Loanly Governments:
Sovereign Debt in the Wake of Credit Downgrades

preliminary and incomplete

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Abstract

This paper studies the funding structure of governments, examining financing beyond traditional sovereign bond markets. We document significant heterogeneity in the use of bonds and loans, and in the composition of foreign and domestic creditors. We relate this heterogeneity to sovereign credit ratings and present three key findings. First, sovereigns change the composition of financing instruments when credit ratings change. Second, not all rating changes and countries are alike. We find strong evidence for substitution from bonds to loans only when (i) credit ratings decrease for (ii) countries that have been rated sufficiently low. Third, the strength of this substitution effect increases in the exposure to foreign bond holders, consistent with these investors being more sensitive to changes in creditworthiness. Finally, we show that the documented loan-bond substitution is accompanied by lower government spending and GDP, suggesting real adverse consequences through loan-bond substitution.

Keywords: Government debt, Sovereign bond markets, Credit ratings, Economic growth

JEL classification codes: F34, H63, G24, O11

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1. Introduction

Sovereign bonds are the primary financial instrument through which governments raise capital and have long been the focus of research when analyzing government debt (Mitchener and Trebesch, 2021). Yet, bonds are not the only source of financing, especially when bond markets are underdeveloped or become illiquid, giving rise to alternative financing channels such as intergovernmental lending or development loans, most notably with the rise of China as an international creditor (Horn et al., 2021; Gelpern et al., 2023). Such loans are relevant for low and middle income countries but not for developed economies. For developed economies, the analysis of loan-based government funding remains limited. This is puzzling, given that our data reveal that over the past decades, loans constituted a relatively stable share of between 10 and 15 percent of government debt among developed economies.

In this paper, we aim to close this gap by studying government debt among 33 OECD countries between 1962 and 2018. We document significant heterogeneity in the funding structure of these countries discriminating between loans and bonds, and between foreign and domestic creditors. Heterogeneity in government debt can be linked to sovereign credit ratings, which yields three key insights. First, sovereigns change the composition of financing instruments when credit ratings change. Second, not all rating changes and countries are alike. We find strong evidence for substitution from bonds to loans only when (i) credit ratings decrease for (ii) countries that have been rated sufficiently low. Third, the strength of this substitution effect increases in the exposure to foreign bond holders, consistent with these investors being more sensitive to changes in creditworthiness. The channel we propose for this finding relies on the increase in bond yields coming from a drop in demand on international bond markets when ratings decrease, necessitating a shift towards loans. We present evidence in favor of this channel and show that the documented loan-bond substitution is accompanied by lower government spending and GDP, suggesting real adverse consequences.

Crucial to this analysis are two levels of data. First are the financial accounts of OECD governments collected by Diebold and Richter (2021) and extended by Kuvshinov et al. (2024) for flow-of-funds data. These data reveal that loans decreased in relative importance between the 1970s and the pre-Great Recession period, corresponding to the spread and internationalization of bond markets. Afterwards, this trend reversed, with loans increasing in importance after 2008 and during the 2010s. Building on the "unveiling" methodology introduced by Mian et al. (2020)

and further developed by Diebold and Richter (2021), we show that for both types of instruments, foreign holders have taken an increasingly important role, increasing exposure to fluctuations in international demand for government debt. Second, we collect government credit ratings for the four major agencies, Fitch, S&P, Moody's, and DBRS Morningstar. We utilize the underappreciated fact that all ratings are on a comparable scale, allowing us to compute an average rating index.

We begin the empirical part of our paper by validating the rating index. In a first step, we demonstrate that credit ratings, according to this index, correlate negatively with government indebtedness in the medium term. Similarly, the data reveal that a better rating is associated with lower government bond yields. In both cases we deliberately avoid taking a definitive stance on the direction of causality, acknowledging that both past increased borrowing and anticipated future borrowing could potentially decrease current ratings and increase borrowing costs. Yet, these correlation suggest that the rating index is a sensible measure of a country's credit worthiness.

Moving on to the connection between credit ratings and the composition of government debt, we show that changes in the rating index are predictive for a significant substitution between financing instruments, notably loans and bonds. Rating improvements predict a notable shift towards bonds whereas relative to loans and vice versa for rating decreases.[1] We test this relationship across several subsamples, finding that the relationship is a robust feature of the data. It is particularly pronounced for countries with already low ratings and those involved in the European sovereign debt crisis. Building on these initial findings, we further investigate whether there are relevant non-linearities in this relationship.

We consider rating increases and decreases separately and condition their relation also on the overall level of each country's credit rating. The combination of a rating decrease for a country rated below average emerges as the primary driver of the substitution between bonds and loans. The interaction term measuring this effect is statistically significant at the five percent level when predicting changes in the ratio of the stock of loans relative to bonds. While this suggests a relative increase in the importance of bond financing, it does not tell us which part of the ratio is driving the response. In a next step, we thus utilize flow-of-funds data and study the new issuance of loans and bonds separately. Here, we find a decrease in the issuance of bonds, which is compensated with an increase in loan issuance of similar magnitude, suggesting bond-loan substitution. Overall, we find strong evidence for substitution from bonds to loans only when (i) credit ratings decrease for (ii) countries that have been rated sufficiently low.

[1] To be precise, we estimate a symmetric specification that does not discriminate between increases and decreases in the rating. We relax this in the subsequent analysis.

We hypothesize that this reallocation towards loans is fundamentally driven by disproportionate shifts in borrowing costs for countries experiencing rating decreases at already low rating levels. Intuitively, consider the example of a country experiencing a decrease from a very high rating, e.g., AAA. While this will presumably increase borrowing costs, it is unlikely to significantly reduce the country's capacity to raise money via bond issuance. In contrast, when ratings are already low, further decreases might erode investor confidence and sharply increase borrowing costs. For such a country, it may also be expected that credit rating downgrades loom larger than upgrades, when it takes time to re-build credibility as a reliable debitor. Such effects may especially show up in long-term yields that capture risk premia. To investigate this hypothesis, we run the same type of regression with the change in ten-year government yields as the outcome variable, revealing an asymmetric pattern of borrowing cost dynamics. As expected, rating increases for countries rated below average are associated with bond yield reductions. However, we find that rating decreases for below-average rated countries are approximately twice as large and highly statistically significant. Importantly, we can run this estimation without being constrained by our sample size for government financial balance sheets and find that this result holds true in a large sample of close to 5,000 quarterly observations, as well as in our baseline sample.

To further understand this result, we investigate the role of creditors. Arguably, international creditors may be particularly sensitive to changes in the credit rating. Thus, we test whether the strength of substitution from bonds to loans following downgrades of countries rated below average depends on the exposure to foreign investors. To do so, we build on the 'unveiling' methodology from Mian et al. (2020) and Diebold and Richter (2021) to obtain the share of debt ultimately held by foreigners. Specifically, we measure this exposure as the share of bonds held by foreigners over the stock of all bonds. We find that the loan-bond substitution intensifies with higher foreign bond holdings. This finding aligns with international bond investors being more rating sensitive.

Finally, we investigate the consequences for the real economy. Such consequences may arise from governments also reducing their expenses when bond yields increase and substitution towards loans is necessary. First, we provide direct evidence on the relation between government expenses and loan-based and bond-based borrowing. An increase in bond issuance is followed by an increase in the governments' financial assets. In contrast, after increases in loan borrowing, financial assets decline. This suggests that governments forced to substitute towards bonds also reduce government expenses, smoothing the credit downgrade across multiple margins of adjustment. Consistent with this, we find a significant and sizable decline in real government spending and real GDP after credit

downgrades for below-average rated countries. These effects build up slowly and reach its trough two to three years after a downgrade. Conversely, the corresponding increases after rating upgrades are smaller, more delayed and less significant, underscoring the importance of the sign of rating changes and the rating level. Quantitatively, we find that decline in real GDP after downgrades is more than two percent larger than the corresponding increase after upgrades.

Contribution: This paper speaks to several topics in the literature. First, the composition of government liabilities, providing evidence for a substantial amount of sovereign debt being via loans, even for advanced economies. Recently, advances on the composition of government funding have been made on the instrument level (e.g., Mihalyi and Trebesch, 2022), but evidence remains incomplete on the macro level across countries. Additionally, the literature that does exist is dominated by theory (Mitchener and Trebesch, 2021), or focuses on bond markets (Meyer et al., 2022). Here, we add the additional layer of loan financing across a large panel of countries over the last decades, as well as a decomposition of both loans and bonds by their final holders (in distinction to Fang et al. (2022), who look at the immediate holders for bond debt). A complementary data contribution we make in this paper is the construction of a numerical composite index of government credit ratings, that allows us to systematically link liability structures to rating changes.

Second, when we combine these two datasources, we speak to the literature on the *determinants* of government debt compositions and specifically to the relationship between debt composition and credit ratings (an extension of government borrowing in distress). An interesting and potentially overlooked point in this context was made by Reinhart et al. (2003) who argue that it is especially (developing) countries with a low debt tolerance and low demand from international investors that resort to loans, because they 'only have sporadic opportunities to borrow'. Importantly, these loans then often come from abroad, as these countries take loans from anybody willing to lend to them, potentially at high cost. We document this in a more general way, finding that distress leads to a shift towards loans and that these loans tend to come from abroad for a set of advanced economies. Relatedly, Cantor and Packer (1996) have shown that sovereign ratings influence market yields beyond observable characteristics, and, importantly, that this holds true particularly for non-investment-grade issuance. This aligns with our finding that countries rated below average experience disproportionate increases in borrowing costs upon receiving a further downgrade, forcing them into changing their source of funds.

