# Loanly Governments*

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**Abstract**

We compile a new dataset on government liabilities by instrument for 33 advanced economies and document that a substantial share of government debt consists of loans rather than bonds. To study governments' loan-bond portfolio choice, we exploit high-frequency variation in bond yields around sovereign credit rating announcements. Our analysis yields three main findings. First, increasing bond yields cause the government to substitute from bond to loan-based borrowing. Second, this substitution is mirrored by foreign creditors, who reduce their direct bond holdings and increasingly provide funding indirectly through domestic bank loans. Third, this shift toward domestic bank loans is associated with elevated levels of financial distress. Finally, we discuss how these findings can be rationalized when repatriating government debt through domestic banks reduces sovereign default risk. This mitigates the initial bond yield increase, albeit at the expense of higher bank balance sheet risk.

*Keywords: Government debt, Sovereign bond markets, Loans, Credit ratings*

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# 1. Introduction

Sovereigns use government debt to finance public expenditures, cope with macroeconomic crises, and smooth taxes over time (e.g., Barro, 1979; Romer and Romer, 2019; Broner et al., 2022). To raise these funds, governments may issue sovereign bonds, which are the key object of interest in a large literature on government debt (e.g., Krishnamurthy and Vissing-Jorgensen, 2012; Meyer et al., 2022; Mitchener and Trebesch, 2023). However, as we show in this paper, advanced economies also use loan-based financing, giving rise to a non-trivial debt portfolio choice.

Motivated by this observation, we are the first to study this loan-bond portfolio choice. We ask how the composition of loans and bonds depends on bond yields, which capture the funding cost for governments' main debt instrument. To establish a causal link from government bond yields to portfolio choices, we follow a high-frequency identification approach based on sovereign credit rating announcements. Our analysis yields three main findings. First, in response to an increase in government bond yields, sovereigns substitute away from bond financing toward loans. In contrast, total government debt tends to be unresponsive, which suggests government debt is remarkably inelastic, an insight that a bond-based analysis necessarily overlooks. Second, sovereigns' substitution patterns are mirrored by foreign creditors, who reduce their direct bond holdings and increasingly provide funding indirectly through domestic bank loans. Third, this shift toward domestic bank loans financed from abroad is associated with elevated financial distress.

Our three findings connect bank balance sheet risk with the repatriation of sovereign debt, i.e., direct bond holdings being shifted away from international investors toward domestic agents in the form of loans. Such repatriation may arise as an equilibrium outcome when agents perceive a government default to be less likely if more debt is directly held by domestic agents (Broner et al., 2010). The reason is that, all else equal, sovereigns have fewer incentives to default when not repaying debt would induce further domestic repercussions, e.g., a banking crisis (Gennaioli et al., 2014; Thaler, 2021). As such, debt repatriation through domestic banks provides a stabilizing force that contains risk premia and, thus, governments' funding cost. However, it comes at the expense of higher bank balance sheet risk because it reinforces the classical mechanism analyzed in Diamond and Dybvig (1983). Domestic banks' assets shift toward less liquid loans while the liability side of bank balance sheets becomes increasingly exposed to volatile foreign funding (Calvo, 1998; Forbes and Warnock, 2012; Broner et al., 2013).[1]

[1]Consistent with both of these channels, Diebold and Richter (forthcoming) show that foreign-financed bank loan expansions predict crises while domestically financed ones do not.

For our analysis, we compile granular government debt data from the OECD financial accounts for an unbalanced panel of 33 advanced economies at quarterly frequency between 1960 and 2024, with most countries entering the sample in the 1980s and 1990s. We start by documenting that loan financing is prevalent in all countries in our sample. Typically, the stock of outstanding loans is above 10% of GDP. This is partly accounted for by the central government and partly by lower levels, e.g., states or municipalities. Strikingly, in many cases, the share of loan financing increases around periods of financial turmoil. These observations motivate us to investigate how governments' funding choices depend on the cost of their main debt instrument: sovereign bonds.

Sovereign bond yields, however, summarize investors' beliefs about the macroeconomic and fiscal situation of a given country, raising reverse causality concerns. To address these concerns, we follow Diebold and Hack (2026) and employ a high-frequency identification strategy. The main identification idea is that high-frequency bond yield changes surrounding credit rating announcements by rating agencies can be used as a source of variation that is plausibly unrelated to macroeconomic fundamentals.[2] The underlying premise is that all relevant macroeconomic and financial information has been available before the announcement and, therefore, has already been priced in prior to the rating change. Beyond these fundamentals, the pure information content of the rating announcement can still affect bond yields as announcements may coordinate expectations or affect investment opportunities of institutional investors due to their mandates, leading to portfolio re-balancing.[3]

To operationalize this approach, we first estimate daily event studies, summarizing the behavior of bond yields on the days surrounding sovereign credit rating announcements in our sample of OECD economies. We find no pre-trends, but a notable shift in the level of yields after an announcement. This pattern indicates that these events provide valuable identifying variation, which is not anticipated by bond investors. Additionally, we find considerable heterogeneity across announcements. The effects are larger for rating downgrades than upgrades, and for yield changes that agree with the underlying announcement, i.e., yield increases due to rating downgrades and yield decreases due to upgrades. We subsequently refer to these as the conventional cases.

The event study evidence further reveals that the level shift in yields materializes precisely

[2]This approach is similar to those high-frequency approaches previously applied to, monetary policy (e.g., Kuttner, 2001; Bernanke and Kuttner, 2005; Nakamura and Steinsson, 2018; Altavilla et al., 2019, 2025), OPEC oil supply (e.g., Känzig, 2021; Degasperi, 2023), U.S. treasury auctions (e.g., Phillot, 2025; Bi et al., 2025) and several other types of events.

[3]We view it as implausible that rating agencies possess private information unavailable to other market participants, e.g., investment banks or hedge funds. Therefore, we expect that our credit rating surprises do not reveal any new fundamentals. This contrasts with central bank announcements (e.g., Nakamura and Steinsson, 2018; Miranda-Agrippino and Ricco, 2021; Bauer and Swanson, 2023a), where it is conceivable that these institutions possess superior information.

over a two-day window around rating change announcements. As a result, we use a two-day event window to compute high-frequency yield surprises.[4] Given this event window choice, we compute separate surprise series for positive and negative yield changes. We also compile four additional series that distinguish positive yield changes due to upgrades versus downgrades, and vice versa for negative yield changes. Lastly, we provide instrument diagnostics and find only modest predictability of the bond yield surprises by past macroeconomic data.

We start our main analysis with a simple panel regression of several government debt outcomes on quarterly yield changes. The outcomes are the one-year change in the ratio of outstanding government loans to bonds, the loan-bond ratio, as well as the issuance of loans and the issuance of bonds over a one-year period. Simple OLS results indicate that positive yield changes are associated with an increase in the loan-bond ratio and the issuance of new loans, whereas bond issuance declines. Conversely, the effects of yield decreases display similar signs, but the magnitudes are more muted. Therefore, we account for sign-dependencies in the subsequent analysis.

To establish causality, we instrument the quarterly yield changes with the high-frequency yield surprises. In the first stage, we pass the weak instrument test from Montiel-Olea and Pflueger (2013) at the 1% significance level when instrumenting positive yield changes, whereas negative yield changes deliver a weak first stage. Therefore, we also consider the sign restriction that yield and rating changes agree and focus on positive yield surprises due to downgrades and negative yield surprises due to upgrades. When using surprises stemming from these conventional cases, we can reject the null hypothesis of weak instruments for positive and negative yield changes.[5]

We proceed to the second stage, estimating the causal effects of yield changes on the above mentioned government debt outcomes. A yield increase by 0.25 percentage points causes an increase in the loan-bond ratio of 0.06 over a four-quarter horizon, i.e., per dollar of bond debt there are 6% more loans. This is partially driven by a sizable increase in loan issuance ranging between 1.8 and 1.9% of GDP over the same response horizon. Interestingly, this is almost perfectly mirrored by a similarly-sized decrease in bond issuance, which further contributes to the increase in the loan-bond ratio. All of these estimates are statistically significant at the 1% level. Lastly, when considering yield decreases, we find only modest evidence for loan-bond substitution with estimates being considerably smaller and less significant.

[4] Using daily data is not uncommon for high-frequency identification. For example, Känzig (2021) uses a one-day event window to study OPEC announcements, as opposed to intraday data commonly used to measure monetary policy surprises (e.g., Kuttner, 2001; Gürkaynak et al., 2005).

[5] Imposing sign restrictions on high-frequency surprises is also used by Jarociński and Karadi (2020) and Degasperi (2023) to sharpen identification.

One may suspect that these loans stem exclusively from official lending programs, e.g., from the IMF (e.g., Arellano and Barreto, 2024). Thus, we collect additional data that capture official lending and use it to comprehensively control for this channel. When doing so, the first stage remains similarly strong. The estimated second-stage effects are smaller in magnitude, but the decrease in bond issuance and the increase in loan issuance still exceeds 1% of GDP, and all coefficients remain highly statistically significant. This suggests that our finding of substitution away from bonds toward loans is not purely driven by official lending.

We present several additional results on loan-bond substitution. First, focusing on the dynamics via instrumental variable local projections (Jordà, 2005), we find that the bond yield itself remains persistently elevated for more than three years. This leads to equally persistent loan-bond substitution, which stabilizes only after around three years. Second, discriminating between the central and general government, we show that loan-bond substitution is primarily driven by the central government and not by lower levels, e.g., municipalities and states. Third, we find that overall debt, i.e., the sum of loan and bond debt, remains relatively unresponsive to yield changes, which indicates that government debt is rather inelastic.[6]

To better understand the mechanism behind the main result of loan-bond substitution, we focus on the creditors of government debt. Such an analysis is challenging because counterparty debt data are not available for many countries and periods. Therefore, we apply the "unveiling" methodology introduced by Mian et al. (2020) and extended by Diebold and Richter (forthcoming) to allocate government loans and bonds to their holders, providing us with an estimate of the latent counterparty data. This methodology builds on a proportionality assumption, which we carefully validate with those observations for which the counterparty data are available. The estimated counterparty data reveal direct holdings of government debt. However, domestic households and the foreign sector may also provide funds indirectly to the government, with the corporate sector acting as an intermediary. Thus, we further apply the "unveiling" methodology to allocate the corporate sector asset holdings to the sectors that ultimately provide funds to the corporate sector, as in Mian et al. (2020).

Using these data, we find that governments' loan-bond substitution is partly mirrored by domestic financial intermediaries, which increase government loan holdings but lower their bond positions. The foreign sector decreases its direct holdings of government bonds even more strongly, but does not increase its loans to the government by a comparable amount. Attributing corporate

[6] This is interesting because inelastic government debt supply is often assumed in Heterogeneous Agent New Keynesian economies (e.g., Kaplan et al., 2018; Auclert et al., 2024; Hack, 2025), although there is little empirical evidence.

ownership to households and the foreign sector as in Mian et al. (2020), we find that a sizable share of loans from the domestic banking sector to the government is ultimately financed by the foreign sector. This indirect financing accounts for 0.6% of GDP over a one-year horizon in response to an increase in yields of 0.25 percentage points, with this estimate being highly statistically significant. The result implies that sovereigns' loan-bond substitution is accompanied by a repatriation of sovereign debt in terms of *direct* holdings by domestic banks. Repatriation may emerge as an equilibrium outcome when it reduces the incentives for sovereigns to default. In this case, foreign investors may prefer *indirect* financing via domestic banks because they perceive this investment to be less risky. In turn, governments prefer this way of financing because it contains risk premia and mitigates the initial interest rate increase.

A direct implication of the repatriation channel is an increase in bank balance sheet risk due to two forces. On the one hand, banks hold more loans and fewer bonds and, hence, have less liquid assets. Thus, they become more prone to financial distress due to deposit withdrawal shocks as in Diamond and Dybvig (1983). On the other hand, the banks' liability side is more exposed to volatile foreign funding, which provides a second source of withdrawal risk. As a result, financial distress may become more likely. We provide corroborative evidence for this prediction by studying loan-bond ratios of various sectors, i.e., the ratio of government loan to bond positions held by a non-government sector. We find that an elevated loan-bond ratio of domestic financial intermediaries is associated with a subsequent increase in the financial distress index from Romer and Romer (2017). Attributing corporate holdings to households and the foreign sector, we find that only an increase in the loan-bond ratio of the foreign sector is associated with a statistically significant increase in financial distress. These correlational results suggest that the repatriation of sovereign debt and the accompanying reduction in sovereign default risk (e.g., Broner et al., 2010) comes at the expense of financial fragility due to elevated bank balance sheet risk (e.g., Diamond and Dybvig, 1983).

