. But results are robust to defining just one headquarters following the bank supervisory database. The information is based on bank supervisory data of the Deutsche Bundesbank and Bloomberg.

State-owned: a dummy variable which is equal to one if the bank is directly owned by a state. These include some Landesbanken and state development banks. For a complete list of state-owned banks see Appendix A1. Information is taken from supervisory data on bank ownership and from public homepages of banks.

State-level variables

State debt: state debt per capita (in thd euro). All debt instruments including bonds and loans are included. Only debt associated with the core budget ("Kernhaushalt") is considered. Additional budgets ("Extrahaushalt") contain spending related to bad banks and public enterprises that would distort my analysis. The information is collected from the German Federal Statistical Office and in annual frequency.

State bonds outstanding: volume of outstanding state bonds per issuer (in mn eur). The information is collected from the German Ministery of Finance and in annual frequency.

Stability Council: a dummy variable which is equal to one after the introduction of the German Stability Council in the first quarter of 2010.

Breaches of stability criteria: the number of stability criteria that are breached according to the German Stability Council. This ordinal variable ranges from zero to eight. The Stability Council assesses four criteria in the following two dimensions: current budgetary situation (covering the current and last two years) and future fiscal planning (covering the next four years). Criteria include structural net lending/borrowing (per capita), credit funding ratio (i.e. net borrowing to fiscal budget) (%), interest expense to tax income ratio (%) and outstanding debt (per capita). The information is collected from the annual online publications (in German) of the German Stability Council. For more information on the Stability Council, see http://www.stabilitaetsrat.de/EN/Home/home_node.html.

Bank-level variables

Balance sheet total: log of total assets (in thsd euro) of the bank. Data are taken from the *Monthly Balance Sheet Statistics* of the Deutsche Bundesbank. It is a measure for bank size.

Capitalization: ratio of equity capital (= subscribed capital + reserves - published losses) to total assets (in %), obtained from the *Monthly Balance Sheet Statistics* of the Deutsche Bundesbank. This variable reflects the risk-bearing capacity of banks.

Commitments ratio: ratio of commitments (= contingent liabilities + placing and underwriting commitments + irrevocable lending commitments) to total assets plus commitments (in %) obtained from the *Monthly Balance Sheet Statistics* of the Deutsche Bundesbank.

Deposit ratio: ratio of overnight deposits from household and non-financial firms to total assets (in %) obtained from the *Monthly Balance Sheet Statistics* of the Deutsche Bundesbank.

Loan ratio: ratio of claims on banks and non-banks (= loans + advances, including received bills) to total assets (in %) obtained from the *Monthly Balance Sheet Statistics* of the Deutsche Bundesbank.

NPL (4th quartile): an indicator equal to one if bank is in the 4th quartile of the ratio of non-performing loans to total loans (in %) in the respective year as obtained from the annual financial statements submitted to the Deutsche Bundesbank. To account for the statistical breaks in prudential definitions of NPL, I use this relative NPL indicator instead of comparing NPL ratios over time.

Tables and Figures

Figure 1: Funding structure of German states

This Figure shows the decomposition of the aggregate outstanding debt of German states by debt type (i.e. bonds, loans from banks and other debt) over time. Data are taken from Deutsche Bundesbank.