Our third contribution is to the rollover literature, for which little empirical evidence exists on government debt (Trebesch, 2023). Intuitively, when bond markets freeze, rollover becomes difficult,

but this does not mean that all existing bonds are converted into loans. Instead, terminating bonds are replaced by loans, and when the bond market becomes liquid again, after regaining a higher rating, the rollover shifts back to bonds, reverting the previous allocation towards loans. This puts our study in contrast to other studies that have remarked on loans being a financing substitute in the absence of bond markets Reinhart et al. (2003). Recent studies investigating this point have often focused on the rise of long-term development loans from China (Horn et al., 2021; Gelpern et al., 2023). In contrast to the findings, we show that, while loans make up around 10 percent of debt at most times, sharp increases in these shares are occur over short horizons after credit downgrades, and potentiality revert when they improve.

Fourth, we contribute to the literature on credit ratings, a significant portion of which focuses on understanding the rating process itself. Cantor and Packer (1996) identified six primary factors influencing ratings: per capita income, GDP growth, inflation, external debt, economic development, and default history. Similarly, Reinhart et al. (2003) and Reinhart and Rogoff (2009) highlighted the persistent negative impact of default history on sovereign ratings. Research on institutional quality has revealed a home bias where agencies rate culturally or geographically closer countries more favorably (Fuchs and Gehring, 2017). Becker and Milbourn (2011) showed that Fitch's entry as a third major rating agency led to a reduction in the quality of ratings provided by incumbents, suggesting that competition among agencies affects rating quality and informativeness. El-Shagi and von Schweinitz (2022) analyze the timing of rating changes, distinguishing between the intention to reevaluate and the rating outcome, which question the accuracy of updates due to the inertia in reported fundamentals such as debt-to-GDP ratios. Existing literature looking at the implications of downgrades have often focused on firm responses, even when sovereign ratings were used Almeida et al. (2017). Panizza et al. (2009) analyze the signaling function of sovereign credit ratings in determining borrowing costs. This literature, however, predominantly focused on bond financing, leaving the role of ratings in loan financing and the transition between bonds and loans largely unexplored.

2. Data

We collect government credit ratings, government bond yields, inflation, government consumption, and GDP at a quarterly frequency for 33 OECD countries between 1962 and 2018.

Sovereign credit ratings are collected from World Government Bonds Credit Ratings (2024), and in cases of missing entries or countries, supplemented using Trading Economics (2024) and the

websites of Fitchs (2024); Moodys (2024); Standard and Poors (2024); DBRS (2024).[2] We aggregate the daily credit ratings to quarterly frequency to match the other quarterly data by taking the last value of each quarter. All agencies employ rating schemes that can be ranked on a numerical scale from 0 to 32. Ratings for governments in default are coded as 0. We start the rating with 1 point for the lowest non-default rating, which e.g., in the case of S&P is "C" with a negative outlook. It increases to 1.5 for a stable outlook and 2 for "C" with a positive outlook. Afterwards, each rating step[3] has three potential instances — negative, stable, and positive outlook — with each increasing our rating by half a point, bringing the maximum rating to 32. All agencies employ a comparable rating scale, although with different naming conventions. We illustrate this in Figure A1.1, which shows the rating scale along with the current rating of the United States as of November 2024 for each agency. Given that the ratings are on a similar scale, we can compute the average rating across rating agencies for each country and quarter. In the remainder of the paper, we will always refer to this average rating.

Additionally, we refer to countries with an sovereign credit rating below the sample average as 'low rating' countries. Specifically, we define an indicator for low-rated countries being activated when the country is rated below the average rating for at least one quarter in a given year. In our OECD sample, the average rating is approximately 26.5 points, which coincides perfectly with the distinction between 'high medium' and 'upper medium' rated bonds (or, e.g., the move from AA- to A+ for S&P).

We take additional quarterly data on ten-year sovereign bonds yields, CPI inflation, government consumption and GDP from the OECD. Finally, government's financial balance sheets and transaction values (Flows of Funds Data) are from Diebold and Richter (2021) and Kuvshinov et al. (2024), who complied this data based on the OECD financial accounts. The data is at annual frequency. Thus, we linearly interpolate balance sheet variables to quarterly frequency. Similarly, annual flow variables take a constant value within each year, so that the quarterly variable sums exactly to the annual counterpart.

[2]We include these rating agencies as the only ones classified as External Credit Assessment Institutions (ECAI) by the EBA (European Banking Authority, 2018), coinciding with them having the four largest market shares of all credit rating agencies.

[3]E.g., for S&P: CC, CCC-, CCC, CCC+, B-, B, B+, BB-, BB, BB+, BBB-, BBB, BBB+, A-, A, A+, AA-, AA, AA+ and AAA.

3. Trends in government debt

We start by describing trends in government debt for selected countries in our sample. First, we focus on total sovereign debt and a decomposition in the underlying financing instruments. Second, we apply an 'unveiling' methodology to identify the ultimate creditors of government debt. We find an important role for government financing via loans and by foreign investors.

3.1. Financing instruments

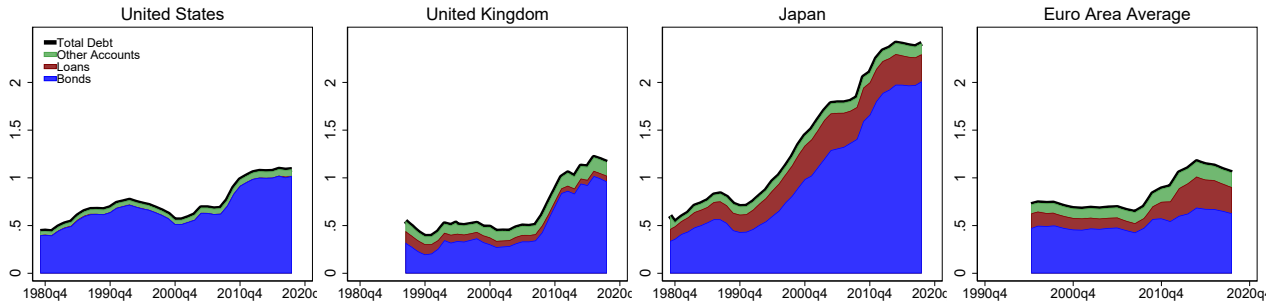
Beyond tax revenues, government financing relies on their ability to issue debt on financial markets. Figure 1, shows, for a select group of countries, the development and the instrument of the stock of government liabilities over time. Concretely, it plots the debt-to-GDP ratio for the United States, the United Kingdom, Japan, and an Euro Area average. Total government debt is broken down into the underlying financing instruments, bonds, loans, and other accounts.[4] This reveals, that the displayed countries are heterogeneous in their funding structure. Bonds, as expected, make up the largest share, especially for the United States. However, the United Kingdom, Japan, and the Euro Area have a non-negligible fraction of debt financed via loans. For example, in the Euro Area, there are outstanding loans to the government amounting to around 10 percent of GDP on average.

We provide summary statistics for government debt by decade for our full sample in Table A1.1. In addition to total, bond-based, and loan-based debt, the table also includes the ratio of all outstanding loans to all outstanding bonds, the loan-to-bond ratio. This is a convenient measure that captures the reliance on financing via loans. The loan-to-bond ratio is a good metric because it is unaffected by changes in debt-to-GDP that do not affect the composition of financing instruments. It decreases in both mean and median (with the median consistently being below the mean) for all decades between the 1970s and the 2000s. This relative decline in loan financing is attributable more to the rapid increase of bond-based government debt in the last decades, rather than a decline in loan-to-GDP ratios. The trend reverses after the Great Recession, when financing via loans increases even faster than financing via bonds. This trend reversal varies across countries, as measured by the increase in the standard deviation, pointing towards more heterogeneous funding structures after the Great Recession and European sovereign debt crisis.

Taken together, we find a non-negligible role for government financing via loans in the long-term and an increasing importance of this channel over the last decade.

[4]We exclude government liabilities in the form of insurance and pension schemes, as these are not a means for government to raise money on financial markets.

Figure 1: *Government debt by financing instrument*



Notes: The figure shows the stock of debt, relative to GDP and by financing instrument for selected countries.

3.2. Unveiled ultimate creditors

We build on the unveiling methodology introduced by Mian et al. (2020) and further developed by Diebold and Richter (2021), to 'unveil' the ultimate creditors of government debt, distinguishing between domestic households, the external sector (foreign lenders), and indirect lending between different parts of the government.

In short, this process involves the proportional allocation of sectoral liabilities to the assets of other sectors at the instrument level. While bonds and especially loans are often held as an asset by banks (and more generally, financial intermediaries), the bank is not the ultimate counterparty providing financing. Instead, banks finance their asset side with deposits, equity, bonds, etc., on the liability side of their balance sheet. And thus, the banks' assets are ultimately financed by the agents that hold the banks' liabilities as an asset. We extend the methodology used in Diebold and Richter (2021) for household and non-financial loans to sovereign bonds and loans, 'unveiling' the role of financial institutions (and to a lesser extent non-financial corporations), linking sovereign debt to its ultimate financiers. Following Mian et al. (2020), we assume that ultimate financing sectors (u) can be domestic households, the government, or the rest of the world ($u \in HH, GG, RoTW$).