**Related literature.** First, we contribute to the empirical sovereign debt literature about which Mitchener and Trebesch (2023) provide a recent overview. Many papers study government bonds focusing on the long-run (e.g., Meyer et al., 2022), the implications for bank lending (e.g., Gennaioli et al., 2018), revaluation patterns (e.g., Horn et al., 2024), a comparison with corporate bonds (e.g., Gopinath et al., 2025), and how bond returns are affected by wars (e.g., Federle et al., 2025). Beyond bonds, Fang et al. (2025) study total government debt, including loans, but do not discriminate between instruments. At the debt instrument level, there is only limited evidence available focusing on emerging markets (e.g., Mihalyi and Trebesch, 2022) and China's lending activities (e.g., Horn et al., 2021; Gelpern et al., 2023; Horn et al., 2025). Relative to these papers, we are the first to demonstrate the relative importance of government loans in advanced economies and provide novel causal estimates on how loan and bond financing responds to sovereign bond yield changes.

Further related are Arslanalp and Tsuda (2014) and Arslanalp (2014), who provide estimates of direct holdings of government debt by sector at annual frequency. Castells-Jauregui et al. (2024) and Diebold and Richter (forthcoming) collect detailed OECD financial accounts data, and the latter proposes an unveiling approach following Mian et al. (2020) to estimate direct and ultimate holdings using financial accounts data. Relative to these complementary works, we provide estimates of counterparty data and ultimate holdings at the instrument level and quarterly frequency for a large cross-section of advanced economies.

Second, we contribute novel evidence that informs a large theoretical literature, which focuses on government debt and default risk. Mendoza and Yue (2012) study the implication of default for the business cycle, Bassetto and Galli (2019) contrast foreign and domestic currency debt, and Bianchi and Mondragon (2022) focus on the rollover of debt. Further, several papers study the implications of sovereign risk for the private sector, showing that an increase in sovereign risk weakens banks balance sheets (e.g., Gennaioli et al., 2014) and, thus, reduces bank lending and raises the funding cost of the private sector (e.g., Corsetti et al., 2013; Bocola, 2016; Arellano et al., 2017). Relatedly, Farhi and Tirole (2018) focus on the interaction between banking and sovereign insolvency, and Sosa-Padilla (2018) argues that government default may trigger a domestic banking crisis. Relative to these papers, we offer evidence for a novel channel through which an increase in bond yields leads to financial distress via the repatriation of sovereign debt.

While the above papers focus on government debt in general, we emphasize the importance of different debt instruments. A few complementary theoretical papers also account for the type of government debt focusing on official lending (Corsetti et al., 2006; Arellano and Barreto, 2024), liquidity provision with different debt instruments (Gomez-Gonzalez, 2019), and on bond debt restructurings (Galli and Guibaud, 2024).

Third, we contribute to the literature of debt repatriation. The repatriation mechanism has originally been proposed by Broner et al. (2010), who argue that outstanding debt is sold to domestic agents on secondary markets. This idea has been further enriched and applied to the Euro crises (Broner et al., 2014). Several papers provide empirical evidence for this channel focusing on the Euro crisis (Brutti and Sauré, 2016; Ongena et al., 2019), a larger cross-section of countries (Arslanalp and Sunder-Plassmann, 2022), and Nazi Germany in the 1930s (Papadia and Schioppa, 2024). Different from these papers, our results do not focus on secondary markets. Instead, we find a shift in debt issuance from bonds to loans which is accompanied by repatriation via domestic bank loans. Importantly, we find that repatriation applies only to direct debt holdings because a sizable share of loans is still indirectly financed from abroad.

Fourth, there is a large complementary literature studying the Euro crisis in general and bank balance sheet risk in particular. Studies of the Euro crisis often focus on Greece (e.g., Zettelmeyer et al., 2013; Brutti and Sauré, 2015), the evolution of official lending (e.g., Corsetti et al., 2020),[7] and impaired bank lending (e.g., Acharya et al., 2018; Bottero et al., 2020; Kalemli-Özcan et al., 2022). More specifically, Ongena et al. (2019) document that domestic banks were considerably more likely to hold domestic government debt during the Euro crisis. This finding aligns well with our debt repatriation mechanism, but our results indicate patterns that extend beyond the Euro crisis.

Further related is also Bahaj (2020), who applies a high-frequency identification strategy to Euro crisis events. He identifies spread shocks and focuses on country-specific policy events instead of rating changes. Instead, our approach does not rely on the Euro crisis but allows the identification of more general patterns in a large cross section of advanced economies.

Beyond the Euro crisis, there exists extensive research on financial intermediation and risk with the seminal contribution by Diamond and Dybvig (1983). More recent works focus, e.g., on debt maturity (Greenwood et al., 2015), crowding out due to government debt (Krishnamurthy and Vissing-Jorgensen, 2015), and on a comparison of government and private debt (Jordà et al., 2016). Relative to these complementary works, we show that debt repatriation provides a source of bank balance sheet risk that might lead to financial distress.

## 2. Sovereign debt in loans and bonds

We begin by motivating our analysis of loans and bonds by documenting trends in the liability structure of governments for our sample of advanced economies. We find that a substantial portion of government debt consists of loans, and that loan financing often increases around periods of financial distress.

[7] Relatedly, Schlegl et al. (2019) argue that official lending is not more senior.

**Data.** Our main data on government debt are the quarterly OECD financial accounts.[8] They contain the issuance, as well as the existing stock of government debt by credit instrument, i.e., loans and bonds. For the regression analyses in subsequent sections, we further supplement our main data with various conventional macroeconomic series, including ten-year sovereign bond yields, CPI inflation, and real GDP, as well as the financial distress index from Romer and Romer (2017). Table A1.1 in Appendix A1 provides an overview of our sample coverage for our main variables for each country. Overall, we have an unbalanced panel of 33 advanced economies covering the period from 1960 to 2024, with most countries entering the sample in the 1980s and 1990s.

**Descriptive evidence.** Figure 1 shows the development of government liabilities relative to GDP, decomposed by financing instrument for a selected set of countries between 1980 and 2024. The top row displays the United States, Japan, and an average of all other sample countries. The bottom row depicts selected European countries. The corresponding charts for all other countries in our sample are provided in Figure A1.1 in Appendix A1.

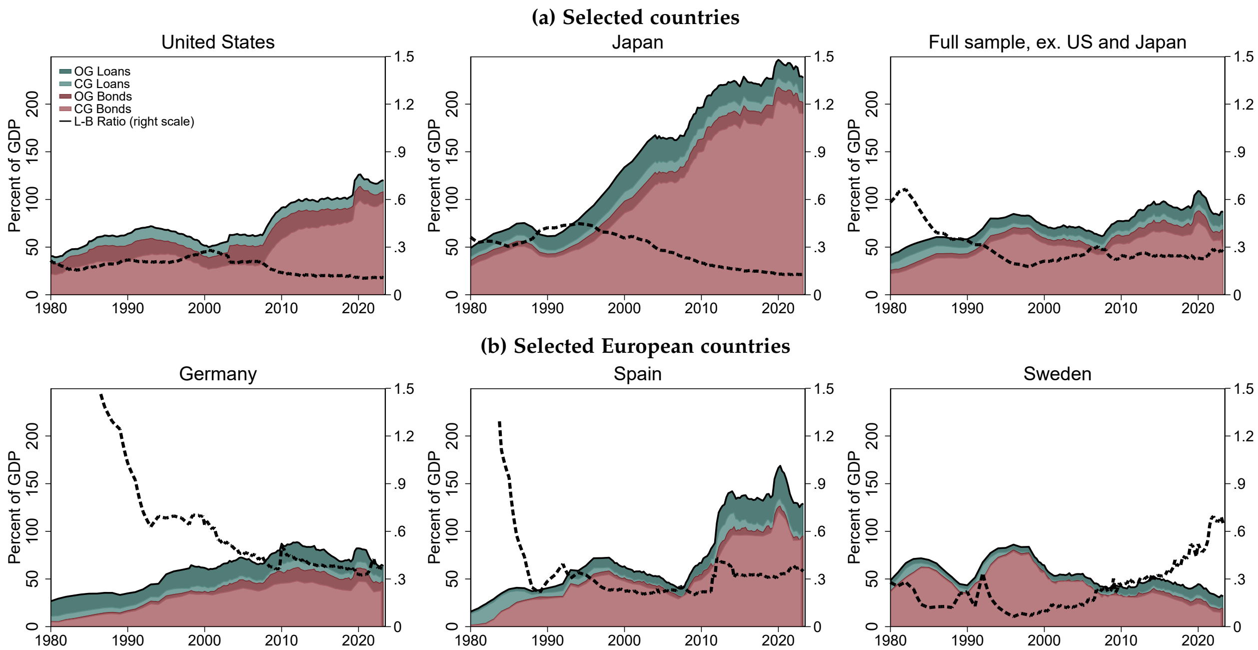
The panels show the stock of outstanding bond liabilities in red (the two lower areas) and outstanding loan liabilities in green (the two upper areas). These data are at the level of the general government, which includes the central government and lower levels, e.g., states or municipalities. Additionally, we offer a breakdown between the central government (CG) and the remaining other levels of the government (OG). The central government's liabilities are always indicated by the lighter-colored areas (the lower ones), whereas the remaining OG liabilities are the darker-colored areas (the upper ones). The dotted black line additionally shows the general government's loans divided by bonds, the loan-bond ratio, on a secondary vertical axis on the right.

For the United States, government liabilities consist mostly of bonds throughout the entire sample. Yet, even the United States has a stable share of loan financing of around 10 percent of GDP. In Japan, loans account for more than 25 percent of GDP, split between the central government and lower-level entities. Focusing on all remaining sample countries in the top-right panel of Figure 1, we obtain an intermediate case, with the typical share of loans out of GDP being around 15 percent in most periods.

Focusing on the loan-bond ratio, we can see a secular decline in this ratio since the 2000s in the US, the 1990s in Japan, and during the 1980s for the remaining sample countries. The general trend away from loan financing, particularly during the early part of our sample, is consistent

[8] When quarterly data are unavailable, we use annual data and linearly interpolate to quarterly frequency to enhance sample coverage.

**Figure 1:** *Government loans and bonds by country*




*Notes:* This figure shows the stock of government debt relative to GDP, broken down by financing instrument, between 1980 and 2024 for selected countries. Panel (a) displays series for the United States, Japan, and a sample average excluding the United States and Japan. Panel (b) presents series for Germany, Spain, and Sweden. The same figures for all remaining sample countries are in Figure A1.1 in Appendix A1. Across panels, government bond liabilities are shown in red (bottom area), liabilities in the form of loans in green (top area). Lighter areas represent the portion of the respective instrument issued by the central government (CG), and the darker areas summarize the remaining other levels of the government (OG). The dotted black line shows the loan-bond ratio of the general government on a secondary vertical axis on the right.

with the global development of government bond markets (Baker et al., 2021; OECD Global Debt Report, 2024) and with structural reforms that enabled governments to shift from relationship-based financing to market-based funding (De Broeck et al., 1998).

Moving to the selected European countries in the second row of Figure 1, we cap the loan-bond ratio at 1.5 to ensure the visibility of fluctuations at lower levels in the later part of the sample. For Germany and Spain, there is a pronounced decline in the loan-bond ratio during the initial decades of the sample. This trend is mostly driven by an increasing amount of bond debt, while loan debt relative to GDP remained relatively stable. Additionally, in both countries, we observe an increase in loans relative to bonds during the Euro crisis, as indicated by the uptick in the loan-bond ratio. This uptick is stronger and more persistent in Spain, which was directly affected by the crisis. In the bottom-right panel, we show that loans are generally less important in Sweden. However, the figure shows a marked spike in the loan-bond ratio during the Scandinavian financial crisis in the early 1990s. There is also a considerable upward trend in this ratio beginning in the 2000s. This increase in the loan-bond ratio is highly persistent, driven mostly by a declining amount of central government bonds, and continues until the end of our sample in 2024.

Overall, we find non-negligible loan financing that is prevalent across both space and time. Interestingly, loan financing often increases relatively during periods of financial turmoil. This motivates us to study the relationship between governments' financing costs, measured by bond yields, and debt, measured separately via loans and bonds, in the following sections.

## 3. Identification strategy

In this section we briefly describe our identification approach, closely following Diebold and Hack (2026). This approach leverages high-frequency changes in government bond yields around sovereign credit rating announcements. We document that this approach yields credible bond yield surprises to instrument sovereign bond yield changes in our quarterly sample.

### 3.1. Yield change surprises

**Identification approach.** The identification idea is that high-frequency bond yield changes surrounding credit rating announcements can be used as a source of variation that is plausibly unrelated to macroeconomic fundamentals. The underlying premise is that all relevant macroeconomic and financial information has been available before the rating change and, therefore, has already been priced in prior to the rating change. This plausibly rules out reverse causality, i.e., that we are capturing the effects of macroeconomic and financial conditions on the bond yield. However, one may wonder why rating changes should still move markets if all information is already incorporated in asset prices. We argue rating changes still matter because, e.g., they may coordinate expectations and institutional investors can often hold certain assets only if they are rated sufficiently well. As a result, investors may re-balance their portfolios after credit rating changes primarily due to the rating change. Thus, bond yield changes in a sufficiently tight window around credit rating announcements reflect a surprise shift in the demand for sovereign bonds that we aim to measure.[9]

**Credit rating announcements.** We follow Diebold and Hack (2026) and use their $RatingIndex_{i,\tau}$ of sovereign credit rating changes, which captures the average across the ratings from Moody's,

[9] Our argument does not hinge on whether a given announcement further affects corporate credit ratings of companies that reside in the country which experiences a rating change, as discussed in Bahaj (2020).

