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Banks and sovereign risk: A granular view☆

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ABSTRACT

We investigate the determinants of sovereign bond holdings of German banks and the implications of such holdings for bank risk. We use granular information on all German banks and all sovereign debt exposures in the years 2005–2013. As regards the determinants of sovereign bond holdings of banks, we find that these are larger for weakly capitalized banks, banks that are active on capital markets, and for large banks. Yet, only around two thirds of all German banks hold sovereign bonds. Macroeconomic fundamentals were significant drivers of sovereign bond holdings only after the collapse of Lehman Brothers. With the outbreak of the sovereign debt crisis, German banks reallocated their portfolios toward sovereigns with lower debt ratios and bonds with lower yields. With regard to the implications for bank risk, we find that low-risk government bonds decreased the risk of German banks, especially for savings and cooperative banks. Holdings of high-risk government bonds, in turn, increased the risk of commercial banks during the sovereign debt crisis.

1. Motivation

Banks are important investors on sovereign bond markets. During the European sovereign debt crisis, the patterns of such investments have changed as banks have tended to withdraw from foreign markets. Changes in the investment patterns of banks have given rise to the debate on how the risk of banks and sovereigns are linked and how this "bank-sovereign nexus" affects financial stability in the Eurozone.[1] Since the outbreak of the European sovereign debt crisis, sovereign bonds issued by periphery countries in the Eurozone[2] were reallocated from foreign investors toward domestic banks (Battistini et al., 2014). The mirror-image of this pattern is a withdrawal of foreign investors, including German banks, from risky European sovereign debt, which is what we study.

This paper analyzes the investment behavior of German banks by answering two questions. Why do banks invest into sovereign bonds? And do holdings of sovereign debt affect bank risk? Empirical work on these questions faces two challenges. First, sufficiently detailed information on sovereign bond portfolios of banks are usually confined to the largest banks and to the period after the outbreak of the European sovereign debt crisis.[3] Second, banks do not hold sovereign debt randomly. They actively choose whether, how much, and which sovereign bonds to hold, conditional on

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[1] The foreword to the ESRB Report on the Regulatory Treatment of Sovereign Exposures (European Systemic Risk Board, 2015, p. 5) emphasizes this link: "*The exposures that banks and insurance corporations have held vis-à-vis sovereigns have been seen by many as a source of fragility in the recent and prolonged episodes of financial stress, while others have seen them as a factor of crisis mitigation. [...] from a macro-prudential point of view, the current regulatory framework may have led to excessive investment by financial institutions in government debt.*"

[2] These countries are Greece, Ireland, Italy, Portugal, and Spain.

[3] Recent evidence regarding the interdependence of sovereign, bank, and financial system risk, see for example, Blommestein et al. (2016) or Betz et al. (forthcoming), is often based on the (co-)movement of capital market prices of risk, such as CDS spreads, which gauges a small fraction of banks. We, in turn, investigate sovereign debt holdings and risk for a comprehensive sample of all banks in a large European financial system.

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banks' assessments of the sovereign risk, on regulatory costs, and on bank-level characteristics.

We analyze the relationship between sovereign bond holdings and observed risk of all German banks while taking the selection of banks into holding sovereign debt explicitly into account. Our analysis uses the *Securities Holdings Statistics* of the Deutsche Bundesbank. This database provides quarterly, granular data of the security portfolios of all German banks, including holdings of sovereign bonds, bank-by-bank, and security-by-security from Q4:2005 until Q3:2013 (Amann et al., 2012). Thus, the data cover the pre-crisis period, the global financial crisis, and the sovereign debt crisis in the Eurozone. We combine sovereign risk exposures with detailed micro-prudential supervisory and issuer-country data. Thereby, our model exploits the rich cross-sectional variation across commercial, savings, cooperative, and mortgage banks in Germany. The granular data employed in this paper reveal the following stylized facts[4]:

First, a certain fraction of German banks, namely 15%, *never* hold sovereign bonds during the entire sample period. Another 25% of all German banks *always* hold some sovereign debt. Other banks actively move into and out of investments into sovereign bonds. On average, two thirds of all German banks hold sovereign debt in each quarter. Participation in sovereign bond markets varies considerably across banking groups. Average sovereign bond portfolios account for about 5% of total assets across all German banks. These shares are the lowest for commercial and cooperative banks (3.5%) and the largest (13%) for mortgage banks. But some of the larger banks hold up to 20% of their assets in the form of sovereign debt.

Second, savings and cooperative banks did not have a significant exposure to Eurozone peripheral debt to begin with. German mortgage banks, which specialize in the securitzation of public and private debt, continue to hold substantial volumes of risky sovereign debt. During the sovereign debt crisis, German commercial banks reduced their exposure to Eurozone peripheral debt issued by governments in Greece, Italy, Ireland, Portugal, or Spain, and they largely replaced these investments with domestic German sovereign debt.