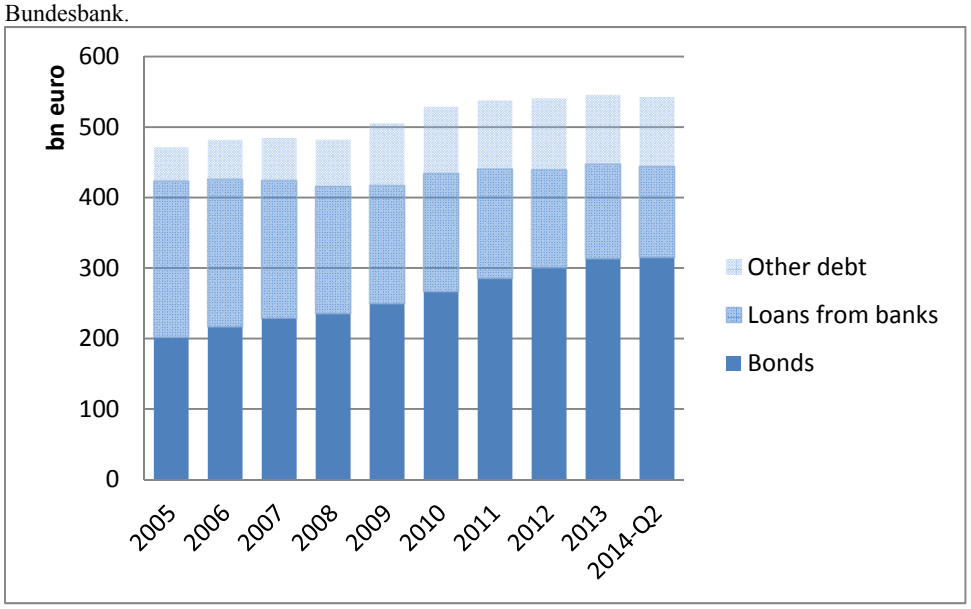

Figure 2: Heterogeneity between states in the fiscal indicators

This Figure shows the distribution of four fiscal indicators over time using boxplots. The upper (lower) hinge of the box shows the 75th (25th) percentile of the distribution. The median is indicated by the horizontal line within a box and the lines give the upper and lower adjacent values respectively. Outside values are not shown. The upper left panel shows the interest expense to tax income (in %), the upper right panel the state debt level Per Capita (in thsd euro), the lower left panel the credit funding ratio (i.e. net borrowing to fiscal budget, in %) and the lower right panel the structural net borrowing Per Capita (in thsd euro). Data are collected from the public reports by the Stability Council that can be accessed at http://www.stabilitaetsrat.de/EN/Home/home_node.html.

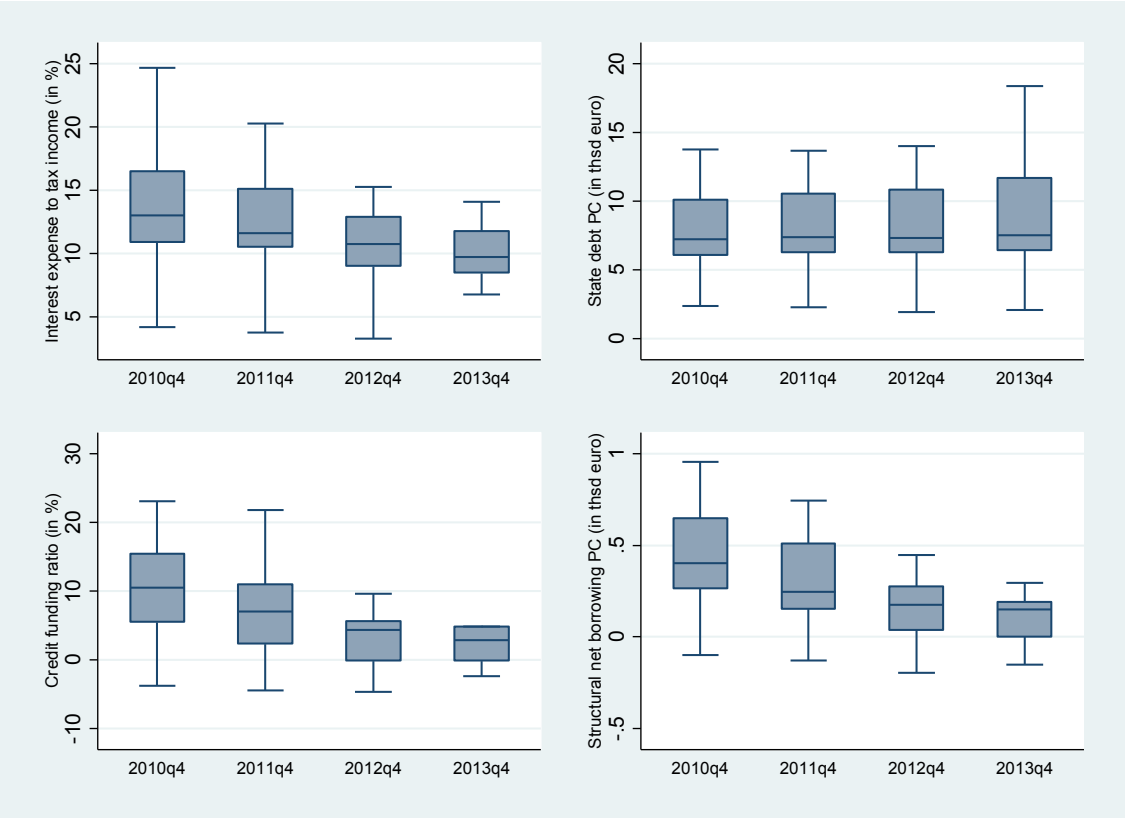

Table 1: Assessments by the German Stability Council

This Table shows the variation in assessments of the German Stability Council between states, i.e. the variation in the variables "breaches of stability criteria". Columns give the number of stability criteria that are breached by the issuer state. The variable ranges from zero to eight, i.e. four criteria in two dimensions each (current fiscal situation and future budgetary planning). Criteria include structural net lending/borrowing (per capita), credit funding ratio (%), interest expense to tax income ratio (%) and outstanding debt (per capita). Each observation in the Table gives the assessment of one year. For each state there are four observations, i.e. annual assessments of the Stability Council from 2010-2013.