Fitch, S&P, and DBRS Morningstar. Based on this, we define an indicator variable

$$RatingChange_{i,\tau} = \begin{cases} 1 & \text{if } \Delta RatingIndex_{i,\tau} \neq 0 \\ 0 & \text{else,} \end{cases} \tag{1}$$

where $i$ and $\tau$ index countries and daily dates, respectively, and $\Delta$ indicates the change relative to $\tau - 1$.[10] Corresponding indicators that are only activated on credit rating downgrade announcements and upgrade announcements are further defined as $RatingChange^{\mathcal{D}}_{i,\tau}$ and $RatingChange^{\mathcal{U}}_{i,\tau}$, respectively.

**Daily event studies.** We estimate daily event study regressions to asses the behavior of ten-year government bond yields on the days surrounding credit rating announcements in our sample of advanced economies. We do so to assess potential pre-trends in bond yields and to understand how long it takes until markets have fully responded. Formally, we estimate a sequence of regressions

$$Y_{i,\tau+h} - Y_{i,\tau-1} = \alpha_i^h + \beta^h \ RatingChange^k_{i,\tau} + u^h_\tau, \tag{2}$$

for $h \in [-10, 10]$, where $Y_{i,\tau}$ is the daily ten-year constant maturity bond yield at the closing value, $\alpha_i^h$ is a country fixed effect, $RatingChange^k_{i,\tau} \in \{0, 1\}$ is a credit rating announcement indicator as defined above, and $u^h_\tau$ is an error term.[11]

We run these regressions using the credit rating downgrade and credit rating upgrade indicators because upgrades and downgrades likely have opposing effects on bond yields. The results are presented in the top row of Figure 2.The solid line shows the point estimates given by $\beta^h$ and the blue shaded area indicates 95% confidence bands, based on standard errors being clustered at the country and time level.

Focusing on downgrades, we obtain a flat pre-trend with all point estimates being close to zero prior to downgrades. Post credit rating downgrades, we find a sharp increase in bond yields well above 5 basis points. These effects are highly statistically significant and mostly realize within two days. This two-day window is also indicated by a gray shaded area. Rating upgrade announcements, also display no statistically significant pre-trend, although the point estimates fall over the days

[10]The index excludes weekends since no yield data is available, so that $\tau$ refers to workdays. When credit rating changes occur on Saturday or Sunday, these events are recoded to the following Monday.

[11]Diebold and Hack (2026) present similar event study evidence, which we replicate in our estimation sample. The estimation sample is the same that we subsequently use to measure high-frequency yield surprises, i.e., we exclude announcements with confounding events within a two-day window, as explained below.

prior to an upgrade. Yet, even after upgrades, we detect a statistically significant negative effect on bond yields, but the magnitudes are more muted. This evidence suggests that credit rating announcements move markets, plausibly because these announcement shift investors willingness to provide funds to sovereigns.

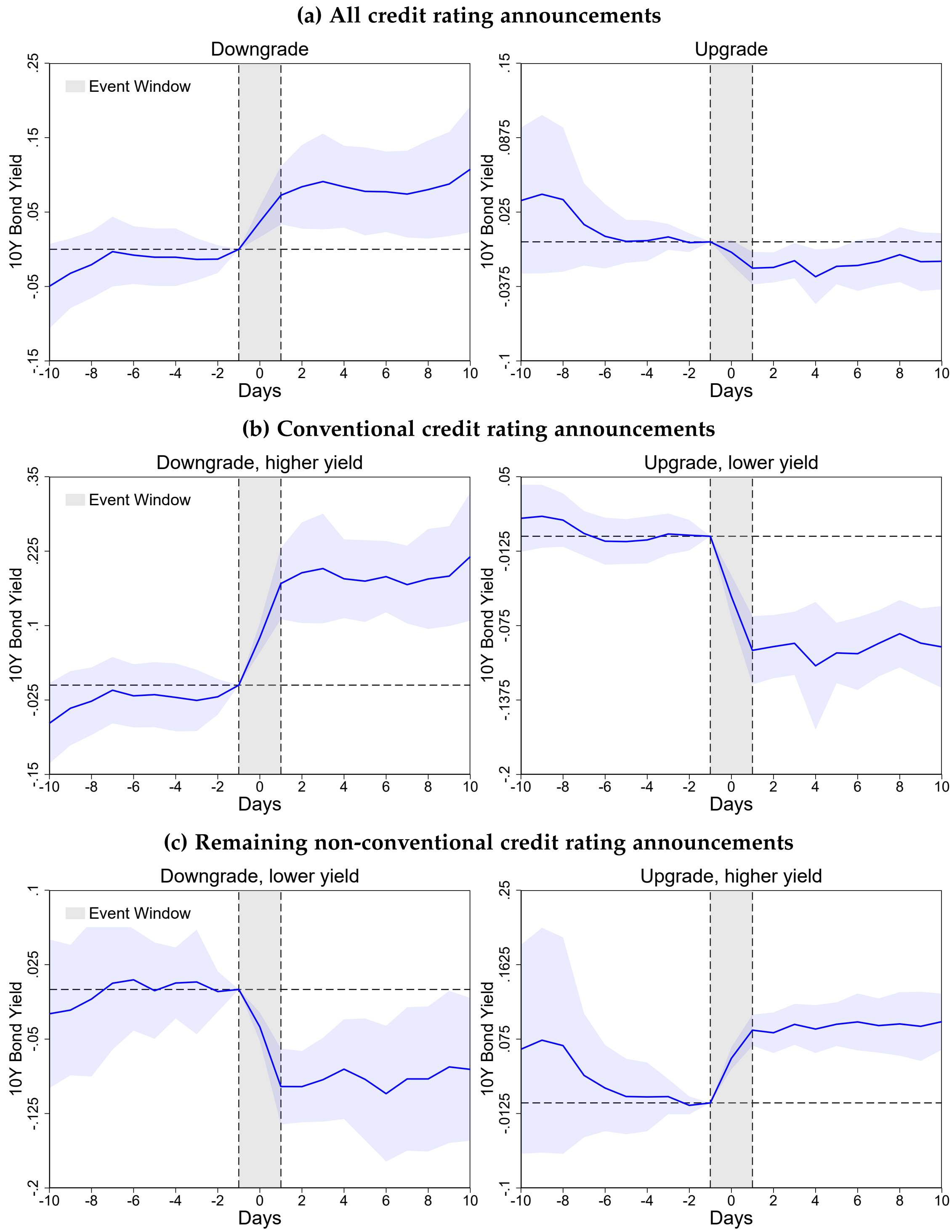
A limitation of the event study is that expectations may mute the estimated effects. For example, if a downgrade was fully anticipated, one should not expect any yield changes. More importantly, if a downgrade step was not as large as expected, yields may even decrease, and vice versa for credit rating upgrades. To investigate this, the remaining rows of Figure 2 impose a sign restriction that splits the sample into credit rating announcements that deliver a yield increase and those that display a yield decrease over the indicated two-day event window.

The second row shows downgrades inducing higher yields and upgrades inducing lower yields. In these "conventional cases", the yield responds as expected, i.e., an unanticipated downgrade signals lower creditworthiness driving up yields, and vice versa for upgrades. As a result, we find magnitudes to be amplified relative to not discriminating by yield changes, as shown in the first row of Figure 2. The shifts in yields are highly statistically significant and persistent, suggesting that these events may be suitable to construct an instrumental variable for bond yield changes at the quarterly frequency. The last row shows the remaining cases, where yield and credit rating changes do not align. In these cases, expectations were possibly disappointed or it took markets more time to digest the announcement. Downgrades leading to lower yields display estimates that turn statistically insignificant after ten days. Upgrades inducing higher yields deliver a more significant effect but no clear level shift in yields, when compared with the pre-trend. Both findings cast doubt on whether these events can be used to compute a relevant instrumental variable for quarterly bond yield changes. Our subsequent empirical strategy accounts for this, as we carefully evaluate instrumental strength for each case.

Overall, we obtain strong evidence that credit rating announcements are not fully anticipated but move yields significantly after being revealed.[12] This is especially true when focusing on the two conventional cases. Thus, we construct high-frequency bond yield surprises next.

[12]These results are not solely driven by the Euro crisis, or by the small subset of countries affected by it. If we exclude the GIIPS countries (Greece, Italy, Ireland, Portugal, Spain), we obtain similar results, as shown in Figure A2.2.

**Figure 2:** *Daily event study of government bond yields around credit rating announcements*




*Notes:* This figure presents daily event study regression results based on Equation 2, as specified in the text. The left-hand side variables are leads and lags of the daily ten-year constant maturity bond yield, which are projected on a rating announcement indicator with the OLS estimates being provided by the solid blue lines. The horizontal axis indicates the lead or lag of the left-hand side variables, relative to the rating announcement. The blue shaded areas indicate confidence bands at the 95% level, based on standard errors clustered by country and time. The left and right columns show estimates for credit rating downgrades and upgrades, respectively. The first row shows all up- and downgrades. The second and third row split the sample based on whether yields increase or decreases within the indicated two-day event window.

## 3.2. High-frequency bond yield shocks

**Construction.** To construct high-frequency surprises, we need to decide on an event window surrounding credit rating announcements. A smaller window reduces the risk of confounding events being inadvertently captured in the surprise variable, the so-called background noise (Nakamura and Steinsson, 2018). A larger event window helps to measure the effect of the rating change more comprehensively if market participants need more time to process the news and adjust their trading behavior. A two-day window balances these considerations, which is also supported by the event study evidence. In addition, this accommodates that many rating changes are announced in the evening after markets have closed to avoid undue market turmoil. Thus, a yield change surprise $YCS_{i,\tau}$ for country $i$ on day $\tau$ is formally defined as

$$YCS_{i,\tau} = (Y_{i,\tau+1} - Y_{i,\tau-1}) \times RatingChange_{i,\tau} \tag{3}$$

where $RatingChange_{i,\tau}$ is the rating announcement indicator defined above. To account for potentially confounding events, the final series of events excludes all credit rating announcements where newsworthy macroeconomic information is released. This includes macroeconomic data releases, political events such as elections, and debt policy events such as sovereign debt restructurings, bailouts, or similar interventions by international organizations.

To account for heteroskedasticity as is common in event-based identification approaches (e.g., MacKinlay, 1997; Känzig, 2023; Odendahl et al., 2025), it also removes credit rating surprises that are small and focuses on surprises that stand out relative to the typical variation in yields over the days prior to the announcement.[13] This approach improves precision, but it is not critical for our subsequent results.

**Non-linearity and sign restriction.** The event study strongly suggest a distinction between four types of rating change events. In addition, separate series for each case may also be useful to allow for non-linearities. Therefore, we first define two additional high-frequency yield change surprises

$$YCS^{\mathcal{H}}_{i,\tau} = YCS_{i,\tau} \times \mathbb{1}\{YCS_{i,\tau} > 0\} \quad \text{and} \quad YCS^{\mathcal{L}}_{i,\tau} = YCS_{i,\tau} \times \mathbb{1}\{YCS_{i,\tau} < 0\}, \tag{4}$$

[13] The concern is that yields vary at high frequency regardless of credit rating announcements. As a result, even when credit rating changes would have no effect on yields, we would measure a surprise. However, such a surprise may only reflect background noise.

to distinguish between positive and negative yield surprises. Subsequently, we further distinguish

$$YCS^{\mathcal{HD}}_{i,\tau} = YCS^{\mathcal{H}}_{i,\tau} \times \mathbb{1}\{\Delta RatingIndex_{i,\tau} < 0\} \text{ and } YCS^{\mathcal{LD}}_{i,\tau} = YCS^{\mathcal{L}}_{i,\tau} \times \mathbb{1}\{\Delta RatingIndex_{i,\tau} < 0\} \quad (5)$$

$$YCS^{\mathcal{HU}}_{i,\tau} = YCS^{\mathcal{H}}_{i,\tau} \times \mathbb{1}\{\Delta RatingIndex_{i,\tau} > 0\} \text{ and } YCS^{\mathcal{LU}}_{i,\tau} = YCS^{\mathcal{L}}_{i,\tau} \times \mathbb{1}\{\Delta RatingIndex_{i,\tau} > 0\}, \quad (6)$$

to differantiate between credit rating downgrades and upgrades, capturing all four above-mentioned cases. As a last step, we aggregate the individual surprises time series from daily to quarterly frequency by summing up all surprises that occur within a quarter.

**Summary statistics.** In Table A2.2 in Appendix A2, we provide summary statistics for all our quarterly surprise series. In total, we have 278 quarters with positive surprises and 297 quarters with negative ones. Relative to high-frequency monetary policy surprises, we have comparatively large magnitudes with the standard deviation ranging between 0.13 and 0.36 percentage points and the largest surprises being above 1.4 percentage points in absolute terms.[14] This suggests that the surprise series capture meaningful variation in bond yields that may be used to identify the effects of sovereign yield changes on government funding choices.