To link the assets of intermediary sectors to their ultimate counterparties, we allocate their liabilities on the instrument-level proportionally to the distribution of asset holdings of the respective instrument on the sector-level. Consider the following simplified example: We allocate deposits, used by the financial sector to finance bonds, to a counterparty sector based on the share this sector has in total deposits in the economy (excluding the financial sector itself). When the household sector holds 70% of all deposits (excluding deposits held by the financial sector itself), we assign 70% of the deposit liabilities of the financial sector to the household sector. If the financial sector's total liabilities consist of 50% deposits, we would allocate a total of 35% of the bonds held by the financial sector to be held by the household sector via deposits. In a second step, we apply the same

proportionality assumption to the bond liabilities of the government. Assuming that households and the financial sector hold 10% and 50% of bond holdings in the entire economy respectively, we assume that these shares also apply to their holdings in government bond debt. Households would thus ultimately own 10% of government bonds directly, and another 17.5% via its deposits in the financial sector (35% of the financial sector's 50% direct government bond holdings).

The full unveiling loops over all available instruments (deposits, bonds, loans, shares, insurances and pensions, gold and SDRs, derivatives and options, other accounts), and fully accounts for potential cross-holdings between unveiled sectors (e.g., households might hold equity in non-financial corporations, who in turn store their savings in a bank (by whatever instrument), which in turn extends a loan to the government). For a detailed description, further underlying assumptions (including alternative unveiling procedures), robustness checks, and cross-referencing with whom-to-whom matrices, consider the descriptions in Mian et al. (2020) and Diebold and Richter (2021).

Figure 2 shows the unveiled time series for selected countries, separately for loans and bonds.[5] Focusing on bonds in Panel (a), there is a notable trend towards increasing international funding. Furthermore, we find substantial heterogeneity across countries. Foreign lending via bonds is sizable for the United Kingdom and Euro Area but less pronounced for the United States and Japan.

In Panel (b) of Figure 2, we unveil the ultimate holders of loans. To ensure comprehensive representation, we take out the United States since the amount of loans is so small that it is invisible on the same scale with other countries. We instead display Germany as the largest euro economy with liquid bond markets and high credit ratings. Loan financing via foreign creditors does not show the same secular increase as for bonds, with the notable exception of the euro area, where loans sharply increase during the sovereign debt crises.

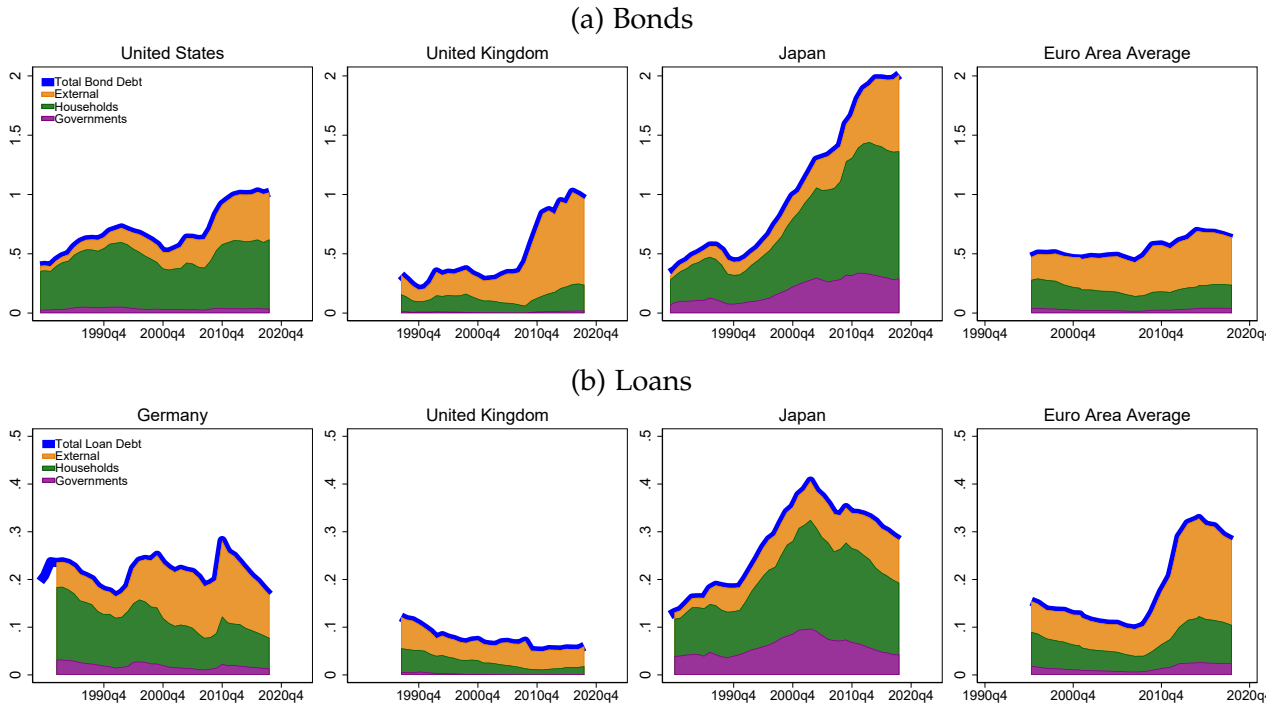
Overall, we find that there is substantial heterogeneity in the importance of foreign investors across financing instruments and countries over time. In the remainder of the paper, we link the choices of financing instruments and the reliance on foreign investors to credit ratings.

4. Government Credit Ratings and debt restructuring

In this section, we assess the relationship between credit ratings and the use of financing instruments, namely loans and bonds. We present three key findings. First, sovereigns change the composition of financing instruments when credit ratings change. Second, not all rating changes and countries

[5]Note that the Euro Area is not treated as one country in the unveiling. Instead, as one should expect, the unveiling is implemented at the country level and the results are aggregated to the Euro Area level afterwards.

Figure 2: *Government debt by creditor*



Notes: The figure shows the stock of debt, relative to GDP and by the ultimate creditor based on the 'unveiling' methodology from Mian et al. (2020) and Diebold and Richter (2021). Panels (a) and (b) display these data for bonds and loans, respectively. We display selected countries and replace the US by Germany in Panel (b) since the US has a negligible share of loans.

are alike. We find strong evidence for substitution from bonds to loans only when (i) credit ratings decrease for (ii) a country that has been rated sufficiently low. Third, the strength of this substitution effect increases in the exposure to foreign bond holders, consistent with these investors being more sensitive to changes in creditworthiness compared with domestic creditors.

4.1. Credit ratings, government debt, and financing costs

To establish an intuition behind our sovereign rating index, the average across the ratings from the four leading agencies, we begin this section by linking it to two key fundamentals of government borrowing: the government debt-to-GDP ratio and the ten-year government bond yield. We consider the contemporaneous relationship over a medium-term time horizon of three years (12 quarters). Formally, we define $\Delta_h x_t = x_t - x_{t-h}$ for any variable x_t and estimate

$$\Delta_{12} y_{i,t} = \alpha_i + \beta \Delta_{12} \text{Rating}_{i,t} + \Gamma X_{i,t} + u_{i,t}, \tag{1}$$

where t denotes quarters, $y_{i,t}$ is either the debt-to-GDP ratio or the bond yield, α_i is a country fixed effect, $\text{Rating}_{i,t}$ is our sovereign rating index, $X_{i,t}$ is a vector of controls, and $u_{i,t}$ is an error

Table 1: *Credit ratings, government debt and government financing costs.*

	Δ_{12} Debt-to-GDP$_{i,t}$	Δ_{12} Ten-year bond yield$_{i,t}$
	(1)	(2)
Δ_{12} Rating$_{i,t}$	-4.406***	-0.643***
	(0.768)	(0.098)
R^2	0.481	0.423
Country fixed effects	✓	✓
Lags of ten-year bond yield	✓	
Lags of debt-to-GDP		✓
Observations	2946	2994

Notes: The table presents results regression results based on Equation 1, as specified in the text. Lags refer to twelve lags of the state variable. Standard errors are in parenthesis and clustered by country and year, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

term. When studying debt, we control for 12 quarterly lags of bond yield and vice versa for bond yields.[6] At this stage, we intentionally avoid taking a strong stance on the timing and direction of the relationship, as the anticipation of high or low government spending in the future might change ratings and bond yields today, just as high or low borrowing in the past will affect the rating and bond yields in the present. Column (1) of Table 1 shows that changes in the rating correlate negatively with total government debt-to-GDP, and column (3) shows a negative correlation with bond yields. The standard errors in parentheses are clustered at the country and year level and show that these relations are statistically significant at the one percent level. Quantitatively, an increase in the rating by one point (on a 32 point rating scale) correlates with long-term bond yields being around 60 basis points lower, consistent with a decrease in risk premia. Similarly, the debt-to-GDP ratio is between 3 and 4 percentage points lower.

This shows that rating changes correlate with indebtedness and bond yields in the expected direction. As such, this result suggests that our composite rating index is a good measure of credit worthiness. Therefore, we study the relation of ratings with the loan-bond composition next.