	Number of stability criteria that are breached								
Issuer	0	1	2	3	4	5	6	7	8
Baden-Wuerttemberg	4	0	0	0	0	0	0	0	0
Bavaria	4	0	0	0	0	0	0	0	0
Berlin	0	0	2	0	1	1	0	0	0
Bremen	0	0	0	0	0	0	0	1	3
Hamburg	2	2	0	0	0	0	0	0	0
Hesse	1	3	0	0	0	0	0	0	0
Lower Saxony	4	0	0	0	0	0	0	0	0
Northrhine-Westphalia	3	1	0	0	0	0	0	0	0
Rhineland Palatinate	1	3	0	0	0	0	0	0	0
Saarland	0	0	0	0	0	0	0	1	3
Schleswig Holstein	0	0	1	1	1	1	0	0	0
Mecklenburg Western Pomerania	4	0	0	0	0	0	0	0	0
Brandenburg	4	0	0	0	0	0	0	0	0
Saxony-Anhalt	0	2	2	0	0	0	0	0	0
Thuringia	4	0	0	0	0	0	0	0	0
Saxony	4	0	0	0	0	0	0	0	0
Total (=64)	35	11	5	1	2	2	0	2	6

Table 2: Intensity of state government control over state-owned banks

This Table shows descriptive statistics for the intensity of state government control over state-owned banks. The first row shows the share of bank capital owned by the state (in %). The subgroup of regional development banks are fully state-owned, which is shown in italics in the second row. The following rows report the owners of state-owned banks other than the state governments. Other proxies for the intensity of state control are an indicator variable on whether the bank is owned by more than one state and the share of state politicians on the supervisory board (in %). Column 3 gives the share of the respective banks in the total assets of the German banking system (in %). For instance, banks that are owned by several states account for 9.12% of the banking system's assets. The Table shows unweighted averages for the 20 state-owned banks at the second quarter of 2014.

	(1)	(2)	(3)
	Mean	Std	Size of banks in % of banking system assets
Share owned by state (in %)	83.17	25.88	16.96
Other owners of state-owned banks			
Savings association (in %)	10.68	20.58	
Other public banks (in %)	2.84	12.24	
Other (in %)	3.31	7.82	
Owned by several states (1/0)	0.20	0.41	9.12
State politicians on supervisory board (in %)	44.00	25.00	

Table 3: German banks' government bond portfolios

This Table shows the importance of state bonds in the government bond portfolios of German banks. Unweighted averages within each banking group are reported. The group of cooperative banks include the head institutions. Column 1 shows total assets in bn euro, Columns 2 and 3 the overall government bond portfolio and Columns 4 and 5 holdings of German central government bonds. Columns 6 and 7 give the state bonds holdings per banking group. Column 8 shows the number of banks per banking group. Data sources: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, *Securities Holdings Statistics* and *Monthly Balance Sheet Statistics*, own calculations, 1,732 banks as of Q2:2014. Data are for the second quarter of 2014.

	Total assets (TA)	Government bond portfolio (Gov PF)		German central government bond holdings		German state bond holdings		No of banks
	bn euro	bn euro	*in % of TA*	bn euro	*in % of Gov PF*	bn euro	*in % of Gov PF*	No
Commercial banks	15.69	0.54	*3%*	0.02	*5%*	0.25	*46%*	167
State-owned banks	63.54	5.13	*8%*	0.17	*3%*	2.06	*40%*	20
Savings banks	2.65	0.11	*4%*	0.00	*3%*	0.06	*57%*	417
Cooperative banks	0.97	0.04	*4%*	0.00	*1%*	0.01	*33%*	1,076
Mortgage banks	24.67	3.26	*13%*	0.01	*0%*	0.66	*20%*	17
Other MFI	29.39	1.03	*3%*	0.00	*0%*	0.42	*41%*	35
All banks	4.33	0.21	*3%*	0.01	*3%*	0.09	*41%*	1,732

Table 4: Home bias in banks' state bond portfolios

This Table shows descriptive statistics on the home bias in banks' state bond portfolios measured as HomeBias_it=1-(The group of cooperative banks include the head institutions. Share of foreign state bonds in portfolio_it)/(Share of foreign bonds in German state bond markets_t). Column 1 gives the mean of the home bias measure in the respective banking group, Column 2 the standard deviation and Column 3 the number of banks in each banking group. Banks that do not have any state bond holdings in 2014 Q2 are exlcuded because the home bias is not defined in these cases. Data sources: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, *Securities Holdings Statistics* and *Monthly Balance Sheet Statistics*, own calculations, 933 banks. Data are for the second quarter of 2014.