Analyzing the drivers of these adjustments and the impact on bank risk is the purpose of this paper. Our empirical model proceeds in two steps. In a first step, we analyze the determinants of sovereign bond holdings of German banks. We specify a Heckman selection model to estimate the likelihood that banks hold certain sovereign bonds and how much they hold conditional on this selection choice. In a second step, we assess the impact of sovereign bond holdings on bank risk, measured through market-based (CDS spreads) and accounting-based measures (*z-score*).

As regards the determinants of banks' sovereign bond holdings, several factors have been stressed in the literature. Banks may hold sovereign debt to diversify asset portfolios (Rochet, 2008), as collateral for interbank refinancing operations (Bolton and Jeanne, 2011), or as a means to generate liquidity (Gennaioli et al., 2014). Recent empirical papers explain the increase in domestic sovereign bond holdings by Eurozone periphery banks with a search for yield (Acharya and Steffen, 2015), moral suasion (Becker and Ivashina, 2014; Horváth et al., 2015; Ongena et al., 2015),[5] or gambling for resurrection (Ari, 2015; Horváth et al., 2015). Most of these studies are based on data released together with the stress test results of the European Banking Authority (EBA).

The perspective taken in this paper differs from previous work for two reasons. First, we study the investment behavior of German banks rather than the behavior of banks in (risky) peripheral countries. Second, we have granular data for all German banks, not only the large banks covered by the EBA stress tests. Our results show that accounting for heterogeneity across banks is indeed important. Large, weakly capitalized banks, and banks which are more active on capital markets[6] hold more sovereign bonds.

With respect to country characteristics, we find that German banks did not respond much to macroeconomic risk factors before the collapse of Lehman Brothers in 2008. Between 2008 and 2010, German banks reduced their sovereign bond holdings of small and high inflation countries that participated in an IMF program. With the outbreak of the European sovereign debt crisis, German banks reduced bond holdings of high indebted and high yield sovereigns. Also, domestic sovereign bonds started playing a more prominent role. In contrast to evidence for the sample of the largest European banks (Acharya and Steffen, 2015), we thus do not find a search for yield by the average German bank in sovereign bond markets. Instead, our results indicate a "flight to safety" and to the home market akin to Hildebrand et al. (2012).

The second part of our analysis focuses on the effects that sovereign exposures have on bank risk. Given that German banks have withdrawn from risky markets during the crisis we expect, a priori, that increasing domestic sovereign exposures have stabilized rather than destablized banks. Hence, the perspective taken in this paper differs from previous work that focuses on the link between bank (in)stability and sovereign indebtness (Alter and Schüler, 2012; Acharya et al., 2014; Pagano and Sedunov, 2016), a reduced effectiveness of bank rescues and guarantees (König et al., 2014; van der Kwaak and van Wijnbergen, 2014), and crowding out of private sector credit (Albertazzi et al., 2014; Bedendo and Colla, 2015). Existing literature focuses on sovereign and/or bank CDS spreads to provide evidence on the existence of a bank-sovereign risk nexus (Alter and Beyer, 2014; De Bruyckere et al., 2013).

In order to study the effects of sovereign bond holdings on bank risk, we need to take into account that this choice is endogenous. We use predicted rather than observed bond exposures as a function of issuer country-specific macro factors and of bank-specific covariates to mitigate endogeneity concerns. Our main indicator of bank risk is the *z-score.* We find that a larger share of high-risk bonds is associated with higher bank risk for commercial banks but not for cooperative and savings banks after 2010. Holdings of low-risk bonds are associated with lower bank risk for savings and cooperative banks for the entire sample period. These risk effects are stronger when considering CDS spreads that are available for a subsample of (larger) banks as an alternative risk proxy. Holdings of risky sovereign debt also increased banks' CDS spreads during the entire sample period, not just after 2010. These risk effects were not visible based on the accounting-based risk measure before 2010, probably due to the widespread absence of marking to market at the time.

In Section 2, we present and describe the data for German banks' sovereign bond holdings. In Section 3, we analyze the determinants of banks' sovereign bond holdings. In Section 4, we analyze the impact of these holdings on bank risk. Section 5 concludes.

2. Holdings of securities by German banks

2.1. Banks included in the sample

The data used in this paper include 1970 banks, which covers almost the entire population of German banks. The German

[4] For details, see Section 2.3.

[5] In crisis periods, (myopic) governments may permit domestic banks to be weakly capitalized and encourage them to hold sovereign debt so as to maximize the government's future debt bearing capacity (Crosignani, 2015).

[6] Banks active on capital markets are those using market-based funding, having large security, and small customer loan portfolios.