**Predictability of high-frequency surprises.** For monetary policy, an influential literature documents that high-frequency surprises can be predicted by past macroeconomic data (Cieslak, 2018; Miranda-Agrippino and Ricco, 2021; Bauer and Swanson, 2023a,b). Therefore, we investigate whether lagged macroeconomic indicators predict our surprises at the quarterly level. To this end, we estimate the following regression

$$YCS^{k}_{i,t} = \alpha_i + \alpha_t + \beta X_{i,t-1} + v_t, \quad (7)$$

where $k$ indexes the surprise series, $\alpha_i$ and $\alpha_t$ are country and time fixed effects, and $X_{i,t-1}$ contains a lag of the quarterly rating change indicator, real GDP growth, CPI inflation, the rating index, the stock of total government debt, and the ten-year government bond yield at end-of-quarter values. Importantly, all regressors are predetermined with respect to the yield change surprise.

The regression results are shown in Table 1. Columns (1) to (3) focus on positive surprises, and columns (4) and (6) show negative surprises. Across all specifications, we find a within $R^2$ (after taking out fixed effects) that is comparatively low across specifications. Columns (1) and (2) show

[14] For a comparison with monetary policy, see, e.g., the databases from Altavilla et al. (2019) and Acosta et al. (2025).

**Table 1:** *Predictive regressions for high-frequency yield change surprises*

| | $YCS^{\mathcal{H}}_{i,t}$ | $YCS^{\mathcal{HD}}_{i,t}$ | $YCS^{\mathcal{HU}}_{i,t}$ | $YCS^{\mathcal{L}}_{i,t}$ | $YCS^{\mathcal{LU}}_{i,t}$ | $YCS^{\mathcal{LD}}_{i,t}$ |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $Rating\ Change_{i,t-1}$ | 0.003 | 0.005 | -0.001 | 0.003 | 0.002 | 0.001 |
| | (0.006) | (0.005) | (0.001) | (0.006) | (0.003) | (0.004) |
| $GDP\ Growth_{i,t-1}$ | -0.001 | -0.002 | $0.001^{**}$ | 0.001 | 0.000 | 0.000 |
| | (0.001) | (0.001) | (0.000) | (0.001) | (0.001) | (0.000) |
| $Inflation_{i,t-1}$ | -0.001 | -0.001 | -0.000 | $0.003^{***}$ | $0.002^{***}$ | 0.001 |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.001) |
| $Rating\ Index_{i,t-1}$ | -0.001 | 0.001 | $-0.002^{***}$ | $0.004^{***}$ | $0.003^{***}$ | $0.000^{*}$ |
| | (0.002) | (0.002) | (0.001) | (0.000) | (0.001) | (0.000) |
| $Total\ Gov.\ Debt_{i,t-1}$ | -0.000 | -0.000 | -0.000 | $0.000^{*}$ | $0.000^{**}$ | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| $10\text{-}year\ Gov.\ Yield_{i,t-1}$ | $0.016^{***}$ | $0.014^{***}$ | 0.002 | $-0.013^{**}$ | $-0.006^{*}$ | $-0.007^{**}$ |
| | (0.005) | (0.004) | (0.002) | (0.005) | (0.003) | (0.003) |
| Within $R^2$ | 0.061 | 0.048 | 0.034 | 0.126 | 0.068 | 0.064 |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 3245 | 3245 | 3245 | 3245 | 3245 | 3245 |

*Notes:* This table presents quarterly OLS regression results based on Equation 7, as specified in the text. The left-hand side variables are quarterly yield change surprises, which are projected on a set of lagged macroeconomic predictors. Columns (1) and (4) use all positive ($\mathcal{H}$igher yields) and all negative ($\mathcal{L}$ower yields) surprises, respectively. Columns (2) to (3) and (5) to (6) further discriminate whether the yield changes stems from a credit rating $\mathcal{D}$owngrade or $\mathcal{U}$pgrade. The within $R^2$ indicates the fraction of variation that is explained the lagged macroeconomic predictors after taking out fixed effects. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

that positive yield surprises are not predictable apart from residual serial correlation in bond yields. The same applies to downgrades leading to lower yields, as shown in column (6). In contrast, in column (3) higher yields following credit rating upgrades display some predictability by our rating index and real GDP growth. Similarly, negative yield surprises in columns (4) and (5) are partly predictable. Consequently, all of our subsequent regressions include a rich set of macroeconomic controls to address residual identification concerns, and to increase precision via an enhanced signal-to-noise ratio.[15]

## 4. Bond yields and governments' loan-bond portfolio choice

In this section, we study the relation between government bond yields and government debt in loans and bonds. Using the high-frequency yield surprises, we estimate the first stage and provide formal weak instrument tests that suggest our instruments are strong, especially for yield increases. Given the strong first stage, we estimate the causal effects of yield changes. Our general finding is that an increase in government bond yields causes a shift in financing from bonds to loans. We

[15]Including control variables in the subsequent instrumental variable regressions is equivalent to using residualized surprises, as can be seen applying the Frisch-Waugh-Lovell theorem.

further investigate the role of official lending, the response of total government debt, and whether or not loan-bond substitution occurs at the level of the central government.

**Econometric specification.** To study governments' loan-bond portfolio choices, we estimate the following panel regression

$$z_{i,t+4} = \alpha_i + \alpha_t + \beta\, \Delta Y^k_{i,t} + \gamma\, X_{i,t-1} + \nu_{i,t+4}, \tag{8}$$

where our key regressor of interest is $\Delta Y^k_{i,t}$, i.e., the quarterly change in the ten-year constant maturity bond yield for country $i$ at quarterly date $t$. To allow for possible sign-dependence of the estimated effects, the superscript $k \in \{\Delta > 0, \Delta < 0\}$ indicates whether we only consider yield increases and set yield decreases to zero ($\Delta > 0$), and vice versa for yield decreases ($\Delta < 0$). The remaining terms of the right-hand side of Equation 8 are country and time fixed effects denoted by $\alpha_i$ and $\alpha_t$, and $\nu_{i,t+4}$ is an error term. The control vector $X_{i,t-1}$ contains a quarterly lag of real GDP growth, CPI inflation, the bond yield, the rating index, and total government debt.

The left-hand side variable, $z_{i,t+4}$, is the change between $t-1$ and $t+4$ of the loan-bond ratio, i.e., government loans divided by bonds, both measured as stock variables. Alternatively, $z_{i,t+4}$ denotes the sum of newly issued loans between $t$ and $t+4$, and similarly for newly issued bonds.[16] These flow variables are always expressed relative to nominal GDP, and all government debt variables are at the level of the general government in the national accounts.[17]

Here and throughout the regressions in Section 4 and Section 5, we present estimates that correspond to a 0.25 percentage point change in bond yields.[18] We compute standard errors that are clustered at the country and time level.

## 4.1. Baseline results

**OLS results.** We start our analysis by estimating Equation 8 with OLS before exploiting our high-frequency identification strategy. We present the OLS estimation results in Table 2. Columns (1), (4), and (7) show the pooled case where our regressor of interest captures all yield changes regardless of their sign. In this pooled case, a 0.25 percentage point increase in bond yields is associated with an increase in the loan-bond ratio of 0.02. This is particularly driven by loan

[16] Studying newly issued bonds instead of stocks is advantageous because issuance is free of valuation effects and, thus, better captures governments' active funding decisions.

[17] We provide additional estimates using only the central government along with additional results in Subsection 4.3.

[18] A 0.25 percentage point change corresponds to roughly half a standard deviation of quarter-on-quarter yield changes, which is 0.55 percentage points in our sample.

**Table 2:** *The link between yield changes and government loan-bond portfolio choices*

| | $\Delta_5$ Loan-Bond ratio$_{i,t+4}$ | | | $\Sigma_{j=0}^{4}$ Loan Issuance$_{i,t+j}$ | | | $\Sigma_{j=0}^{4}$ Bond Issuance$_{i,t+j}$ | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| $\Delta Y_{i,t}$ | 0.019** | | | 0.501*** | | | -0.265*** | | |
| | (0.008) | | | (0.117) | | | (0.096) | | |
| $\Delta Y_{i,t}^{\Delta>0}$ | | 0.032*** | | | 0.879*** | | | -0.366* | |
| | | (0.012) | | | (0.223) | | | (0.219) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | | 0.017 | | | 0.434*** | | | -0.326*** |
| | | | (0.010) | | | (0.130) | | | (0.104) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 3589 | 3589 | 3589 | 3589 | 3589 | 3589 | 3589 | 3589 | 3589 |

*Notes:* This table presents quarterly OLS regression results based on Equation 8, as specified in the text. The left-hand side variables are the change in the loan-bond ratio between $t-1$ and $t+4$ in columns (1) to (3), the cumulative issuance of government loans relative to GDP from $t$ to $t+4$ in columns (4) to (6), and the cumulative issuance of government bonds relative to GDP over the same period in columns (7) to (9). $\Delta Y_{i,t}$, refers to the quarter-on-quarter change in ten-year government bond yields. $\Delta Y_{i,t}^{\Delta>0}$ and $\Delta Y_{i,t}^{\Delta<0}$ indicate the same bond yield change but further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

issuance which increases by 0.50 percent of GDP over the one year horizon under consideration. In contrast, bond issuance is reduced by 0.27 percent of GDP. All of these estimates are highly statistically significant.

In the remaining columns of Table 2, we repeat the estimation but allow for sign-dependence and discriminate between bond yield increases and bond yield decreases. This reveals that the above discussed effects are primarily driven by yield increases, whereas the estimated effects for yield decreases are more muted, especially for the loan-bond ratio and loan issuance.[19] As a result, the subsequent analysis always accounts for the possibility of sign-dependencies.

Overall, these results highlight a close connection between loan–bond portfolio choices and movements in government bond yields. However, we fully acknowledge that these results are only correlational. In particular, these estimates may partly reflect reverse causality, i.e., we are also measuring the effect of governments' portfolio choices on the bond yield itself. To address this reverse causality concern and to focus on governments' choices as a function of the bond yield, we turn to our high-frequency identification strategy.

**First stage.** To establish causality from bond yields to loan-bond portfolio choices in our quarterly data, we leverage the high-frequency identified yield surprises. We start this analysis by investigating instrument relevance and estimate the first stage corresponding to Equation 8. Specifically, we

[19]This sign dependency aligns with the event study estimates presented in Section 3, where we also documented stronger effects of rating downgrades that are followed by a yield increase.

instrument our main regressor of interest, $\Delta Y^{k}_{i,t}$, with a corresponding yield change surprise, $YCS^{k}_{i,t}$.

We consider several possible sets of instruments and present the corresponding first stage estimates in Table 3. First, in columns (1) and (2), we use $YCS^{\mathcal{H}}_{i,t}$ and $YCS^{\mathcal{L}}_{i,t}$ capturing all positive and negative yield change surprises, respectively. We refer to this approach as pooled IV. Instrumenting positive yield changes with $YCS^{\mathcal{H}}_{i,t}$ in column (1), we obtain a highly statistically significant coefficient that displays the expected sign. Moreover, the within $R^2$ equals 0.15, suggesting that 15% of variance is accounted for by the instrumental variable after taking out fixed effects and control variables. Moving to negative yield changes in column (2), however, we find a negative first stage point estimate. This is puzzling because it indicates that a surprise decrease in yields predicts a positive quarter-on-quarter yield change.[20] Additionally, the within $R^2$ is very close to zero. These results cast doubt on the relevance of the instrument for yield decreases.

Therefore, we consider a second set of sign restricted instruments. Specifically, we consider only surprises where rating and yield changes align, i.e., rating downgrades with a positive yield surprise and rating upgrades with a negative yield surprise.[21] The results are displayed in columns (3) and (4). In both cases, we find highly statistically significant coefficients with the expected sign and the $R^2$ increases considerably compared with the pooled IV case, especially for yield decreases.

Lastly, for maximal transparency, we also show the first stage estimates when using only those rating announcements that violate the above sign restriction. As shown in columns (5) and (6), both coefficients display a puzzling sign and the $R^2$ drops strongly. These results suggest that our sign restriction refines our instrumental variable to capture mainly rating events with strong effects on bond yields. Importantly, this result is not by construction since the sign restriction is not conditioning on any first stage result.

**Weak instrument tests.** The first stage results suggest that at the quarterly level the pooled IV is only strong for positive yield changes, whereas the sign restricted IV may be strong for both, yield increases and decreases. These three cases correspond to columns (1), (3), and (4) in Table 3. To further assess instrument strength, we turn to formal weak instrument tests.

As recommended by Andrews et al. (2019), we use the weak instrument test from Montiel-Olea and Pflueger (2013), which is robust to heteroskedasticity, serial correlation and clustering. This test compares an effective F statistic with a critical value.[22] The reported critical value corresponds

[20] Potentially, this could occur when it takes more time for markets to digest the rating change so that our event window is too short to capture this event appropriately.

[21] This is similar to the poor man's sign restriction applied to monetary policy by Jarociński and Karadi (2020).

[22] In our "just identified" setting, the effective and Kleibergen-Paap F statistics coincide (Andrews et al., 2019).