	(1)	(2)	(3)
Bank type	Home bias		No of banks
	mean	sd	
Commercial banks	0.02	0.22	72
State-owned banks	0.19	0.29	19
Savings banks	0.07	0.30	319
Cooperative banks	0.08	0.33	486
Mortgage banks	0.00	0.18	16
Other MFI	0.14	0.28	21
All banks	0.08	0.31	933

Table 5: Descriptive statistics for Heckman model estimations

This Table shows in Panel A descriptive statistics for the dependent variables in selection and outcome equation and in Panel B the complete observations of issuer-specific variables in the selection and the outcome equations. Panel C shows the descriptive statistics for bank variables. The variables are defined in the Appendix A2. The variable "breaches of stability criteria" captures the number of stability criteria (0-8) that a state breaches in the respective year as reported by the German Stability Council. For a definition of all variables, see data appendix. Data sources: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, *Securities Holdings Statistics* and *Monthly Balance Sheet Statistics*, Q4:2005 – Q2:2014, own calculations, 2,024 banks (unbalanced), and 16 issuer states. I include the 25th and 75th percentile of variables for the outcome equation in order to better assess the magnitude of the estimated coefficients in the outcome equation.

	Selection equation 1,031,203		Outcome equation 89,171			
	Mean	Stdv	Mean	Stdv	p25	p75
Panel A: Dependent variables						
Holding bonds issued by state *j* (dummy)	0.09	0.28				
Volume held of bonds issued by state *j* (ln)			15.97	1.74	14.73	16.99
Volume held of bonds issued by state *j* (euro bn)			0.05	0.22	0.00	0.02
Panel B: State-specific variables						
State bonds outstanding	13.81	16.35	27.14	22.15	9.16	34.75
State debt (thd euro PC)	8.61	7.43	9.45	9.66	6.08	9.00
Stability Council	0.41	0.49	0.55	0.50		
Breaches of stability criteria	0.68	1.86	0.65	1.51		
Home	0.06	0.24	0.12	0.33		
Panel C: Bank-specific variables						
Balance sheet total (ln)	13.18	1.59	14.62	2.04	13.25	15.52
Capitalization (%)	6.37	5.78	5.13	2.62	4.07	5.92
Deposit ratio (%)	26.53	12.94	23.64	15.19	12.50	34.60
Commitment ratio (%)	5.21	3.62	5.64	4.05	3.12	6.99
NPL (4th quartile)	0.25	0.43	0.21	0.41		

Table 6: Differences between home and out-of-state banks

This Table shows regression results for estimating the determinants of banks' investments in state bonds using a Heckman model. The log of bank i's sovereign bond holdings of state j is the dependent variable in the outcome equation. An indicator equal to one when observing that bank i holds bonds of state j is the dependent variable in the selection equation. An indicator that is equal to one from the introduction of the Stability Council onwards is included (stand-alone and interacted with home indicator) but not reported. The variable "breaches of stability criteria" captures the number of stability criteria (0-8) that a state breaches in the respective year as reported by the German Stability Council. For a definition of all variables, see data appendix. Fixed effects are included as specified in the lower part of the Table. The inverse Mills ratio (IMR) is obtained from the extensive margin and corrects for self-selection. Data sources: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, *Securities Holdings Statistics* and *Monthly Balance Sheet Statistics*, Q4:2005 – Q2:2014, own calculations. Marginal effects for the extensive margin are reported in Column 4. ***, ** and * indicate significance at the 1%, 5% and 10% level. Robust standard errors are shown in brackets.

	(1)	(2)	(3)	(4)
	Intensive margin	Extensive margin	Intensive margin	Extensive margin (Marginal Effects)
Home	0.317***	0.323***	0.485***	0.025***
	(0.025)	(0.010)	(0.029)	(0.001)
State bonds outstanding	0.032***	0.022***		
	(0.001)	(0.000)		
Breaches of stability criteria	-0.008***	-0.015***		
	(0.003)	(0.001)		
Home * Breaches of stability criteria	0.152***	0.013	0.155***	0.002**
	(0.016)	(0.008)	(0.019)	(0.001)
Balance sheet total (ln)	1.022***	0.322***	1.195***	0.027***
	(0.017)	(0.001)	(0.021)	(0.000)
Capitalization (%)	-0.033***	-0.025***	-0.049***	-0.002***
	(0.002)	(0.001)	(0.003)	(0.000)
Deposit ratio (%)	0.007***	0.007***	0.010***	0.001***
	(0.001)	(0.000)	(0.001)	(0.000)
Commitment ratio (%)	-0.037***	-0.007***	-0.040***	-0.001***
	(0.001)	(0.001)	(0.001)	(0.000)
NPL (4th quartile)	-0.116***	-0.049***	-0.140***	-0.004***
	(0.010)	(0.005)	(0.011)	(0.000)
Constant	-1.724***	-6.276***	-4.844***	
	(0.392)	(0.025)	(0.458)	
Observations	89,171	1,031,203	89,171	1,031,203
FE	No	No	Issuer-Time	Issuer, Time
Inverse Mills ratio (IMR)	1.379		1.994	
Standard deviation of IMR	0.0698		0.0810	