4.2. Credit ratings and loan-bond substitution

Rating decreases are related to higher government debt and higher bond yields. As bonds are the main instrument of borrowing, do governments switch to alternative funding sources when their credit rating decreases and the cost of their primary borrowing instrument, bonds, increases? We investigate whether such a reallocation of debt from bonds to loans is borne out in the data. Intuitively, this may occur when sovereigns are concerned that they fail to sell the desired amount

[6]We choose 12 lags to match the long-difference of the left-hand side. Our results are insensitive to varying the number of lags.

of bonds at the market. Such a failure may aggravate the signal of reduced creditworthiness and incentivize a reallocation to loans to reduce the risk of finding not enough bond buyers. To assess this hypothesis, we estimate

$$\Delta_4 y_{i,t+4} = \alpha_i + \beta \Delta_4 \text{Rating}_{i,t-1} + \Gamma X_{i,t} + v_{i,t+4}, \tag{2}$$

where t denotes quarters, $y_{i,t}$ is the loan-to-bond ratio, α_i is a country fixed effect, $\text{Rating}_{i,t}$ is our sovereign rating index, $X_{i,t}$ is a vector of controls, and $v_{i,t}$ is an error term. For this exercise, we only control for the contemporaneous loan-to-bond ratio to account for potential pre-trends. We present the estimates of β, along with standard errors in parentheses, clustered at the country and year level in Table 2. We begin in column (1) by showing that, across our full sample, increases in the rating index between $t-1$ and $t-4$ are linked to decreases in the loan-to-bond ratio in the following four quarters, i.e., between t and $t+4$. The result is statistically significant at the five percent level and suggests that there is loan-bond substitution. Which countries drive this link? Presumably, countries that are consistently rated highly will face only minor fluctuations in borrowing costs conditional on credit rating changes. Similarly, high-rated countries should have no concerns about finding enough bond buyers. Consequently, they are unlikely to switch to loans in response to minor cost increases. Instead, in column (2), we restrict the sample to countries rated below average in a given year.[7] This reduces the sample to approximately a third of the original size, while coefficient size, statistical significance, and R^2 all increase. In (3), we relax the definition of being low rated and consider all countries that are rated below average at least once. Compared to the baseline in (1), the differences are small, hinting that it is not so much the group of countries reallocating between loans and bonds, but rather the timing of the rating change that is relevant.

As seen in Figure 1, a pronounced increase in the loan-to-GDP ratio occurs in the Euro Area between 2009 and 2014. In (4), we study only the European countries most affected by the Great Recession and the subsequent Euro crisis, finding that in these countries, the reallocation between loans and bonds is more pronounced than in the baseline.[8] The substitution between loans and bonds is more pronounced than in the baseline in column (1). Loan-bond substitution is, however, not limited to these countries. As column (5) shows, focusing only on low-rated countries other than those strongly affected by the Euro crisis, we still find a relationship between loan-bond substitution

[7] Recall that we define a country-quarter as low-rated when the country has a rating below the sample average of 26.5, or equivalently, below a rating of AA-, for at least one quarter in the calendar year under consideration.

[8] The countries are Italy, Spain, Greece, Portugal, Ireland, Latvia, and Slovenia. The results are insensitive to different definitions, e.g., excluding Latvia and Slovenia or adding Lithuania.

Table 2: *Rating Changes and loan to bond ratio across countries*

	Δ_4 Loan-to-bond$_{i,t+4}$				
	All	Low rated country-years	Low rated countries	Euro Crisis countries	Low rated and not Euro Crisis country-years
	(1)	(2)	(3)	(4)	(5)
Δ_4 Rating$_{i,t-1}$	-0.036**	-0.050***	-0.039**	-0.060**	-0.013***
	(0.014)	(0.016)	(0.015)	(0.021)	(0.001)
R^2	0.180	0.185	0.170	0.258	0.207
Country fixed effects	✓	✓	✓	✓	✓
Observations	3494	1114	1902	631	792

Notes: The table presents results regression results based on Equation 2, as specified in the text. The outcome is always the year-over-year change in the loan-to-bond ratio. Column (1) present the results for the baseline sample. The remaining columns present the results for subsamples, only including countries-year observations for countries that have been rated below average in the current year (Column 2), or rated below average at least once in the sample (Column 3). Column (4) focuses on Euro Crisis countries as defined in the text. Finally, column (5) presents the results all countries from column (2) that are not included in column (4). Standard errors are in parenthesis and clustered by country and year, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

and rating changes that is statistically significant at the one percent level, although with reduced point estimates.

The evidence indicates that the there is a meaningful relation between changes in sovereign credit ratings and composition of bonds and loans. This relation appears to be more pronounced when credit ratings are low to begin with. In the next section, we investigate further and assess these aspects more formally.

4.3. Credit rating changes and loan-bond substitution

Credit rating changes are associated with loan-bond substitution. The previous section suggests that lower-rated countries are important for this result. Beyond the level of ratings, is the result primarily driven by rating downgrades and substitution to loans? Or, is a similar mechanism at play when credit ratings improve? If not, one may conclude that reputation as a creditworthy borrower is easier to lose than to build. To answer these questions, we first define two indicator variables

$$DR_{i,t} = \begin{cases} 1, & \text{if } \Delta_1 \text{Rating}_{i,t} < 0 \\ 0, & \text{Otherwise,} \end{cases} \quad \text{and} \quad IR_{i,t} = \begin{cases} 1, & \text{if } \Delta_1 \text{Rating}_{i,t} > 0 \\ 0, & \text{Otherwise.} \end{cases}$$

where DR, captures decreased ratings, andIR, conversely, captures increased ratings. An additional indicator variable $BAR_{i,t}$ captures below-average ratings. It is activated when a country features a rating below the unconditional sample average of our rating index within the calendar year in which quarter t is located, as discussed in Section 2. Given these variables, we estimate the

following regression at quarterly frequency

$$\tilde{y}_{i,t+4} = \alpha_i + \alpha_t + \beta_0 \, BAR_{i,t} + \beta_1 \, DR_{i,t} + \beta_2 \, IR_{i,t} + \Gamma \, X_{i,t} + \gamma_1 \, DR_{i,t} \times BAR_{i,t} + \gamma_2 \, IR_{i,t} \times BAR_{i,t} + \tilde{v}_{i,t+4}. \quad (3)$$

The outcome $\tilde{y}_{i,t+4}$ is either the change in the loan-to-bond ratio, Δ_4 Loan-to-bond$_{i,t+4}$, or the flow value of newly issued bonds or loans relative to GDP within one year, i.e., $\sum_{j=1}^{4}$ Bond Issuance$_{i,t+j}$ for bonds and $\sum_{j=1}^{4}$ Loan Issuance$_{i,t+j}$ for loans, and $\tilde{v}_{i,t}$ is an error term. We include time and country fixed effect to control for time-invariant country characteristics and global trends. We include all three indicator variables in levels to control for their direct effect on the outcomes. The vector of controls, $X_{i,t}$ further includes 4 lags of the ten-year bond yield to purge variation that is predictable by this variable. Finally, we control for the contemporaneous rating index to purge the level effect of ratings. Instead, we are interested in assessing the effects of rating changes for countries which already have a below-average rating. Therefore we are primarily interested in the coefficients associated with the interaction terms, $DR_{i,t} \times BAR_{i,t}$ and $IR_{i,t} \times BAR_{i,t}$.

We report the results in Table 3, along with standard errors in parentheses that are clustered by country and year. In column (1), we report the full specification for the loan-to-bond ratio. Strikingly, we find only downgrades for countries with below-average rating ($DR_{i,t} \times BAR_{i,t}$) are associated with a strong and statistically significant substitution from bonds to loans. While rating increases lead to some substitution in the opposite direction for countries with below-average rating ($IR_{i,t} \times BAR_{i,t}$), we find that this effect is statistically insignificant at all conventional levels. Moreover, the point estimate in absolute terms is more than four times larger for rating decreases. The effect of $DR_{i,t} \times BAR_{i,t}$ is also economically meaningful. The point estimate of 0.13 corresponds approximately to half a standard deviation in the loan-to-bond ratio. Non of the indicator variables has a meaningful effect in levels. This result is robust when estimating separate specifications for increases and decreases as shown in columns (2) and (3).