**Table 3:** *First stage estimates and weak instrument tests*

| | Pooled IV | | Sign restriction | | Sign restriction violated | |
|---|---|---|---|---|---|---|
| | $\Delta Y_{i,t}^{\Delta>0}$ | $\Delta Y_{i,t}^{\Delta<0}$ | $\Delta Y_{i,t}^{\Delta>0}$ | $\Delta Y_{i,t}^{\Delta<0}$ | $\Delta Y_{i,t}^{\Delta>0}$ | $\Delta Y_{i,t}^{\Delta<0}$ |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $YCS_{i,t}^{\mathcal{H}}$ | 1.176*** | | | | | |
| | (0.141) | | | | | |
| $YCS_{i,t}^{\mathcal{L}}$ | | -0.844** | | | | |
| | | (0.416) | | | | |
| $YCS_{i,t}^{\mathcal{HD}}$ | | | 1.395*** | | | |
| | | | (0.188) | | | |
| $YCS_{i,t}^{\mathcal{LU}}$ | | | | 2.395*** | | |
| | | | | (0.404) | | |
| $YCS_{i,t}^{\mathcal{HU}}$ | | | | | -0.160 | |
| | | | | | (0.189) | |
| $YCS_{i,t}^{\mathcal{LD}}$ | | | | | | -1.070*** |
| | | | | | | (0.236) |
| Within $R^2$ | 0.15 | 0.03 | 0.19 | 0.17 | 0.00 | 0.02 |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Effective F | 65.94 | 4.32 | 51.96 | 33.03 | 8.75 | 19.37 |
| Montiel-Olea & Pflueger (2013) critical value | 30.13 | 30.13 | 30.13 | 30.13 | 30.13 | 30.13 |
| Observations | 3169 | 3169 | 3169 | 3169 | 3169 | 3169 |

*Notes:* This table presents quarterly first stage regression results based on Equation 8, as specified in the text. The left-hand side variables are the quarter-on-quarter change in the ten-year government bond yield, conditioning on positive ($\Delta > 0$) or negative ($\Delta < 0$) yield changes as indicated by the superscript. The regressors are the yield change surprises, where superscripts $\mathcal{H}$ and $\mathcal{L}$ indicate positive and negative surprises, respectively. We refer to these cases as pooled IV. The additional superscripts $\mathcal{D}$ and $\mathcal{U}$ refer to rating downgrades and rating upgrades, respectively. Sign restriction refers to those surprises for which rating and yield changes agree in their sign. The effective F statistic and the critical value correspond to the Montiel-Olea and Pflueger (2013) weak instrument test at the 1% significance level. An F statistics above the critical value allows rejecting the null of weak instruments. The within $R^2$ indicates the fraction of variation that is explained by the yield surprise after taking out fixed effects and control variables. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

to a test of the null hypothesis that the relative weak instrument bias exceeds 10%. We compute the critical value for testing this null at the 1% significance level. Both the critical value and the effective F statistic are included in Table 3. Only the above mentioned cases in columns (1), (3), and (4) in Table 3 display an effective F statistic exceeding the critical value, which allows us to reject the null of weak instruments at the 1% significance level.

Lastly, we test for weak instruments via the reduced-form of Equation 8, i.e., we replace the endogenous variable by the instrument to project directly on the instrumental variable via OLS. Following Chernozhukov and Hansen (2008), the hypothesis test of the reduced-form estimates against the null of a zero coefficient is equivalent to testing whether the instrument has zero relevance. For all of our government debt outcomes we present the result in Table A3.3, A3.4, and A3.5 in Appendix A3. Across outcomes, we can reject the null at the 1% significance level when considering yield increases. For yield decreases, we can reject the null only when considering loan issuance as the outcome variable. However, we emphasize that this does not necessarily imply a weak instrument for yield decreases and that the above-displayed Montiel-Olea and Pflueger (2013) does reject the null of weak instruments for yield decreases when using the sign restricted IV.

As a result of the above presented tests, we conclude that we have several strong instruments for quarterly government bond yield changes that allow us to estimate the causal effects of these bond yield changes on governments' debt portfolio choices.

**Second stage.** Given the strong first stage, we present the corresponding second stage IV estimates of Equation 8 in Table 4. Throughout, we show the results for both the set of pooled and the set of sign-restricted instruments.

The effects of yield increases are shown in the first row. In response to a yield increase by 0.25 percentage point, we find an increase in the loan-bond ratio of 0.06, i.e., per dollar of bond debt there are 6% more loans after one year. This is driven by an increase in loan issuance between 1.83 and 1.90 percent of GDP, and a decrease in bond issuance between 1.57 and 1.74 percent of GDP. All of these estimates are statistically significant at the 1% level, regardless of the instrumental variable used for identification.

Since our surprises capture shocks to the demand for government debt, one may interpret our estimated coefficients as slopes of the government debt supply schedules. The results imply a bond supply curve, which is upward sloping in bond prices. However, total government debt supply given by loans and bonds together appears rather inelastic to increases in bond yields.[23]

Moving to yield decreases in the second row of Table 4, we find a statistically significant effect on loan issuance using the sign restricted IV. However, the estimated coefficient is considerably smaller than the estimate for yield increases. Furthermore, the loan-bond ratio and the issuance of new bonds display only insignificant effects. This suggests an economically meaningful sign-dependence of yield changes: While increases in yields lead to a substitution toward loan financing, we find that an equally-sized decrease in yields only partly reverses this effect.[24] Similarly, we find no evidence that yield decreases reverse the effect on bond issuance or the loan-bond ratio.

[23] We present the response of total debt in Subsection 4.3 as an additional result.

[24] Often, it can be challenging to disentangle sign- and size-dependencies (Caravello and Martinez-Bruera, 2024). In our case, however, we note that the distribution of positive and negative yield change surprises, as shown in Figure A3.3, is comparable so that we can plausibly attribute the detected non-linearity to sign-dependencies.

**Table 4:** *Causal effects of yield changes on government loan-bond portfolio choices*

| | $\Delta_5$ Loan-Bond ratio$_{i,t+4}$ | | | | $\Sigma_{j=0}^{4}$ Loan Issuance$_{i,t+j}$ | | | | $\Sigma_{j=0}^{4}$ Bond Issuance$_{i,t+j}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.062*** | | 0.056*** | | 1.896*** | | 1.833*** | | -1.740*** | | -1.574*** | |
| | (0.008) | | (0.008) | | (0.338) | | (0.346) | | (0.235) | | (0.216) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | -0.044 | | 0.001 | | -0.959 | | 0.480*** | | 1.103 | | 0.030 |
| | | (0.035) | | (0.006) | | (0.921) | | (0.125) | | (0.926) | | (0.231) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 3169 | 3169 | 3169 | 3169 | 3169 | 3169 | 3169 | 3169 | 3169 | 3169 | 3169 | 3169 |

*Notes:* This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change in the loan-bond ratio between $t-1$ and $t+4$ in columns (1) to (4), the cumulative issuance of government loans relative to GDP from $t$ to $t+4$ in columns (5) to (8), and the cumulative issuance of government bonds relative to GDP over the same period in columns (9) to (12). The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y_{i,t}^{\Delta>0}$ and $\Delta Y_{i,t}^{\Delta<0}$ indicate that the bond yield change is further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

## 4.2. Sensitivity analysis

We inspect whether our results are sensitive to several modeling choices, including control variables, yield surprises, and the estimation sample under consideration. All corresponding results are shown in Appendix A3.

**Control variables.** Given our instrumental variable approach, control variables should not be critical for identification but may still be used to enhance the signal-to-noise ratio (e.g., Stock and Watson, 2018). For this reason, our baseline specification includes a quarterly lag of several macroeconomic indicators. To investigate the role of control variables in our results, we report three additional specifications in the Appendix: omitting all control variables in Table A3.6, including four quarterly lags of the baseline set of controls in Table A3.7, and including four lags of the baseline controls and four lags of loan and bond issuance to better account for serial correlation in these outcomes in Table A3.8. Across all specifications, we obtain estimates that are comparable to the baseline. Importantly, the results are equally significant and the magnitudes are not meaningfully smaller than the baseline estimates.

**Sign- and size-dependencies.** The baseline specification considers either positive yield changes or negative yield changes, while omitting the other one. To assess whether this modeling choice affects our results, we include positive and negative yield changes in a single regression and instrument both regressors accordingly. The results are in Table A3.9 with the estimates being very similar to the baseline in terms of both magnitudes and statistical significance. This suggests that our baseline approach of separating positive and negative changes is not critical for our findings.

A related issue pertains to whether we can causally identify sign-dependencies separately from size-dependence (e.g., Caravello and Martinez-Bruera, 2024). To this end, we display the distributions of the absolute value of negative and positive surprises in Figure A3.3, which are very similar. This suggests that our estimates are unlikely to be confounded by size-dependencies stemming from differences in the underlying instrumental variable distributions.

Lastly, the histogram in Figure A3.3 shows that the vast majority of surprises are below 0.5 percentage points in absolute value. However, there are some observations where the yield surprises take considerably larger values. Thus, we investigate whether our results are driven by those extreme observations and exclude the 2.5 percent largest and the 2.5 percent smallest yield surprises.[25] When doing so, we obtain estimates that remain statistically significant and are somewhat larger than the baseline; see Table A3.10. This indicates that our main results are not amplified by these extreme observations.

**Sub-samples.** One may wonder how important certain countries are in our results. For example, the alert reader may suspect that our effects could be driven by Greece which played an extraordinary role during the Euro crisis (e.g., Brutti and Sauré, 2015). To assess this dependence, we follow a Jackknife-type approach (see, e.g., Hansen, 2022), and leave out all observations of a given country and re-estimate our main specification from Equation 8. We repeat this exercise for each country in our sample and report the coefficient on yield increases in Table A3.11. Across all countries in our sample, we obtain point estimates broadly in line with the baseline. All of these estimates remain highly statistically significant. Importantly, addressing the above-mentioned concern on the role of Greece, we find, if anything, excluding Greece delivers slightly larger responses.

These results confirm that our findings do not hinge on a specific country in the sample. However, it might not fully address the concern that our results are strongly driven by the Euro crisis. Thus, we conduct a further sub-sample analysis and re-estimate our main specification either with only pre-Euro crisis data, or with only post-Euro crisis data.[26] The results are provided in

[25] This corresponds to the exclusion of yield surprises above 0.99 and below -0.66 percentage points.

[26] We define pre-Euro crisis such that the most recent data used, including the one-year lead of the left-hand side variable, is from the fourth quarter of 2009.

Table A3.12 in the Appendix. Using only pre-Euro crisis data yields slightly smaller coefficients, but overall very similar results for all three studied outcomes. When using the later sub-sample which starts in 2009 and, thus, includes the Euro crisis, we obtain estimates that remain highly statistically significant with magnitudes close to the baseline.

Finally, we also inspect a possible structural break due to the Covid-19 pandemic and provide the results in Table A3.13. While the baseline sample runs until 2024 for maximal coverage, we obtain very similar results when ending the sample in 2019. Strikingly, when estimating our main specification only on the remaining post-Covid observations, we still find a highly statistically significant increase in the loan-bond ratio and in loan issuance, despite the small sample.

Overall, we conclude that our results are remarkably robust across various sub-samples, which confirms that loan-bond substitution is a robust consequences of yield increases.

### 4.3. Additional results

**The role of official lending.** We investigate whether the substitution from bonds to loans is also a substitution from private creditors to official lending programs, e.g., from the IMF (e.g., Arellano and Barreto, 2024). To do so, we assemble six measures of official lending from the International Monetary Fund (IMF), the European Stability Mechanism (ESM), the European Financial Stability Facility (EFSF), the European Balance of Payments Facility, the European Financial Stabilisation Mechanism (EFSM), and the European instrument for temporary Support to mitigate Unemployment Risks in an Emergency (SURE). These series comprehensively capture official lending. Therefore, we include all six series as additional control variables. Specifically, we include the change in the stock of outstanding official lending between $t-1$ and $t+4$ for each of the six series. Note that this timing matches the left-hand side variable to absorb all changes in the outcome that can be explained by official lending.