Table 7: Differences between state-owned and other banks

This Table shows regression results for estimating the determinants of banks' investments in state bonds using a Heckman model and distinguishing between state-owned and other banks. The log of bank i's sovereign bond holdings of state j is the dependent variable in the outcome equation. An indicator equal to one when observing that bank i holds bonds of state j is the dependent variable in the selection equation. The variable "breaches of stability criteria" captures the number of stability criteria (0-8) that a state breaches in the respective year as reported by the German Stability Council. For a definition of all variables, see data appendix. Fixed effects and bank control variables are included as specified in the lower part of the Table. The inverse Mills ratio (IMR) is obtained from the extensive margin and corrects for self-selection. Data sources: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, *Securities Holdings Statistics* and *Monthly Balance Sheet Statistics*, Q4:2005 – Q2:2014, own calculations. ***, ** and * indicate significance at the 1%, 5% and 10% level. Robust standard errors are shown in brackets.

	(1)	(2)	(3)	(4)	(5)
	Baseline		Split by Stability Council assessment		
	Intensive margin	Extensive margin	Intensive margin	Extensive margin	Extensive margin (Marginal Effects)
Home	0.452***	0.296***	0.444***	0.295***	0.024***
	(0.029)	(0.010)	(0.029)	(0.010)	(0.001)
State-owned bank	-0.269***	0.074***	-0.378***	0.072***	0.006***
	(0.031)	(0.016)	(0.041)	(0.021)	(0.002)
Home * State-owned bank	0.886***	0.386***	0.852***	0.455***	0.037***
	(0.095)	(0.060)	(0.120)	(0.073)	(0.006)
Home * Breaches of stability criteria			0.092***	-0.004	-0.000
			(0.021)	(0.010)	(0.001)
State-owned * Breaches of stability criteria			0.047***	0.013	0.001
			(0.017)	(0.009)	(0.001)
Home * State-owned * Breaches of stability criteria			0.135**	0.115***	0.009***
			(0.053)	(0.030)	(0.002)
Constant	-4.983***	-6.189***	-4.699***	-6.191***	
	(0.464)	(0.030)	(0.457)	(0.030)	
Observations	89,171	1,031,203	89,171	1,031,203	1,031,203
Bank control variables	Y	Y	Y	Y	Y
FE	Issuer-Time	Issuer, Time	Issuer-Time	Issuer, Time	Issuer, Time
Inverse Mills ratio (IMR)	2.002		1.950		
Standard deviation of IMR	0.0821		0.0808		

Table 8: Alternative empirical approaches

This Table shows regression results for estimating the determinants of banks' investments in state bonds relative to outstanding state bonds using fractional data response models and fixed effects regressions. The proportion of state bond holdings relative to the outstanding state bonds is the dependent variable in Columns 1 and 2 and multiplied by 100% in Columns 3. The variable "breaches of stability criteria" captures the number of stability criteria (0-8) that a state breaches in the respective year as reported by the German Stability Council. For a definition of all variables, see data appendix. Fixed effects, underlying interaction effects and bank control variables are included as specified in the lower part of the Table. Data sources: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, *Securities Holdings Statistics* and *Monthly Balance Sheet Statistics*, Q4:2005 – Q2:2014, own calculations. ***, ** and * indicate significance at the 1%, 5% and 10% level. Standard errors clustered at the issuer-time level are shown in brackets.