The result could be driven by changes in the loan-to-bond ratio originating from the numerator, the denominator or both. To investigate the underlying mechanisms, we study issuance of new bonds and loans as additional outcome variables. The new issuance excludes changes in the valuation of existing bonds or loans and, as such, is best suited to assess whether there is active substitution across financing instruments. In column (4), we show that rating decreases for below-

Table 3: *Rating changes in countries with below-average ratings*

	Δ_4 Loan-to-bond$_{i,t+4}$			$\Sigma_{j=1}^{4}$ Bond Issuance$_{i,t+j}$			$\Sigma_{j=1}^{4}$ Loan Issuance$_{i,t+j}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$DR_{i,t} \times BAR_{i,t}$	0.128**	0.140***		-0.029***	-0.029***		0.025**	0.027**	
	(0.050)	(0.050)		(0.009)	(0.010)		(0.012)	(0.013)	
$DR_{i,t}$	-0.004	-0.003		0.020***	0.020***		0.005	0.005	
	(0.019)	(0.016)		(0.005)	(0.005)		(0.005)	(0.005)	
$IR_{i,t} \times BAR_{i,t}$	-0.030		-0.056	0.005		0.009*	-0.004		-0.010
	(0.029)		(0.034)	(0.003)		(0.004)	(0.005)		(0.007)
$IR_{i,t}$	-0.007		-0.005	-0.006**		-0.008***	-0.002		-0.002
	(0.008)		(0.008)	(0.003)		(0.003)	(0.002)		(0.002)
$BAR_{i,t}$	-0.082	-0.090	-0.045	0.030*	0.031*	0.024	-0.012	-0.013	-0.004
	(0.056)	(0.054)	(0.057)	(0.017)	(0.017)	(0.017)	(0.013)	(0.012)	(0.013)
R^2	0.139	0.138	0.133	0.429	0.428	0.416	0.422	0.421	0.396
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	3092	3092	3092	2932	2932	2932	2813	2813	2813

Notes: The table presents results regression results based on Equation 3, as specified in the text. Standard errors are in parenthesis and clustered by country and year, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

average rated countries lead to a significant decline in the issuance of new bonds, with the effect being statistically significant at the one percent level. This confirms that there is an active shift away from bonds. However, a decrease in the ratings without conditioning on a below-average rating ($DR_{i,t}$) is linked to higher bond issuance, presumably due to an anticipated increase in bond borrowing affecting the credit rating today. We note that, if anything, this reverse causality problem should bias the coefficient of $DR_{i,t} \times BAR_{i,t}$ towards zero. Thus, our estimates may constitute a conservative lower bound.[9] In contrast, we find no evidence for increased bond issuance in response to rating increases for countries rated below average. Similar as for decreases, the negative effect of $IR_{i,t}$ (in levels) may reflect reverse causality in the sense that rating agencies may upgrade a rating in response to an anticipated decrease in bond issuance. All results remain unchanged if we estimate a separate model for increases and decreases as shown in columns (4) and (5).

When we study loan issuance in column (7), we find the opposite pattern. Loan issuance increases significantly after downgrades for below-average rated countries. Interestingly, the magnitude of this increase is very close to the decreases in newly issued bonds. Given that both outcomes, loans and bond, are specified in levels, this suggests that substitution is close to perfect with no meaningful effect on the overall level of debt. All other coefficients are statistically insignificant. Again, columns (8) and (9) confirm the disproportionate role of downgrades. Together,

[9]While being insignificant, we note that the level effect of a below-average rating, $BAR_{i,t}$ is presumably subject to the same reverse causality problem. Thus, we prefer to focus on the estimated coefficient for $DR_{i,t} \times BAR_{i,t}$.

these results point towards a robust relationship between sovereign credit downgrades and a shift away from bond-based and towards loan-based financing, when countries are rated below average.

To further assess the plausibility of our results, we estimate the regression from Equation 3 but use the change in the ten-year bond yield, $\Delta_4 \text{Yield}_{i,t+4}$, as outcome variable. The results are reported in Table A2.2 in the Appendix. We find that a rating decreases for below-average rated countries is associated with bond yields being more than 50 basis points higher in our baseline sample. This effect is statistically significant at the five percent level. The corresponding coefficient for rating increases at low levels is, as expected negative, but only about half the size and statistically insignificant.[10]

Overall, our results reveal a striking asymmetry. Credit rating downgrades are followed by a substitution away from bonds and towards loans for countries rated below average. In contrast, credit rating upgrades do not displays the reversed pattern. The former event is linked to bond yield increases whereas the latter is not. This may suggest that reputation as a creditworthy borrower can be lost quickly but building reputation is more difficult.

Robustness: In Table A2.3 in the Appendix, we repeat the exercise from Table 3, focusing only on central governments. If anything, the coefficients slightly increase compared to the baseline for the entire (general) government. Table A2.4 confirms the results using two alternative specifications, once interacting changes in the index itself with the indicator for low ratings, and another doing so for a 'change' variable taking the values -1, 0, 1 respectively for negative, zero, and positive changes. The results again are very similar to Table 3, confirming that rating changes at low levels are important determinants for the new issuance of bonds and loans, irrespective of how these changes are measured. Finally, Figure A2.2 plots the interaction coefficients of $DR_{i,t} \times BAR_{i,t}$ where we increase the horizon of the outcome from $\tilde{y}_{i,t+4}$ to $\tilde{y}_{i,t+h}$, with $h = 0, 1, ..20$. Studying $DR_{i,t} \times BAR_{i,t}$ over a horizon up to 5 years, we confirm that the result is not contingent on the short time horizon of the previous specifications, but persists over the medium term.

4.4. Credit ratings, reallocation and foreign exposure

Which sovereigns are most affected by downgrades and drive the substitution response? A plausible mechanism behind our results is that investors are particularly sensitive to rating downgrades for countries which are already at a sovereign rating below average. Arguably, international investors

[10]Note that for this exercise, we are not constrained by the availability of government balance sheets and can perform the test on a larger sample of more than 4,500 quarterly observations. If we estimate the same regression on this extended sample, we find similar results which are equally significant.

are most sensitive to re-balance their portfolios in response to rating changes. This hypothesis predicts that the observed substitution away from bonds and towards loans, increases with a country's dependence on international creditors. If correct, we should see a more pronounced substitution from bonds to loans in response to downgrades for countries that are more exposed to foreign creditors.

To test this line of reasoning, we build upon the 'unveiled' government bond liabilities presented in Section 3. These data estimate the exposure to international bond investors. Specifically, we compute the foreign-held share of bonds over all outstanding bonds, $FHS_{i,t} \in [0,1]$. We use this to run the following augmented version of the regression from Equation 3

$$\begin{aligned}\tilde{y}_{i,t+4} = \alpha_i + \alpha_t + \beta_0\, BAR_{i,t} + \beta_1\, DR_{i,t} + \Gamma\, X_{i,t} \\ + \gamma_1\, DR_{i,t} \times BAR_{i,t} + \delta_1\, DR_{i,t} \times BAR_{i,t} \times FHS_{i,t} + \tilde{v}_{i,t+4}. \end{aligned} \tag{4}$$

The regression is specified as before, including the choice of control variables and outcomes. Here, we omit the variables involving $IR_{i,t}$ as the coefficients of interest were insensitive to these variables. Instead, we augment the regression with the triple interaction $DR_{i,t} \times BAR_{i,t} \times FHS_{i,t}$. A positive coefficient on this triple interaction would suggest that the substitution towards loans is stronger when a country is more exposed to international creditors, as prescribed by the above hypothesis.

We present the regression results in Table 4, again with standard errors that are clustered at the country and year level. As before, we study the loan-to-bond ratio, as well as the issuance of new bonds and loans separately. The results clearly support the above hypothesis. In columns (1) and (2), we present results for the loan-to-bond ratio. The coefficient on the triple interaction is positive and significant at the five percent level whereas the double interaction ($DR_{i,t} \times BAR_{i,t}$) features a negative and insignificant coefficient. First, we show that these results are consistent with those presented in Table 3. Specifically, we evaluate the regression at $\omega = \gamma_1 + \delta_1 \overline{FHS}_{i,t}$, where $\overline{FHS}_{i,t}$ is the average foreign held-share conditional on $DR_{i,t} = BAR_{i,t} = 1$. We find $\omega = 0.14$ being statistically significant at the five percent level. This is precisely the coefficient on the interaction in column (2) of Table 3. While not surprising, it confirms that results are consistent across specifications. In the second step, we can safely interpret the coefficient on the triple interaction. The magnitude of this effect is moderate. It implies that a country with a one standard deviation larger share of

Table 4: *Rating downgrades and exposure to foreign bond investors in countries with below-average rating*

	Δ_4 Loan-to-bond$_{i,t+4}$		$\Sigma_{j=1}^{4}$ Bond Issuance$_{i,t+j}$		$\Sigma_{j=1}^{4}$ Loan Issuance$_{i,t+j}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$DR_{i,t} \times BAR_{i,t} \times FHS_{i,t}$		0.392**		-0.089*		0.209***
		(0.183)		(0.047)		(0.045)
$DR_{i,t} \times BAR_{i,t}$	0.135**	-0.098	-0.027***	0.027	0.028**	-0.098***
	(0.052)	(0.073)	(0.010)	(0.029)	(0.013)	(0.022)
$DR_{i,t}$	-0.001	-0.000	0.018***	0.018***	0.003	0.004
	(0.018)	(0.019)	(0.005)	(0.005)	(0.006)	(0.006)
$BAR_{i,t}$	-0.090	-0.082	0.030*	0.028	-0.016	-0.011
	(0.056)	(0.056)	(0.017)	(0.017)	(0.014)	(0.013)
$FHS_{i,t}$	0.117	0.102	0.028	0.032	0.050	0.039
	(0.232)	(0.230)	(0.048)	(0.047)	(0.053)	(0.047)
R^2	0.140	0.142	0.457	0.463	0.433	0.465
Country fixed effects	✓	✓	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓
Observations	2973	2973	2759	2759	2684	2684

Notes: The table presents results regression results based on Equation 4, as specified in the text. Standard errors are in parenthesis and clustered by country and year, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

foreign-held bonds, displays a response in the loan-to-bond ratio that is one-tenth of a standard deviation larger.