When running this augmented regression, we find that the first stage is as strong as in the baseline. In particular, we still pass the Montiel-Olea and Pflueger (2013) weak instrument test at the same level of significance as before, as shown in Table A3.14 in Appendix A3. The second stage results in Table 5 reveal that our results are not entirely driven by official lending. Specifically, focusing on yield increases, the response of the loan-bond ratio still ranges between 0.05 and 0.06, depending on the instrumental variable used. The corresponding coefficients for loan and bond issuance decrease in magnitude compared with the baseline. However, the loan issuance response still ranges between 1.14% and 1.29% of GDP, a reduction in point estimates between 32% and 38%

**Table 5:** *Causal effects of yield changes on government loan-bond portfolio choices, controlling for official lending*

| | $\Delta_5$ Loan-Bond ratio$_{i,t+4}$ | | | | $\Sigma_{j=0}^{4}$ Loan Issuance$_{i,t+j}$ | | | | $\Sigma_{j=0}^{4}$ Bond Issuance$_{i,t+j}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.060*** | | 0.050*** | | 1.290*** | | 1.140*** | | -1.564*** | | -1.334*** | |
| | (0.006) | | (0.005) | | (0.201) | | (0.116) | | (0.079) | | (0.038) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | -0.025 | | 0.003 | | -0.133 | | 0.434** | | 0.460 | | -0.019 |
| | | (0.020) | | (0.006) | | (0.203) | | (0.171) | | (0.415) | | (0.239) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Official lending | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 3048 | 3048 | 3048 | 3048 | 3048 | 3048 | 3048 | 3048 | 3048 | 3048 | 3048 | 3048 |

*Notes:* This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change in the loan-bond ratio between $t-1$ and $t+4$ in columns (1) to (4), the cumulative issuance of government loans relative to GDP from $t$ to $t+4$ in columns (5) to (8), and the cumulative issuance of government bonds relative to GDP over the same period in columns (9) to (12). The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y_{i,t}^{\Delta>0}$ and $\Delta Y_{i,t}^{\Delta<0}$ indicate that the bond yield change is further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. We also control comprehensively for official lending, as described in the text. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

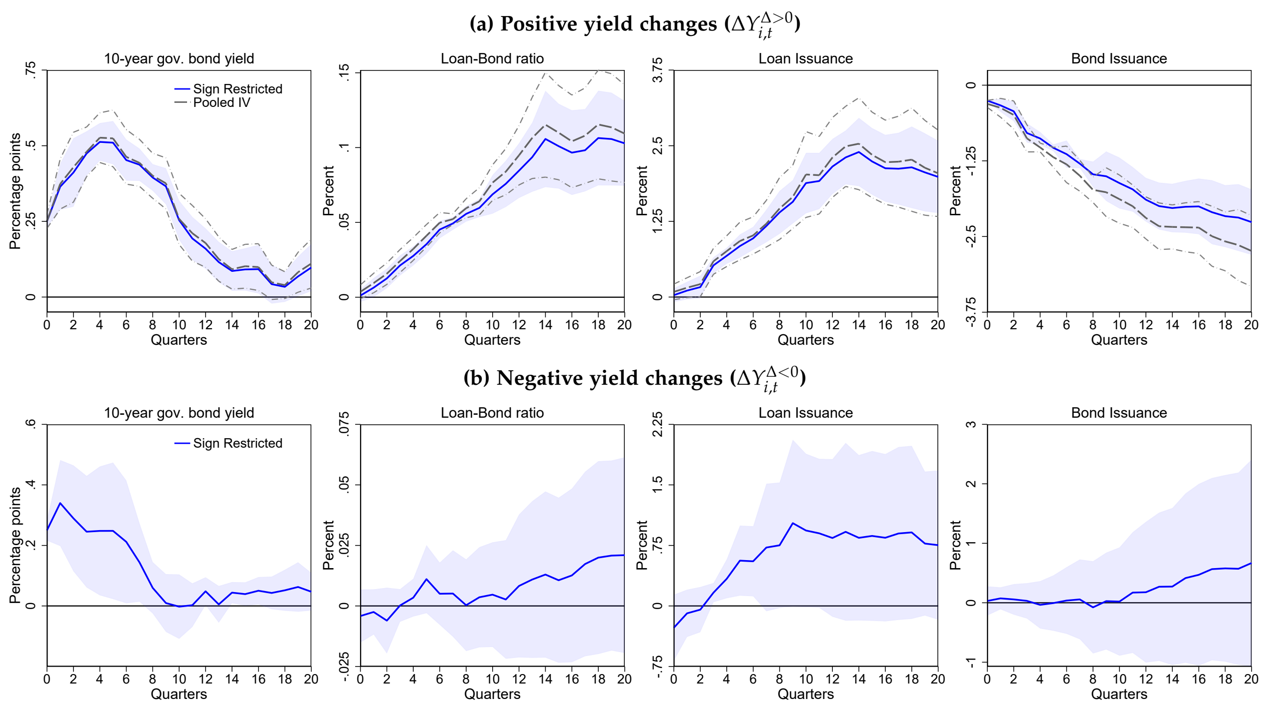
when compared with the baseline, which does not control for official lending. Similarly, we find a reduction in bond issuance between $-1.33\%$ and $-1.56\%$ of GDP, which indicates a reduction in point estimates between 10% and 15%. All of these estimates remain statistically significant at the 1% level. Overall, we conclude that a non-negligible increase in loan issuance is due to official lending but our main result of loan-bond substitution is unlikely to be exclusively driven by official lending.

**Dynamic effects.** So far, we presented estimates for a one year period after a yield change. However, changes in government yields are possibly more persistent. Therefore, we estimate a dynamic version of Equation 8 where we change the left-hand side from $z_{t+4}$ to $z_{t+h}$, for $h = 0, ..., 20$. That is, we estimate panel instrumental variable local projections and consider the $h$-period ahead change of the ten-year government bond yield and the loan-bond ratio, and the cumulative issuance of loans and bonds between $t$ and $t+h$. We keep the right-hand side of the regression fixed but include the above-introduced official lending controls, and use the instrumental variables as before.

The resulting dynamic responses are presented in Figure 3. The blue solid line shows the point estimates using the sign restricted IV, and the blue shaded area indicates 95% confidence bands. The gray dashed lines display the corresponding pooled IV results for positive yield changes. The pooled IV results for negative yield changes are omitted in Figure 3 to enhance readability because the standard errors are very large. However, for completeness, we present these results in Figure A3.4 in Appendix A3, along with a comparison with OLS for yield increases and decreases and both instrumental variables.

We first discuss the estimates corresponding to an impact yield increase by 25 basis points in panel (a) of Figure 3. In response to this initial impulse, the yield increase builds further up to its peak, which is reached about after one year, followed by a slow reversion. After around three years the yield is closer to zero again, relative to the peak effect. The loan-bond ratio rises steadily over this three-year horizon, matching the persistence of the yield response. Once the yield response has mostly dissipated, the response of the loan-bond ratio levels off. Quantitatively, over the full response horizon of five years, the loan-bond ratio increases by 0.15, i.e., there is 15% more loan debt per unit of bond debt. This suggests that a temporary yield change persistently alters governments' loan-bond portfolio choice. When studying the issuance of loans and bonds, we find equally persistent effects, which also level off after around three years.

**Figure 3:** *Dynamic causal effects of yield changes on government loan-bond portfolio choices*




*Notes:* This figure presents quarterly IV local projections based on Equation 8, as specified in the text. The left-hand side variables are the change in the ten-year government bond yield and the loan-bond ratio between $t-1$ and $t+h$ in the left panels, and the cumulative issuance of government loans and bonds relative to GDP from $t$ to $t+h$ in the right panels. The $h$-quarter lead is indicated on the horizontal axis. The top and bottom rows show the responses to an initial increase and decrease of bond yields by 0.25 percentage points, respectively. The gray dashed lines represent the pooled IV case, where positive yield changes are instrumented with all positive bond yield surprises. We omit the pooled IV case for negative yield changes because the instrument is weak and the bands very wide. For completeness, however, we report these results in Figure A3.4 in Appendix A3. The sign restricted IV, represented by the solid blue lines, uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. We include lagged macroeconomic indicators as control variables and further control comprehensively for official lending, as described in the text. The blue shaded areas and dashed gray lines indicate confidence bands at the 95% level, based on standard errors clustered by country and time.

Panel (b) of Figure 3 displays responses to yield decreases.[27] The impulse response of the yield itself is more transitory and dissipates two years after the initial yield change. We find limited evidence for a reduction in loan issuance after yield decreases for the sign-restricted instrument, but no evidence for changes in bond issuance or the loan-bond ratio.

**Total government debt.** The dynamic causal effects in panel (a) of Figure 3 show that the increase in loan issuance and the decrease in bond issuance are of comparable magnitude. This suggests that total government debt, i.e., bond debt and loan debt together, may be unresponsive to an increase in yields. To further investigate whether government debt supply is truly inelastic, we study the issuance of total debt on the left-hand side of the instrumental variable local projection and present the results in Figure A3.5 in Appendix A3.

Focusing on yield increases, in the two left columns of Figure A3.5, we show that government debt decreases moderately in the short run. However, this decline in debt is transitory and dissipates within two years despite elevated bond yields. Importantly, the increase in loan issuance is the key reason why the reduction in total debt is only modest. In summary, this suggests that total debt is somewhat elastic in the short run but rather inelastic over the medium term.

Lastly, in the right column, we show OLS results for comparison. Interestingly, the OLS estimates indicate no decrease in government debt in the short run but a significant increase in debt over the medium term. This likely indicates that the OLS estimates suffer from reverse causality as discussed in Section 3: It may be that an anticipated government debt expansion drives the bond yield increase today. In contrast, our IV estimates do not display this pattern, which we view as further corroborative evidence for the validity of our instrumental variable approach.

**The role of the central government.** Our baseline results are at the level of the general government, which includes all levels of the government including municipalities and states. We do so because sample coverage is largest at the level of the general government. However, for a somewhat smaller sample, we can compute our debt outcomes at the level of the central government and put them on the left-hand side of the instrumental variable local projection. The results are presented in Figure A3.6 in Appendix A3.

The estimated effects are very similar to the baseline in terms of shapes and magnitudes of the impulse responses as well as statistical significance. This holds regardless of whether we use the

[27] Note that the coefficients have to be interpreted identically as for yield increases since we did not multiply the yield decrease effects by minus one. Thus, the responses to yield increases and decreases should be identical in the absence of sign-dependencies.

pooled or sign restricted instruments. As a result, we conclude that our main effects are primarily driven by central governments substituting away from bonds and toward loans.

## 5. Government creditors and financial stability

In this section, we inspect the mechanism behind sovereigns' loan-bond substitution in response to yield changes. Leveraging an "unveiling" methodology, we show that loan-bond substitution is accompanied by a repatriation of government debt, i.e., the foreign sector reduces direct investment in government bonds and domestic financial intermediaries step in as alternative lenders. However, these banks partly source the funds from international investors which, thus, continue to finance government debt indirectly through the domestic banking sector. We discuss how this may arise as an equilibrium outcome and how it can increase bank balance sheet risk, raising financial stability concerns. Finally, we provide corroborative evidence that loan-bond substitution is associated with an increase in financial distress.

### 5.1. Bond yields and governments' direct and indirect creditors

**Methodology.** We seek to understand whether loan-bond substitution is accompanied by a shift in the creditors providing funds to the government. Such an analysis requires counterparty data at the instrument level, which are unavailable for the majority of the observations in our sample.[28] Therefore, we apply the "unveiling" methodology introduced by Mian et al. (2020) and extended by Diebold and Richter (forthcoming) to be applicable to the OECD financial accounts. With this method, we can allocate loans and bonds to creditors, providing us with an estimate of the latent counterparty data, to which we refer as "unveiled" data. The unveiling methodology is described in detail in Diebold and Richter (forthcoming) and builds on a proportionality assumption. In short, this assumption postulates that each sector's holdings of government debt in a specific instrument are proportional to that sector's share in the economy-wide holdings of that instrument. Intuitively, this means, for example, that a sector holding a large share of bonds is assumed to hold an equally large share of government bonds. Thus, the portfolio preferences of financing sectors are assumed to be expressed via the investment in specific instruments, rather than investments in specific sectors. We provide more details and an illustrative example in Appendix A4 and refer the interested reader to Diebold and Richter (forthcoming) for a more comprehensive description.

[28] Arslanalp and Tsuda (2014) construct counterparty data for many advanced economies but do not distinguish between loans and bonds for all potential creditors.

**Validation.** Before studying these unveiled data, we validate our unveiling approach with those observations for which we also have counterparty data available. To compare the counterparty and the unveiled data, we provide binscatter plots in Figure 4. The horizontal axis shows the unveiled data, and the vertical axis the counterparty data, both expressed in natural logarithms. The red solid line indicates the OLS slope between unveiled and counterparty data and the gray dashed line indicates the 45-degree line.

Panel (a) shows the holdings of bonds. The two left plots indicate that the unveiling approach somewhat overstates the bond holdings of the domestic financial sector but understates the holdings of the foreign sector. However, given the simplicity of the unveiling approach, it works remarkably well since most markers are fairly close to the 45-degree line. The two plots on the right show household and non-financial corporate sector holdings of government bonds. While still being close to the 45-degree line, the unveiled household and non-financial corporate sector holdings are noisier. Yet, these two sectors are quantitatively less relevant because both hold relatively little bonds at the aggregate.

Panel (b) focuses on government loans. The unveiling works well for the domestic financial sector, when discarding extreme observations with very high values of loan debt, as indicated by the red markers. Loan holdings of the rest of the world are slightly understated, similar to bonds. The two plots on the right of panel (b) show the same data after excluding extreme observations. The following baseline regression analysis also excludes these observations. However, excluding these observations is not critical for our results as they account only for a small fraction of observations.