	(1)	(2)	(3)
	Fractional logit	Fractional logit	OLS regression
	Proportion including zeros	Proportion including zeros	Proportion (in %) including zeros
Home	0.299***	0.509***	
	(0.082)	(0.088)	
Home * State-owned bank	0.744***	0.661***	
	(0.116)	(0.121)	
Home * Breaches of stability criteria	0.010	0.003	0.006***
	(0.049)	(0.042)	(0.001)
State-owned * Breaches of stability criteria	0.081***	0.087***	0.046***
	(0.013)	(0.014)	(0.013)
Home * State-owned * Breaches of stability criteria	0.120**	0.109***	0.285***
	(0.049)	(0.042)	(0.029)
Constant	-21.496***	-21.721***	
	(0.144)	(0.163)	
Observations	1,029,507	1,029,507	1,036,067
Bank control variables	Y	Y	Y
FE	No	Issuer, Time	Issuer-Time; Bank-Time; Bank-Issuer
Interactions effects	Y	Y	Y
R-squared			0.366

Table 9: Intensity of government control on state-owned banks

This Table shows regression results for estimating the impact of state control on banks' state bond holdings using a Heckman model. The log of bank i's sovereign bond holdings of state j is the dependent variable in the outcome equation. An indicator equal to one when observing that bank i holds bonds of state j is the dependent variable in the selection equation. For the sake of brevity, only the results from the intensive margin are reported. The variable "breaches of stability criteria" captures the number of stability criteria (0-8) that a state breaches in the respective year as reported by the German Stability Council. For a definition of all variables, see data appendix. Fixed effects and bank control variables are included as specified in the lower part of the Table. The inverse Mills ratio (IMR) is obtained from the extensive margin and corrects for self-selection. Only state-owned banks are included in columns 1 to 3; column 4 additionally includes 39 large banks for which supervisory board information was collected for the years 2013 and 2014. Data sources: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, *Securities Holdings Statistics* and *Monthly Balance Sheet Statistics*, Q4:2005 – Q2:2014, own calculations, except for Column 4 which covers Q1:2013 to Q2: 2014. ***, ** and * indicate significance at the 1%, 5% and 10% level. Robust standard errors are shown in brackets.

	(1)	(2)	(3)	(4)
	Baseline	Multiple state owners	Intensity of state ownership	Supervisory board membership
	Intensive margin	Intensive margin	Intensive margin	Intensive margin
Home	1.157***	1.776***	0.625***	0.653***
	(0.085)	(0.120)	(0.125)	(0.187)
Owned by several states		1.073***		
		(0.075)		
Home * Owned by several states		-1.026***		
		(0.159)		
Intensity of state ownership			-0.246***	
			(0.093)	
Home * Intensity of state ownership			0.959***	
			(0.190)	
State politicians in supervisory board (%)				-2.010***
				(0.338)
Home * State politicians in supervisory board (%)				2.690***
				(0.584)
Constant	-1.857	-2.858**	0.912	12.752***
	(1.345)	(1.258)	(1.214)	(1.012)
Observations	3,965	3,965	3,965	1,561
Bank control variables	Y	Y	Y	Y
FE	Issuer-Time	Issuer-Time	Issuer-Time	Issuer-Time
Inverse Mills ratio (IMR)	0.984	1.500	0.668	1.522
Standard deviation of IMR	0.139	0.133	0.128	0.269

Table 10: Robustness tests using different measures for the states' fiscal situation

This Table shows robustness results from a Heckman model using different measures for the fiscal situation of states. The log of bank i's sovereign bond holdings of state j is the dependent variable in the outcome equation. An indicator equal to one when observing that bank i holds bonds of state j is the dependent variable in the selection equation. For the sake of brevity, only the results from the intensive margin are reported. Columns 1-4 give the results for the structural net lending / borrowing, the credit funding ratio, the interest expense to tax income ratio and the outstanding state debt respectively as fiscal variables on the issuing state. Data for these variables are taken from the publications of the Stability Council and thus are available for 2010Q4 - 2014Q2 only. Column 5 uses outstanding state debt as provided by statistical offices and is thus available for the entire sample period. The variable "breaches of stability criteria" captures the number of stability criteria (0-8) that a state breaches in the respective year as reported by the German Stability Council. For a definition of all variables, see data appendix. Issuer-time fixed effects, bank control variables and all necessary two-way interaction effects are included. The inverse Mills ratio (IMR) is obtained from the extensive margin and corrects for self-selection. Data sources: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, *Securities Holdings Statistics* and *Monthly Balance Sheet Statistics*, Q4:2005 – Q2:2014, own calculations, in Columns 4-5 and the period from Q4:2010 to Q2:2014 in Columns 1-3 due to data availability. ***, ** and * indicate significance at the 1%, 5% and 10% level. Robust standard errors are shown in brackets.