Finally, we study newly issued bonds and loans in columns (3) to (4) and (5) to (6), respectively. We can relate the estimated coefficients to those from Table 3 as for the loan-to-bond ratio, confirming that results are consistent. Given this, we focus on the triple interaction finding that it is significant for both variables, albeit only at 10 percent for bonds with a p-value of 0.07. The sign of both coefficients aligns with the above hypothesis, confirming substitution from bonds to loans. Overall, the results from all three outcomes suggest that exposure to international creditors in bond markets governs the strength of the substitution from bonds to loans.

In summary, this section makes three key points. First, sovereigns change the composition of financing instruments, bonds and loans, when credit ratings change. Second, not all rating changes and countries are alike. We find strong evidence for substitution from bonds to loans only when (i) credit ratings decrease for (ii) a country that has been rated sufficiently low. Third, the strength of this substitution effect increases in the exposure to foreign bond holders, consistent with these investors being more sensitive to changes in creditworthiness compared with domestic creditors.

5. Implications for government spending and economic growth

How does a higher costs of borrowing affect governments beyond loan-bond substitution? Are there real economic consequences to credit downgrades and loan-bond substitution? We show that an increase in bond issuance is followed by an increase in the governments' financial assets. In contrast, after increases in loan borrowing, financial assets decline. Consistent with this, we find a significant and sizable decline in real government spending and real GDP after credit downgrades for below-average rated countries. These effects build up slowly and reach its trough two to three years after a downgrade. Conversely, the corresponding increases after rating upgrades are smaller, more delayed and less significant.

5.1. Government Financial Assets

To assess the macroeconomic implications of changes in loan and bond issuance, we initially remain within the framework of the government financial accounts. As a natural first step, we study changes in government financial assets conditional on issuance of new liabilities via loans and bonds.[11] Specifically, we run the following regression at quarterly frequency

$$\Delta_h FA_{i,t+h} = \alpha_i + \alpha_t + \beta_1 \Sigma_{j=1}^{4} \text{Loan Issuance}_{i,t-j} + \beta_2 \Sigma_{j=1}^{4} \text{Bond Issuance}_{i,t-j} + \gamma^X X_{i,t} + \epsilon_{i,t+h}, \quad (5)$$

where $\Delta_h FA_{i,t+h}$ denotes the cumulative change in financial assets at quarter $t+h$. The coefficients of interest are β_1 and β_2 which capture the link to newly issued loans and bonds, respectively.[12] All specifications control for country and time fixed effects, α_i and α_t, and $\epsilon_{i,t+h}$ is an error term. The control vector $X_{i,t}$ contain 4 quarterly lags of three government balance sheet variables from the financial accounts. The variables are the stock of loans, the stock of bonds, and the total balance sheet size, all relative to GDP. This allows distinguishing between trends in balance sheets and the implications of changes in loan issuance or bond issuance.

We report the results in Table 5, including only loan issuance, only bond issuance or both as regressors of interest. As before, standard errors are clustered at the country and year level. Columns (1) and (2) show that government assets significantly decrease after the issuance of new

[11] In financial accounts, government assets include only *financial* assets, meaning that future tax claims, government spending in infrastructure and other non-financial assets are excluded. Included items, among others, include government deposits, equity holdings in publicly listed companies, and loans extended to government-owned companies. In our definition, Central Bank holdings are not considered government assets. Together, these items, on average make up around 50% of GDP across our sample.

[12] Recall that Loan Issuance$_{i,t}$ and Bond Issuance$_{i,t}$ are defined as newly issued loans and bonds in t, relative to GDP, to take out growth trends.

Table 5: *Government financial assets and debt issuance*

	Δ_j *Government Financial Assets*$_{i,t+j}$					
	$j=4$	$j=8$	$j=4$	$j=8$	$j=4$	$j=8$
	(1)	(2)	(3)	(4)	(5)	(6)
$\Sigma_{j=1}^{4}$ *Loan Issuance*$_{i,t-j}$	-0.266	-0.586**			-0.354**	-0.752***
	(0.16)	(0.23)			(0.16)	(0.23)
$\Sigma_{j=1}^{4}$ *Bond Issuance*$_{i,t-j}$			0.229**	0.421**	0.151	0.157
			(0.10)	(0.19)	(0.12)	(0.21)
R^2	0.405	0.458	0.369	0.408	0.418	0.476
Country fixed effects	✓	✓	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓	✓	✓
Asset and Liab. Balance	✓	✓	✓	✓	✓	✓
Observations	3075	2951	3210	3086	3034	2910

Notes: The table presents results regression results based on Equation 5, as specified in the text. The outcome is the change in government financial assets, either after $j=4$ or $j=8$ quarters. Standard errors are in parenthesis and clustered by country and year, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

loans over horizons of one and two years, respectively. This is in line with the view that loan financing is more costly, forcing the government to reduce government spending, as proxied by the change in financial asset holdings.

In columns (3) and (4), we report the results for bond issuance. Strikingly, after the new issuance of bonds, government assets increase, indicating that a part of the newly raised funds go into the acquisition of financial assets. This suggests an overall expansion of the government balance sheets, while for loans the increase in cost seems to outweigh this channel, resulting in an ambiguous effect on the balance sheet with increasing liabilities but decreasing assets. The result might also point to a prioritization in the allocation of government resources, with loans being issued at times when other types of spending take priority (e.g., debt service or roll-overs) relative to financial assets. In columns (5) and (6) we estimate the response to loan and bond issuance jointly confirming the key result for loan issuance. If anything, the responses become larger and more significant, while the effect is smaller and imprecisely measured for bonds.

5.2. Credit rating changes and the real economy

Taking these results as motivation, we revisit the setup from Equation 3 to provide direct evidence on the effects of credit downgrades when a country is rated below average. We estimate exactly the same regression only augmenting the control vector by four quarterly lags of the outcome variable to control for predictable dynamics in the outcome. Specifically, we estimate a sequence of regressions where the outcome $\tilde{y}_{i,t+h}$ for $h=0,...,20$, is either the ten-year bond yield, the natural logarithm of real government spending, or of real GDP. We index the regression coefficients by

superscript h corresponding to the lead of the outcome.

In Figure 3, we present the estimates captured by γ_1^h and γ_2^h, the coefficients associated with $DR_{i,t} \times BAR_{i,t}$ and $IR_{i,t} \times BAR_{i,t}$ in columns 1 and 2, respectively. In column 3, we also present the test whether γ_1^h and γ_2^h are significantly different in absolute terms, formally, we report the estimate $\gamma_1^h + \gamma_2^h$. The confidence bands are 68 and 95 percent and based on standard errors clustered at the country and year level.

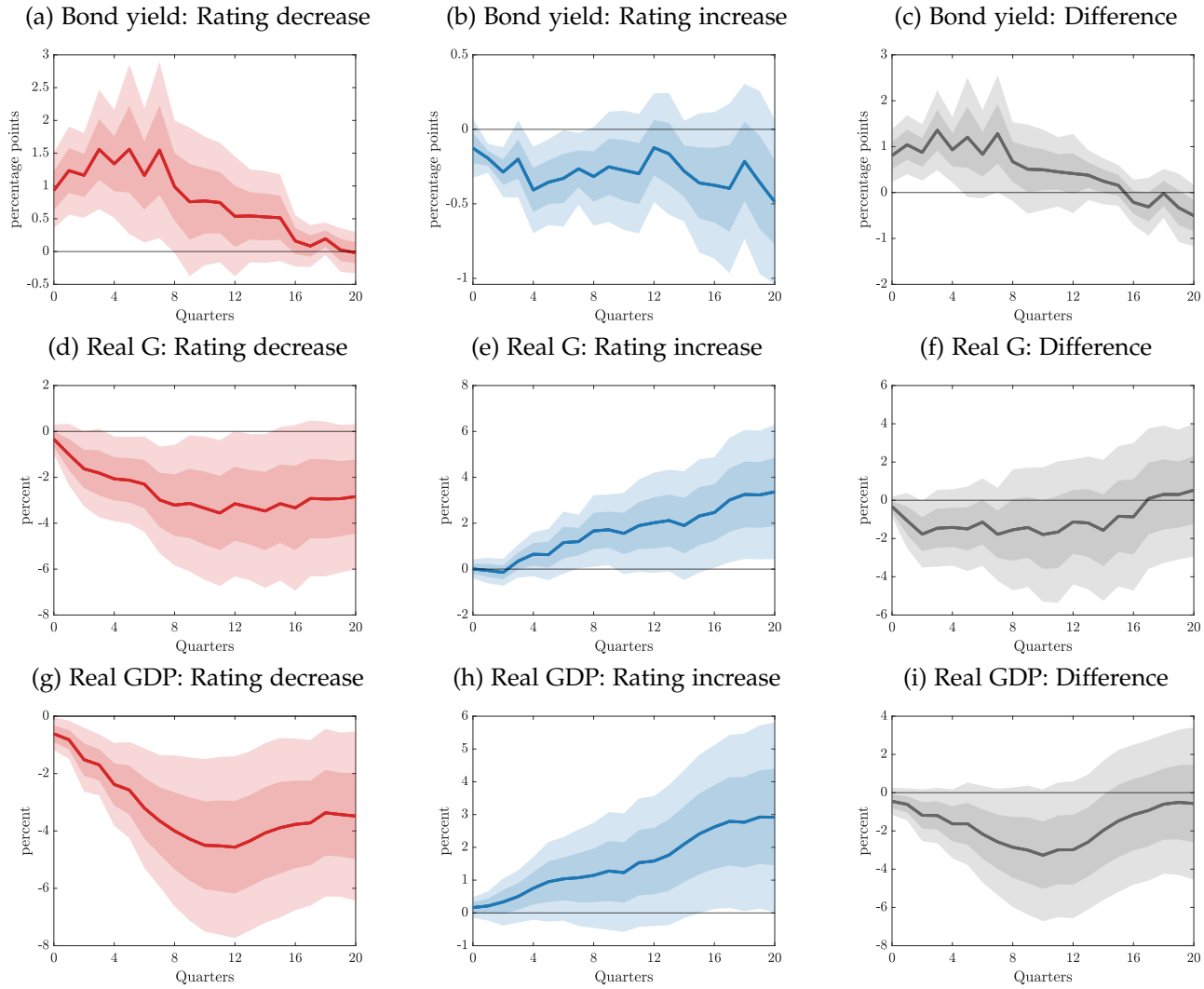
The first row displays the estimates for the ten-year bond yield. The short-run response for $h = 4$ is exactly the same as discussed in Section 4.3. Panels (a) and (b) reveal that the effect is immediate and persistent for both, downgrades and upgrades in the expected direction. Panel (c) shows that the increase in the bond yield is approximately one percentage point larger for downgrades compared with the absolute value associated with rating upgrades. This difference is statistically significant at the five percent level for more than a year and, at the 32 percent level, for almost four years.