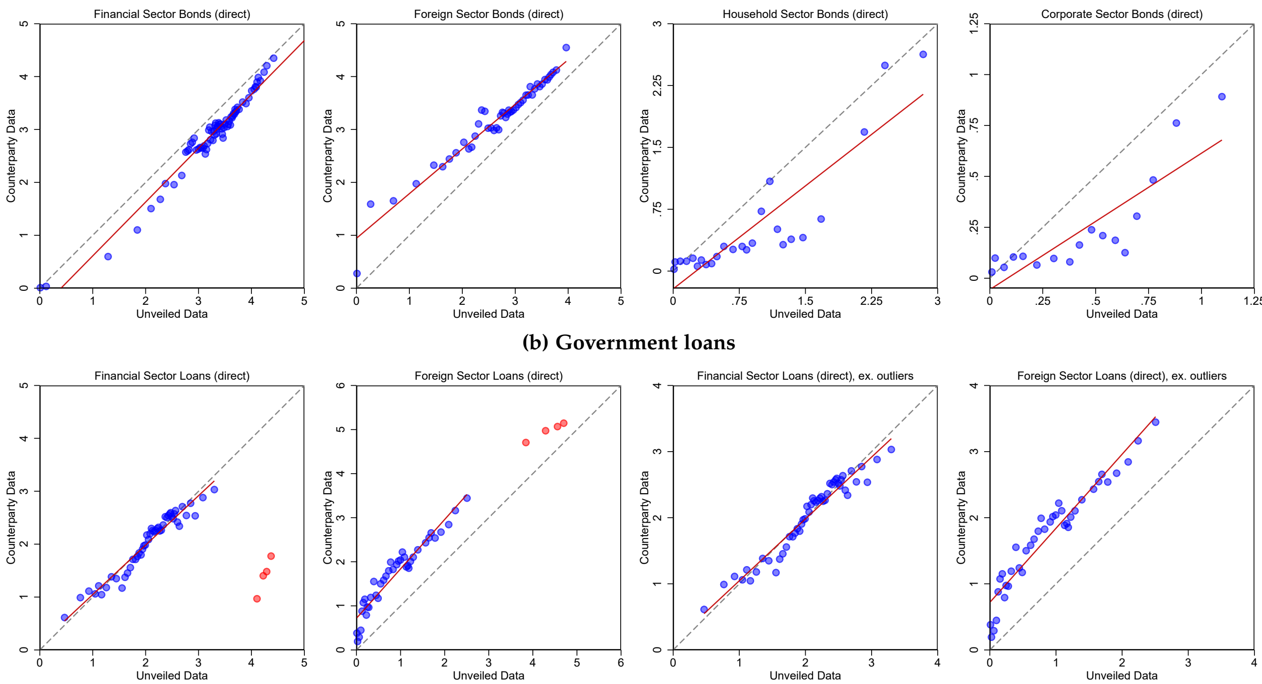
Overall, we view it as striking how well the unveiling approach works, albeit not being perfect. Importantly, for maximum transparency, we also present complementary results using only counterparty data.

**Accounting for indirect holdings.** So far, we have discussed how the unveiling approach provides an estimate of latent counterparty data. As a second step, we further follow Mian et al. (2020) and Diebold and Richter (forthcoming) to account for indirect holdings. The idea is that the financial and non-financial corporate sector must be ultimately financed by either domestic households, the domestic government, or the foreign sector. Thus, we allocate all corporate holdings to these three ultimate creditors. This second-step unveiling approach builds on a similar proportionality assumption on the liability side of balance sheets. We provide more details in Appendix A4. We refer to these data as total holdings, which consist of direct holdings (the estimated counterparty data) and indirect holdings via the corporate sector.

**Figure 4:** *Validation of the unveiling approach using counterparty data*

**(a) Government bonds**

**(b) Government loans**




*Notes:* This figure presents binscatter plots that compare counterparty data from the OECD financial accounts on the vertical axis with our unveiled data on the horizontal axis. These unveiled data are an estimate of the counterparty data using the approach from Mian et al. (2020) and Diebold and Richter (forthcoming). We present this comparison after taking the natural logarithm of all observations. The solid red line indicates the OLS slope between both variables. The dashed gray line indicates the 45-degree line. The top row shows this comparison for government bonds and the bottom row for government loans. The left plots of the bottom row highlight extreme observations in red; see text for details. the right plots of the bottom row show the same data after excluding these extreme observations.

**Results.** To estimate the causal effects of yield changes on direct and total holdings of government loans and bonds, we use the changes of these holdings between quarter $t-1$ and $t+4$ as left-hand side variable of Equation 8, and instrument yield changes as in Section 4.

The estimation results are displayed in Table 6 with columns (1) to (4) showing the responses of loan holdings and columns (5) to (8) displaying corresponding responses of bond holdings. The top panel provides estimates for direct holdings and the bottom panel for total holdings, i.e., direct and indirect holdings together.[29]

We first discuss the effects of yield increases, focusing on the sign restricted IV case and direct holdings in panel (a). An impact increase in yields by 25 basis points delivers a sizable increase in loans to the government from domestic financial intermediaries of 1.48% of GDP ($FI \rightarrow GG$), and

[29]The sample is slightly smaller when compared with the estimates from Section 4 because the unveiling requires full coverage across all non-government sectors and instruments for its proportionality assumption. This higher requirement on the data leads to slightly more missing observations in the unveiled data relative to the pure government debt data.

a smaller increase in loans from the foreign sector of 0.47% of GDP ($RoW \rightarrow GG$). On the other hand, the foreign sector reduces its holdings of government bonds by 2.30% of GDP. All of these estimates are highly statistically significant. In contrast, the reduction in bond holdings of domestic financial intermediaries is small and insignificant. Taken together, this suggests the repatriation of direct government debt holdings: Foreigners reduce their bond positions whereas domestic banks step in and are primarily responsible for the increase in loans to the government.

Accounting for direct and indirect holdings together allows us to uncover from which financier domestic banks obtain the funds to expand government loans following yield increases. Using the sign restricted IV, columns (1) and (3) in the panel (b) of Table 6 reveal that these loans are partly financed by domestic households, which account for loans worth 0.61% of GDP. However, the share financed by the foreign sector in column (3) is more than twice this size at 1.30% of GDP. This suggests that indirect foreign financing is important for loans. In contrast, indirect bond holdings are of minor importance for the foreign sector. This can be seen from the coefficient on foreign bond holdings, which only increases modestly compared to panel (a) when accounting for indirect holdings; see column (7).[30]

The above discussion concentrates on yield increases that are identified via the sign restricted IV. Using the pooled IV delivers similar results for most regressions. As a result, regardless of the instrumental variable in use, we find that the foreign sector finances a sizable share of government loans indirectly through domestic banks.

Lastly, focusing on yield decreases, we obtain hardly any statistically significant estimates. The only exception is a significant adjustment in loan positions from the foreign sector in the sign-restricted specification, mirroring the main results in Section 4, where we also only found meaningful effects for loans in response to yield decreases.

[30]Technically, domestic central bank assets and liabilities are included in the holdings of the financial sector whereas foreign central bank positions are attributed to the foreign sector. In principle, we cannot rule out that some of the loan-bond substitution is financed from foreign central banks via domestic central banks. However, we view this as unlikely to be important for our results because central banks in advanced economies are not allowed to outright finance the government. More specifically, the lending programs of the ECB did focus on sovereign bonds on secondary markets and not on loans or bonds at issuance.

**Table 6:** *Causal effects of yield changes on government debt holdings*

**(a) Direct holdings**

| | $\Delta_5$ Direct Loans$^{FI\rightarrow GG}_{i,t+4}$ | | $\Delta_5$ Direct Loans$^{RoW\rightarrow GG}_{i,t+4}$ | | $\Delta_5$ Direct Bonds$^{FI\rightarrow GG}_{i,t+4}$ | | $\Delta_5$ Direct Bonds$^{RoW\rightarrow GG}_{i,t+4}$ | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Panel A:** Sign Restricted IV | | | | | | | | |
| $\Delta Y^{\Delta>0}_{i,t}$ | 1.48$^{***}$ | | 0.47$^{***}$ | | -0.24 | | -2.30$^{**}$ | |
| | (0.50) | | (0.08) | | (0.72) | | (1.08) | |
| $\Delta Y^{\Delta<0}_{i,t}$ | | 0.41 | | 0.13$^{**}$ | | 0.27 | | -0.02 |
| | | (0.26) | | (0.07) | | (0.18) | | (0.27) |
| **Panel B:** Pooled IV | | | | | | | | |
| $\Delta Y^{\Delta>0}_{i,t}$ | 1.43$^{***}$ | | 0.26$^{*}$ | | -0.48 | | -2.43$^{**}$ | |
| | (0.53) | | (0.15) | | (0.69) | | (1.07) | |
| $\Delta Y^{\Delta<0}_{i,t}$ | | -0.23 | | -0.12 | | 0.51 | | 0.52 |
| | | (0.50) | | (0.23) | | (0.44) | | (0.85) |
| Country fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 2916 | 2916 | 2916 | 2916 | 2916 | 2916 | 2916 | 2916 |

**(b) Total holdings (direct and indirect)**

| | $\Delta_5$ Total Loans$^{HH\rightarrow GG}_{i,t+4}$ | | $\Delta_5$ Total Loans$^{RoW\rightarrow GG}_{i,t+4}$ | | $\Delta_5$ Total Bonds$^{HH\rightarrow GG}_{i,t+4}$ | | $\Delta_5$ Total Bonds$^{RoW\rightarrow GG}_{i,t+4}$ | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Panel A:** Sign Restricted IV | | | | | | | | |
| $\Delta Y^{\Delta>0}_{i,t}$ | 0.61$^{***}$ | | 1.30$^{***}$ | | -0.35 | | -2.45$^{*}$ | |
| | (0.18) | | (0.32) | | (0.48) | | (1.42) | |
| $\Delta Y^{\Delta<0}_{i,t}$ | | 0.14 | | 0.45$^{*}$ | | 0.04 | | 0.13 |
| | | (0.10) | | (0.26) | | (0.14) | | (0.28) |
| **Panel B:** Pooled IV | | | | | | | | |
| $\Delta Y^{\Delta>0}_{i,t}$ | 0.62$^{***}$ | | 1.04$^{***}$ | | -0.45 | | -2.76$^{**}$ | |
| | (0.18) | | (0.37) | | (0.49) | | (1.38) | |
| $\Delta Y^{\Delta<0}_{i,t}$ | | -0.10 | | -0.17 | | 0.19 | | 0.76 |
| | | (0.19) | | (0.47) | | (0.23) | | (1.00) |
| Country fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 2909 | 2909 | 2909 | 2909 | 2909 | 2909 | 2909 | 2909 |

*Notes:* This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change between $t-1$ and $t+4$ in the stock of loans and bonds, relative to GDP. The superscript indicates whether these funds are provided to the government ($GG$) from the domestic financial sector ($FI$), the foreign sector ($RoW$), or the domestic household sector ($HH$). The top panel accounts for direct holdings, whereas the bottom panel shows total holdings, which include direct holdings and indirect holdings via the corporate sector. These unveiled data are obtained using the approach from Mian et al. (2020) and Diebold and Richter (forthcoming). We exclude extreme observations, as indicated in Figure 4. The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y^{\Delta>0}_{i,t}$ and $\Delta Y^{\Delta<0}_{i,t}$ indicate that the bond yield change is further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

**Alternative data.** The above results use our baseline unveiling approach using a proportionality assumption to obtain direct holdings. The validation exercise from above suggests that this assumption is a reasonable approximation when excluding extreme observations. However, for maximum transparency, we re-estimate the effects of yield changes on direct holdings when including all observations and show these results in Table A4.16 in Appendix A3. The estimates remain similar to the baseline. The only noteworthy difference compared to the baseline is that we now also obtain a statistically significant reduction in direct bond holdings of the domestic financial sector, whereas the bond holdings reduction of the foreign sector is slightly smaller.

Alternatively, we can dispense with the unveiling entirely and re-estimate the effects for direct holdings using only counterparty data. Estimating our instrumental variable regression on this considerably smaller sample in Table A4.17, we get qualitatively comparable results but often lack the statistical power to obtain statistically significant coefficients.[31] This confirms that our unveiling approach is valuable for uncovering the repatriation of direct sovereign debt holdings.

**The role of official lending.** Table A4.18 replicates Table 6 while controlling for official lending in the same way as introduced in Subsection 4.3. When doing so, the magnitudes of all point estimates decrease somewhat. Yet, the main coefficients discussed above remain highly statistically significant. Importantly, for direct holdings, we still find that foreign investors sell government bonds and domestic banks provide loans instead. Moving to total holdings, the majority of the loan increase remains indirectly financed from abroad. Overall, this underscores that official lending plays some role but our finding of debt repatriation via loans is unlikely to be entirely driven by official lending.

**Theoretical considerations.** How can one interpret our estimates through the lens of well-established economic theory? We argue that our estimates reveal the repatriation of sovereign debt that can emerge as an equilibrium outcome similar to Broner et al. (2010). Their core idea is that government debt held by domestic agents reduces the incentives to default for the domestic government. Intuitively, in our case, these incentives are reduced when more debt is held by domestic banks because a government default may trigger a domestic banking crisis (e.g., Thaler, 2021). However, different from their model, our repatriation channel does not solely rely on secondary markets but additionally operates via the issuance (and rollover) of debt with a changing

[31] When we estimate the regression excluding Greece, we again obtain highly significant results for higher loans from the financial sector to the government even in the raw counterparty data.

instrument composition.