	(1)	(2)	(3)	(4)	(5)
Fiscal variables	Structural net lending/borrowing	Credit funding ratio	Interest expense to tax income ratio	Outstanding state debt (thd eur PC)	Outstanding state debt (thd eur PC)
	Intensive margin	Intensive margin	Intensive margin	Intensive margin	Intensive margin
Home	0.612***	0.611***	0.410***	0.364***	0.361***
	(0.042)	(0.037)	(0.064)	(0.029)	(0.031)
Home * State-owned bank	0.630***	0.575***	0.153	0.879***	0.797***
	(0.146)	(0.148)	(0.291)	(0.127)	(0.147)
Home * Fiscal variable	-0.001***	-0.040***	0.003	0.011***	0.009***
	(0.000)	(0.005)	(0.006)	(0.003)	(0.003)
State-owned bank * Fiscal variable	0.000***	0.022***	0.025***	0.027***	0.026***
	(0.000)	(0.006)	(0.008)	(0.003)	(0.003)
Home * State-owned bank * Fiscal variable	0.003***	0.133***	0.101***	0.023**	0.006
	(0.000)	(0.018)	(0.024)	(0.011)	(0.012)
Home * Breaches of stability criteria					0.081***
					(0.021)
Home * State-owned * Breaches of stability criteria					0.121**
					(0.053)
Constant	-3.177***	-3.113***	-2.954***	-3.889***	-4.020***
	(0.496)	(0.493)	(0.492)	(0.435)	(0.443)
Observations	48,803	48,803	48,803	89,171	89,171
Bank control variables	Y	Y	Y	Y	Y
Interaction effects	Y	Y	Y	Y	Y
FE	Issuer-Time	Issuer-Time	Issuer-Time	Issuer-Time	Issuer-Time
Inverse Mills ratio (IMR)	1.627	1.613	1.585	1.803	1.827
Standard deviation of IMR	0.0899	0.0893	0.0890	0.0770	0.0784

Table 11: Robustness tests

This Table shows robustness results for estimating the determinants of banks' investments in state bonds using a Heckman model. The log of bank i's bond holdings of state j is the dependent variable in the outcome equation. An indicator equal to one when observing that bank i holds bonds of state j is the dependent variable in the selection equation. For the sake of brevity, only the results from the outcome equation are reported. The variable "breaches of stability criteria" captures the number of stability criteria (0-8) that a state breaches in the respective year as reported by the German Stability Council. For a definition of all variables, see data appendix. Fixed effects, bank control variables and all necessary interaction effects are included as specified in the lower part of the Table. The inverse Mills ratio (IMR) is obtained from the extensive margin and corrects for self-selection. Data sources: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, *Securities Holdings Statistics* and *Monthly Balance Sheet Statistics*, Q4:2005 – Q2:2014, own calculations, except for in Column 3 where it covers Q1:2010 to Q2:2014. ***, ** and * indicate significance at the 1%, 5% and 10% level. Standard errors are clustered at the bank-time level in Column 1 and at the bank-issuer level in Column 2 using a bootstrap technique. In Column 3 robust standard errors are shown in brackets.

	(1)	(2)	(3)	(4)	(5)
	Std errors clustered at bank-time level	Std errors clustered at bank-issuer level	Since Stability Council	Excluding city states	Only city states
	Intensive margin	Intensive margin	Intensive margin	Intensive margin	Intensive margin
Home	0.437***	0.274***	0.404***	0.480***	0.121
	(0.026)	(0.088)	(0.030)	(0.031)	(0.141)
Home * State-owned bank	0.833***	0.762	0.808***	0.612***	0.371
	(0.120)	(0.545)	(0.119)	(0.146)	(0.256)
Home * Breaches of stability criteria	0.092***	0.112*	0.073***	0.012	-0.133**
	(0.019)	(0.060)	(0.019)	(0.026)	(0.061)
Home * State-owned * Breaches of stability criteria	0.140***	0.024	0.156***	0.137*	0.281***
	(0.041)	(0.171)	(0.044)	(0.072)	(0.091)
Constant	-4.617***	-1.615	-2.587***	-5.955***	3.761***
	(0.587)	(1.255)	(0.487)	(0.519)	(1.157)
Observations	89,171	89,171	48,803	83,456	5,715
Bank control variables	Y	Y	Y	Y	Y
Interaction effects	Y	Y	Y	Y	Y
FE	Issuer-Time	No	Issuer-Time	Issuer-Time	Issuer-Time
Inverse Mills ratio (IMR)	1.932	1.341	1.532	2.088	0.909
Standard deviation of IMR	0.0804	0.0693	0.0882	0.0906	0.210

Table 12: Testing the risk-shifting hypothesis

This Table shows regression results from a Heckman model for testing whether banks' investments in state bonds can be explained by the risk shifting hypothesis. The log of bank i's sovereign bond holdings of state j is the dependent variable in the outcome equation. For the sake of brevity, only the results from the outcome equation are reported. The inverse Mills ratio (IMR) is obtained from the extensive margin and corrects for self-selection. Column 1 and 2 analyse the impact of banks' capital ratio and Column 3 and 4 the impact of a banks' non performing loans ratio on its state bond holdings decisions. The variable "breaches of stability criteria" captures the number of stability criteria (0-8) that a state breaches in the respective year as reported by the German Stability Council. For a definition of all variables, see data appendix. Issuer-time fixed effects, bank control variables and all necessary two-way interaction effects are included. Data sources: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, *Securities Holdings Statistics* and *Monthly Balance Sheet Statistics*, Q4:2005 – Q2:2014, own calculations. ***, ** and * indicate significance at the 1%, 5% and 10% level. Robust standard errors are shown in brackets.