In Panels (d) and (e), we show that the asymmetry in bond yields carries over to real government spending. Real spending is significantly lower after rating decreases for below-average rated countries. The effect reaches its trough after almost three years being statistically significant at the five percent level. In contrast, we find that government spending increases much slower after rating increases for countries rated below average. Panel (f) reveals that this difference is quantitatively meaningful with the effect for downgrades being around one percent larger for approximately three years. This effect is less precisely measured but still significant at the ten percent level for a number of quarters.

Given the asymmetry in real government spending, we study how this translates into real GDP in Panels (g) and (h). The response associated with downgrades displays a similar shape as for government spending but the magnitudes are larger, consistent with an elasticity of government spending to GDP above unity. The effect is statistically significant at five percent over the entire response horizon. In contrast, after credit rating increases, we find a more moderate increase in GDP that becomes only significant after more than three years at the five percent level. Panel (i) confirms the asymmetry in impulse responses being economically meaningful. The peak difference exceeds two percent, while being borderline insignificant at the five percent level.

We interpret these results as evidence for a channel running from rating changes to GDP growth, rather than vice versa. If rating changes occurred during periods of low growth and low spending (e.g., due to austerity), we would expect yields and spending to be positively correlated, with yields

Figure 3: *Dynamics of rating changes in countries with below-average ratings*



Notes: The figure presents dynamic effects based on Equation 3, as specified in the text. Column 1 shows the effects for rating decreases for countries rated below average ($DR_{i,t} \times BAR_{i,t}$), and column 2 for rating increases ($IR_{i,t} \times BAR_{i,t}$). The final column tests whether there is a significant difference between increases and decreases in absolute terms. The shaded ares are confidence bands at the 68 and 95 percent level, based on standard errors clustered by country and year.

decreasing as spending declines. Instead, we find that high yields correlate with low spending, and spending being most depressed precisely when yields are elevated the most.

Finally, we complement these results by revisiting the dependence on foreign investors as discussed in Section 4.4. To this end, we revisit the specification from Equation 4 and study the same outcomes as above.[13] The coefficient of interest is δ_1^h, associated with the triple interaction $DR_{i,t} \times BAR_{i,t} \times FHS_{i,t}$, measuring how the above results for downgrades connect to the share of foreign-held bonds. The results are presented in Figure A2.3 in the Appendix. We find that all

[13] As above, we augment the control vector by four lags of the outcome variable

effects, the increase in the bond yield, and the decreases in real government spending and GDP tend to be amplified significantly in the share of foreign-held bonds.

Overall, the presented analysis yields a core insight. The documented substitution from bonds to loans after credit downgrades for countries with a sufficiently low credit rating plausibly has real economic consequences. These real effects may operate through reduced government spending, consistent with an increase in borrowing costs. This mechanism can even be detected conditional on the exposure to foreign credit markets.

6. Conclusion

This paper studies the funding structure of governments, examining financing beyond traditional sovereign bond markets. We document significant heterogeneity in the use of bonds and loans, and in the composition of foreign and domestic creditors, building on the 'unveiling methodology' from Mian et al. (2020) and Diebold and Richter (2021). We relate this heterogeneity to sovereign credit ratings and present three key findings. First, sovereigns change the composition of financing instruments when credit ratings change. Second, not all rating changes and countries are alike. We find strong evidence for substitution from bonds to loans only when (i) credit ratings decrease for (ii) countries that have been rated sufficiently low. Third, the strength of this substitution effect increases in the exposure to foreign bond holders, consistent with these investors being more sensitive to changes in creditworthiness. The findings can be rationalized through disproportionate increases in bond yields. Implicitly, this also means that governments have a preference for bond financing and are only switching to loans when bond sales become untenable. Recall the argument of Reinhart et al. (2003) that this substitution does not mean that loan financing becomes less costly than bond borrowing, but rather that bond markets become so illiquid that these governments have to borrow however and wherever they can. Finally, we show that the documented loan-bond substitution is accompanied by lower government spending and GDP, suggesting real adverse consequences through loan-bond substitution.

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Appendix

Loanly Governments:
Sovereign Debt in the Wake of Credit Downgrades

A. Appendix

A1. Data

Figure A1.1: *Current Rating of the United States (November 2024), for different agencies*

Grade	Description	S&P	Moody's	Fitch	DBRS
Investment Grade	Prime	AAA	Aaa	AAA	AAA
	High Medium Grade	AA+	Aa1	AA+	AA(high)
		AA	Aa2	AA	AA
		AA-	Aa3	AA-	AA(low)
	Upper Medium Grade	A+	A1	A+	A(high)
		A	A2	A	A
		A-	A3	A-	A(low)
	Lower Medium Grade	BBB+	Baa1	BBB+	BBB(high)
		BBB	Baa2	BBB	BBB
		BBB-	Baa3	BBB-	BBB(low)
Speculative Grade	Speculative	BB+	Ba1	BB+	BB(high)
		BB	Ba2	BB	BB
		BB-	Ba3	BB-	BB(low)
	Highly Speculative	B+	B1	B+	B(high)
		B	B2	B	B
		B-	B3	B-	B(low)
	Substantial Risk	CCC+	Caa1	CCC+	CCC(high)
		CCC	Caa2	CCC	CCC
		CCC-	Caa3	CCC-	CCC(low)
	Extremely Speculative	CC	Ca	CC	CC
		C	C	C	C
	In Default	RD	/	RD	RD
		SD	/	SD	SD
		D•NR	D•NR	D•NR	D•NR

Notes: The figure shows the rating scale of the Top 4 rating agencies, highlighting the current credit rating of the United States (November 2024) in green. Positive and negative outlooks are represented by red and green dots respectively. Source: worldgovernmentbonds.com

Table A1.1: *Summary statistics by decade*

	Mean	Median	Std. Dev.	Min	Max	Obs	Panels
Loan/Bond, 70-80	1.424	0.469	1.810	0.007	6.226	171	8
Loan/Bond, 80-90	0.841	0.448	1.134	0.003	6.325	437	13
Loan/Bond, 90-00	0.573	0.379	0.761	0.001	8.790	804	29
Loan/Bond, 00-10	0.466	0.232	0.790	0.001	6.934	1297	34
Loan/Bond, 10-20	0.602	0.256	1.465	0.001	11.173	1216	34
Total Debt/GDP, 70-80	0.511	0.463	0.259	0.165	1.315	171	8
Total Debt/GDP, 80-90	0.631	0.555	0.303	0.249	1.461	446	14
Total Debt/GDP, 90-00	0.706	0.708	0.342	0.105	1.548	807	29
Total Debt/GDP, 00-10	0.646	0.579	0.356	0.069	2.055	1297	34
Total Debt/GDP, 10-20	0.885	0.783	0.473	0.139	2.412	1216	34
Loans/GDP, 70-80	0.105	0.087	0.084	0.003	0.280	171	8
Loans/GDP, 80-90	0.168	0.154	0.128	0.002	0.754	446	14
Loans/GDP, 90-00	0.152	0.131	0.117	0.001	0.683	807	29
Loans/GDP, 00-10	0.110	0.091	0.083	0.001	0.430	1297	34
Loans/GDP, 10-20	0.171	0.122	0.223	0.001	1.671	1216	34
Bonds/GDP, 70-80	0.274	0.387	0.190	0.015	0.570	171	8
Bonds/GDP, 80-90	0.387	0.393	0.251	0.020	1.092	437	13
Bonds/GDP, 90-00	0.471	0.433	0.304	0.012	1.247	804	29
Bonds/GDP, 00-10	0.440	0.371	0.301	0.006	1.592	1297	34
Bonds/GDP, 10-20	0.585	0.492	0.366	0.008	2.012	1216	34

Notes: The table presents summary for selected debt variables by decade.