	(1)	(2)	(3)	(4)
	Capitalization		NPL Ratio	
	Intensive margin	Intensive margin	Intensive margin	Intensive margin
Home	0.428***	0.394***	0.541***	0.457***
	(0.046)	(0.045)	(0.025)	(0.031)
Home * Capitalization (%)	0.005	0.003		
	(0.005)	(0.007)		
Capitalization (%) * Breaches of stability criteria		0.015***		
		(0.001)		
Home * Capitalization (%) * Breaches of stability criteria		-0.005		
		(0.010)		
Home * Breaches of stability criteria		0.104*		0.087***
		(0.058)		(0.024)
Home * State-owned * Breaches of stability criteria		0.159***		0.136***
		(0.053)		(0.053)
Home * NPL (%)			-0.052	-0.080*
			(0.034)	(0.047)
NPL (%) * Breaches of stability criteria				0.032***
				(0.008)
Home * NPL (%) * Breaches of stability criteria				0.008
				(0.041)
Constant	-4.400***	-4.874***	-4.832***	-4.493***
	(0.451)	(0.460)	(0.456)	(0.451)
Observations	89,171	89,171	89,171	89,171
Bank control variables	Y	Y	Y	Y
Interaction effects	Y	Y	Y	Y
FE	Issuer-Time	Issuer-Time	Issuer-Time	Issuer-Time
Inverse Mills ratio (IMR)	1.889	1.997	1.996	1.916
Standard deviation of IMR	0.0797	0.0815	0.0809	0.0800

Table 13: Testing for alternative explanations

This Table shows regression results for testing alternative hypotheses on banks' investments in state bonds using a Heckman model. The log of bank *i*'s sovereign bond holdings of state *j* is the dependent variable in the outcome equation. An indicator equal to one when observing that bank *i* holds bonds of state *j* is the dependent variable in the selection equation. For the sake of brevity, only the results from the outcome equation are reported. Column 1 tests whether banks' capitalization (i.e. equity over unweighted assets) affects the holdings of state-owned banks. Column 2 tests the hypothesis that banks hold home state bonds to store liquidity for future lending opportunities. The loan ratio is defuned as claims on banks and non-banks relative to total assets. Column 3 tests for information asymmetries where Stability Council is an indicator equal to one from 2010 onwards. The variable "breaches of stability criteria" captures the number of stability criteria (0-8) that a state breaches in the respective year as reported by the German Stability Council. For a definition of all variables, see data appendix. Fixed effects, bank control variables and underlying interaction effects are included as specified in the lower part of the Table. The inverse Mills ratio (IMR) is obtained from the extensive margin and corrects for self-selection. Data sources: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, *Securities Holdings Statistics* and *Monthly Balance Sheet Statistics*, Q4:2005 – Q2:2014, own calculations. ***, ** and * indicate significance at the 1%, 5% and 10% level. Robust standard errors are shown in brackets.

	(1)	(2)	(3)
	Capitalization of state-owned banks	Other lending opportunities	Information asymmetries
	Intensive margin	Intensive margin	Intensive margin
Home	0.436***	0.157**	0.317***
	(0.036)	(0.062)	(0.025)
Home * State-owned	1.150***		
	(0.170)		
State-owned * Capitalization (%)	0.151***		
	(0.010)		
Home * State-owned * Capitalization (%)	-0.000		
	(0.030)		
Loan ratio		-0.033***	
		(0.001)	
Home * Loan ratio		0.003***	
		(0.001)	
Home * Breaches of stability criteria		0.165***	0.152***
		(0.015)	(0.016)
Breaches of stability criteria			-0.008***
			(0.003)
Home * Stability Council			-0.061**
			(0.028)
Stability Council			0.213***
			(0.016)
Constant	-4.900***	1.534***	-1.724***
	(0.458)	(0.269)	(0.392)
Observations	89,171	89,171	89,171
Bank control variables	Y	Y	Y
Interaction effects	Y	Y	Y
FE	Issuer-Time	Issuer-Time	No
Inverse Mills ratio (IMR)	2.012	1.230	1.379
Standard deviation of IMR	0.0815	0.0558	0.0698