A2. Additional Results and Robustness

Table A2.2: *Rating decreases and long-term government yields.*

	Δ_4 Ten-year bond yield$_{i,t+4}$							
	All Observations				Baseline Sample			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ChangeVar_{i,t} \times BAR_{i,t}$	-0.361**	-0.371***			-0.434**	-0.398**		
	(0.143)	(0.127)			(0.191)	(0.155)		
$ChangeVar_{i,t}$	0.027	0.002			0.014	0.010		
	(0.086)	(0.079)			(0.111)	(0.096)		
$BAR_{i,t}$	-0.044	0.103	-0.069	0.031	-0.243	0.262	-0.340*	0.139
	(0.143)	(0.127)	(0.142)	(0.125)	(0.183)	(0.171)	(0.181)	(0.182)
$DR_{i,t} \times BAR_{i,t}$			0.469**	0.588**			0.726**	0.672**
			(0.219)	(0.223)			(0.285)	(0.292)
$DR_{i,t}$			-0.112	0.051			-0.126	0.074
			(0.164)	(0.126)			(0.187)	(0.157)
$IR_{i,t} \times BAR_{i,t}$			-0.253	-0.248*			-0.203	-0.257
			(0.161)	(0.126)			(0.180)	(0.153)
$IR_{i,t}$			-0.066	0.048			-0.107	0.082
			(0.083)	(0.061)			(0.089)	(0.061)
R^2	0.131	0.500	0.131	0.501	0.142	0.477	0.143	0.479
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Time fixed effects		✓		✓		✓		✓
Observations	4569	4569	4569	4569	3199	3199	3199	3199

Notes: The table presents results for a regression of the four-quarter (1 Year) forward change in long-term government bond yields on the interaction of a country having a below average rating (BAR) at any point in a given year, interacted, in columns (1), (2), (5), and (6) with a "change" variable, taking the value -1 if at quarter t the country received a decrease in its rating, 0 if the rating remained unchanged, and +1 if the rating increased. In columns (3), (4), (7), and (8), we decompose this variable into indicators for decreased ratings (DR) and increased ratings (IR). Columns (1) to (4) include all available quarterly data points. Columns (5) to (8) repeat the specification for the sample where governments' financial balance sheets are available. Standard errors are dually clustered on country and year levels. *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A2.3: *Rating decreases in countries with below average credit ratings, using only central government*

	Δ_4 Loan-to-bond$_{i,t+4}$			$\Sigma_{j=1}^{4}$ Bond Issuance$_{i,t+j}$			$\Sigma_{j=1}^{4}$ Loan Issuance$_{i,t+j}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$DR_{i,t} \times BAR_{i,t}$	0.205*	0.212*		-0.030***	-0.030***		0.026**	0.028**	
	(0.109)	(0.110)		(0.009)	(0.009)		(0.012)	(0.013)	
$DR_{i,t}$	-0.009	-0.010		0.018***	0.018***		0.004	0.004	
	(0.025)	(0.022)		(0.004)	(0.005)		(0.006)	(0.006)	
$IR_{i,t} \times BAR_{i,t}$	-0.028		-0.068	0.004		0.008	-0.005		-0.011*
	(0.083)		(0.078)	(0.003)		(0.005)	(0.005)		(0.006)
$IR_{i,t}$	0.006		0.009	-0.004*		-0.006**	-0.001		-0.000
	(0.029)		(0.028)	(0.003)		(0.003)	(0.002)		(0.002)
$BAR_{i,t}$	-0.051	-0.057	0.024	0.042**	0.043**	0.034*	-0.014	-0.015	-0.003
	(0.117)	(0.117)	(0.135)	(0.018)	(0.018)	(0.019)	(0.015)	(0.014)	(0.016)
R^2	0.196	0.196	0.195	0.450	0.450	0.436	0.435	0.433	0.407
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	2987	2987	2987	2651	2651	2651	2562	2562	2562

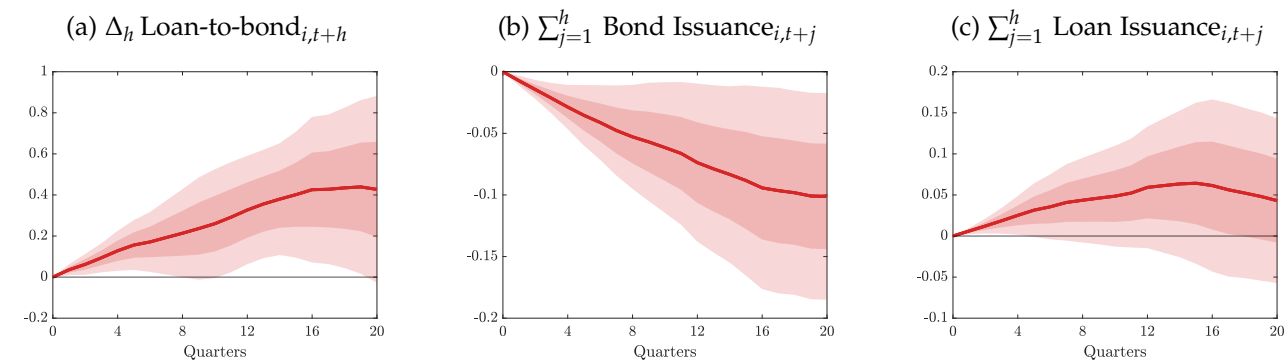
Notes: The table presents results regression results based on Equation 3, as specified in the text. The outcome variables are computed based only on debt from the central government. Standard errors are in parenthesis and clustered by country and year, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A2.4: *Rating decreases in countries with below average credit ratings, alternative specifications*

	Δ_4 Loan-to-bond$_{i,t+4}$		$\Sigma_{j=1}^{4}$ Bond Issuance$_{i,t+j}$		$\Sigma_{j=1}^{4}$ Loan Issuance$_{i,t+j}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Index_{i,t} \times BAR_{i,t}$	-0.092***		0.039***		-0.019**	
	(0.031)		(0.009)		(0.009)	
$\Delta Index_{i,t}$	0.015		-0.031***		-0.006	
	(0.021)		(0.006)		(0.006)	
$ChangeVar_{i,t} \times BAR_{i,t}$		-0.071**		0.016***		-0.012*
		(0.030)		(0.005)		(0.007)
$ChangeVar_{i,t}$		-0.001		-0.013***		-0.003
		(0.011)		(0.003)		(0.003)
$BAR_{i,t}$	-0.060	-0.061	0.027	0.026	-0.007	-0.007
	(0.053)	(0.055)	(0.017)	(0.017)	(0.012)	(0.012)
R^2	0.138	0.138	0.432	0.425	0.454	0.413
Country fixed effects	✓	✓	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓	✓	✓
Observations	3088	3092	2928	2932	2808	2813

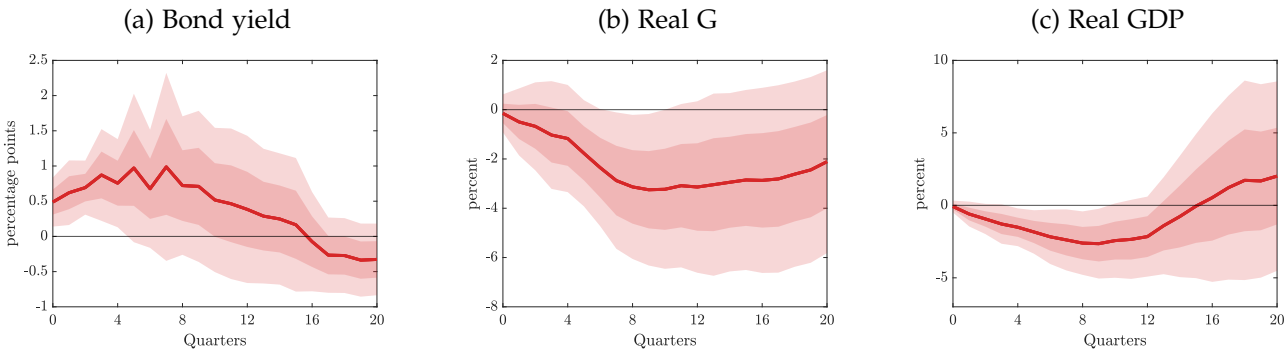
Notes: The table presents results regression results based on Equation 3, as specified in the text. Instead of indicators for increases and decreases, we use either the change in the rating index directly, or use a $ChangeVar_{i,t}$ which takes values -1,0,1, for decreases, no change and rating increases, respectively. Standard errors are in parenthesis and clustered by country and year, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Figure A2.2: *Interaction coefficient of Rating Decrease with low credit rating in t*



Notes: The figure presents dynamic effects based on Equation 3, as specified in the text. The shaded ares are confidence bands at the 68 and 95 percent level, based on standard errors clustered by country and year.

Figure A2.3: *Dynamics of rating downgrades and exposure to foreign bond investors in countries with below-average rating*



Notes: The figure presents dynamic effects based on Equation 4, as specified in the text. The estimates show the effects for rating decreases for countries rated below average depending on the share of bonds held by foreign investors ($DR_{i,t} \times BAR_{i,t} \times FHS_{i,t}$). The shaded ares are confidence bands at the 68 and 95 percent level, based on standard errors clustered by country and year.