Why does repatriation emerge as an equilibrium outcome? From the perspective of a sovereign, repatriation of direct debt holdings mitigates the initial interest rate increase because it contains risk premia to the extent that private investors perceive a government default as less likely when credit to the government is held by domestic banks. Likewise, foreign investors benefit by reducing the risk in their portfolios. Finally, domestic banks may benefit from interest rate margins between foreign investment and loans to the government.

A natural implication of sovereign debt repatriation via loans funded indirectly from abroad is an increase in bank balance sheet risk as in Diamond and Dybvig (1983). The increase in balance sheet risk arises due to two forces. On the one hand, banks hold more loans and fewer bonds and, hence, have less liquid assets on their balance sheets. As a result, they become more vulnerable to financial distress due to, e.g., deposit withdrawal shocks (Diamond and Dybvig, 1983). On the other hand, the banks' liability side becomes more exposed to volatile foreign funding, which increases the risk of capital withdrawals (Calvo, 1998; Forbes and Warnock, 2012).

Overall, our empirical results bridge the gap between two important theoretical ideas, the repatriation channel of sovereign debt (Broner et al., 2010) and bank balance sheet risk as in Diamond and Dybvig (1983). The latter suggests that debt repatriation may ultimately raise financial stability concerns. As the final step of this paper, we thus investigate this implication.

### 5.2. Debt repatriation and financial stability concerns

**Econometric specification.** The link between balance sheet risk and financial stability has been well understood in theory (e.g., Diamond and Dybvig, 1983; Brunnermeier and Pedersen, 2009) and documented empirically (e.g., Jordà et al., 2016; Correia et al., 2025). Thus, in this final analysis, we focus on loan-bond substitution as a source of financial distress to provide corroborative evidence for the connection between debt repatriation and balance sheet risk.

We study the behavior of the financial distress index from Romer and Romer (2017) in the aftermath of loan-bond substitution.[32] To this end, we run the following regression

$$\Delta_5 y_{i,t+4} = \alpha_i + \alpha_t + \beta\, \Delta_4 \textit{Loan-bond ratio}^s_{i,t} + \gamma\, Z_{i,t} + e_{i,t+h}, \tag{9}$$

where the outcome variable $\Delta_5 y_{i,t+4}$ refers to the change in the financial distress index between $t-1$

[32] Romer and Romer (2017) rank financial distress on a range between 0 and 14 on a bi-annual basis, which we linearly interpolate to quarterly frequency.

and $t+4$, which we standardize to ease interpretation. On the right-hand side, $\Delta_4 \textit{Loan-bond ratio}^s_{i,t}$, refers to our previous outcome variable: the one year change in the loan-bond ratio of sector $s$, which denotes either the general government's loan-bond ratio, or the ratio of government debt held as an asset by another sector. Specifically, we study the ratio of direct holdings of government loans to direct holdings of government debt for domestic financial intermediaries and the foreign sector. We also consider total holdings accounting for indirect positions via the corporate sector. In this case, we use the unveiled loan-bond ratio from the asset side of domestic households and the foreign sector.

The coefficient of interest, $\beta$, captures the link between the loan-bond ratios and subsequent financial distress. However, since we have no instrumental variables for loan-bond ratios at our disposal, we must not interpret this coefficient causally.[33] Nevertheless, to absorb predictable variation unrelated to changes in loan-bond ratios, we control for four quarterly lags of the financial distress index, in addition to country and time fixed effects. Furthermore, to ensure our results are not driven by changes in the level of debt, we control for the change in total debt between $t-4$ and $t$, matching the change of the respective loan-bond ratio. Lastly, we control for the (overall) loan-bond ratio at $t-5$ to control for the prior level of this ratio, i.e., prior to the change of the loan-bond ratio between $t-4$ and $t$, which is our main regressor of interest.

**Results.** The estimation results based on Equation 9 are shown in Table 7. In column (1), we focus on the loan-bond ratio measuring the liabilities of the general government. An increase of this ratio is associated with a subsequent higher level of financial distress, but the effects are not statistically significant. Focusing on direct holdings in columns (2) to (4), we find that only an increase in the loan-bond exposure of domestic financial intermediaries is associated with a higher level of financial distress. This effect is highly statistically significant, also when we control for the loan-bond ratio of direct holdings of the foreign sector. In contrast, the loan-bond ratio of the foreign sector does not predict subsequent financial distress. This is exactly what one should expect given that financial distress refers to the domestic economy. As a last step, in columns (5) to (7) we account for indirect holdings through the corporate sector and study loan-bond ratios of the household sector and the rest of the world. When using these total positions, only an increase in the loan-bond ratio of the foreign sector predicts subsequent financial distress, with the coefficient being statistically significant at the 5% level. Quantitatively, a unit increase in this loan-bond ratio

[33] Using our yield surprises would likely violate the exclusion restriction because interest rate changes may affect future financial distress through other channels than changes in the loan-bond asset composition of a specific sector.

**Table 7:** *The link between loan-bond ratios and financial distress*

| | $\Delta_5$ Financial Distress$_{i,t+4}$ | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| $\Delta_4$Loan-Bond ratio$_{i,t}$ | 0.222 | | | | | | |
| | (0.160) | | | | | | |
| $\Delta_4$Loan-Bond ratio$_{i,t}^{FI\to GG}$, Direct | | 0.231$^{***}$ | | 0.252$^{**}$ | | | |
| | | (0.087) | | (0.110) | | | |
| $\Delta_4$Loan-Bond ratio$_{i,t}^{RoW\to GG}$, Direct | | | 0.035 | -0.048 | | | |
| | | | (0.076) | (0.088) | | | |
| $\Delta_4$Loan-Bond ratio$_{i,t}^{HH\to GG}$, Total | | | | | 0.326$^{*}$ | | 0.216 |
| | | | | | (0.187) | | (0.185) |
| $\Delta_4$Loan-Bond ratio$_{i,t}^{RoW\to GG}$, Total | | | | | | 0.333$^{**}$ | 0.182$^{**}$ |
| | | | | | | (0.131) | (0.079) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 2879 | 2539 | 2539 | 2539 | 2539 | 2539 | 2539 |

*Notes:* This table presents quarterly OLS regression results based on Equation 9, as specified in the text. The left-hand side variable is the standardized change in the Romer and Romer (2017) financial distress index between $t-1$ and $t+4$ . The regressors of interest are lagged changes in loan-bond ratios between $t-4$ and $t$. We use the ratio of all government loans to all government bonds in column (1), the ratio based on direct holdings of government debt by the financial ($FI$) and the foreign sector ($RoW$) in columns (2) to (4), and the ratio based on total (direct and indirect) holdings of government debt by the foreign and the domestic household sector ($HH$) in columns (5) to (7). The coefficients correspond to a unit increase in the loan-bond ratio. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

is associated with an increase of financial distress between 0.18 and 0.33 of a standard deviation.

These findings align well with the above-discussed channels of bank balance sheet risk because the indirect holdings of the foreign sector through domestic banks are crucial. Specifically, domestic banks are crucial because this is the point of origin for financial distress. Indirect foreign funding is crucial because this source of funding is known to be volatile, creating an additional capital withdrawal or capital flight risk (e.g., Calvo, 1998; Broner et al., 2013; Diebold, 2023).

## 6. Conclusion

In this paper, we demonstrate that advanced economies use both bond-based and loan-based financing, giving rise to a non-trivial debt portfolio choice. Motivated by this observation, we ask how the composition of loans and bonds depends on bond yields, which capture the funding cost for governments' main debt instrument. To establish a causal link from government bond yields to portfolio choices, we implement an instrumental variable approach. These instrumental variables capture high-frequency variation in bond yields due to sovereign credit rating announcements, addressing reverse causality concerns. Our analysis yields three main findings. First, in response to an increase in government bond yields, sovereigns substitute away from bond financing toward loans, leaving total government debt largely unchanged. This suggests government debt is remarkably inelastic, an insight that a bond-based analysis necessarily overlooks. Second, sovereigns' substitution patterns are mirrored by foreign creditors, who reduce their direct bond holdings and increasingly provide funding indirectly through domestic bank loans. Third, this shift toward domestic bank loans financed from abroad is associated with elevated levels of financial distress.

Our three findings connect bank balance sheet risk with the repatriation of sovereign debt, i.e., direct bond holdings being shifted away from international investors toward domestic agents in the form of loans. A rationale for repatriation may be that governments have less incentives to default if more debt is held by domestic agents (Broner et al., 2010). The reason is that, when more debt is held by domestic banks, not repaying debt would induce further domestic repercussions, e.g., a banking crisis. As such, debt repatriation through domestic banks provides a stabilizing force that contains risk premia and, thus, governments' funding cost. However, it comes at the expense of higher bank balance sheet risk because it reinforces the classical mechanism analyzed in Diamond and Dybvig (1983). Domestic banks' assets shift toward less liquid loans while the liability side of bank balance sheets becomes increasingly exposed to volatile foreign funding (Calvo, 1998; Forbes and Warnock, 2012; Broner et al., 2013). While both channels, repatriation and bank balance sheet risk, have been well understood in isolation, future theoretical work may model the interactions for which we have documented extensive empirical evidence.

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# Appendix

# Loanly Governments

Lukas Diebold  Lukas Hack

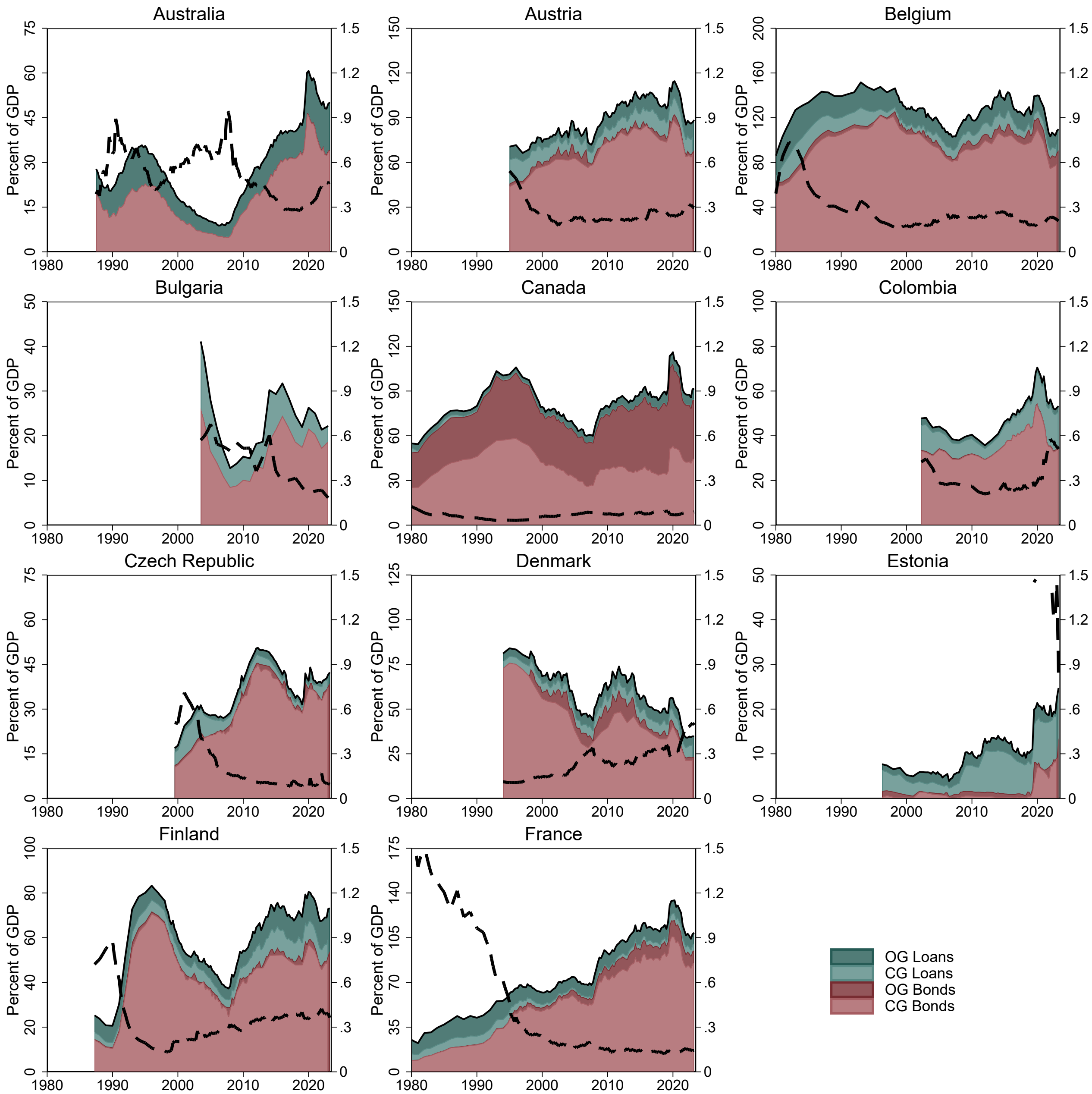
# A1. Data

**Table A1.1:** *Sample coverage by country*

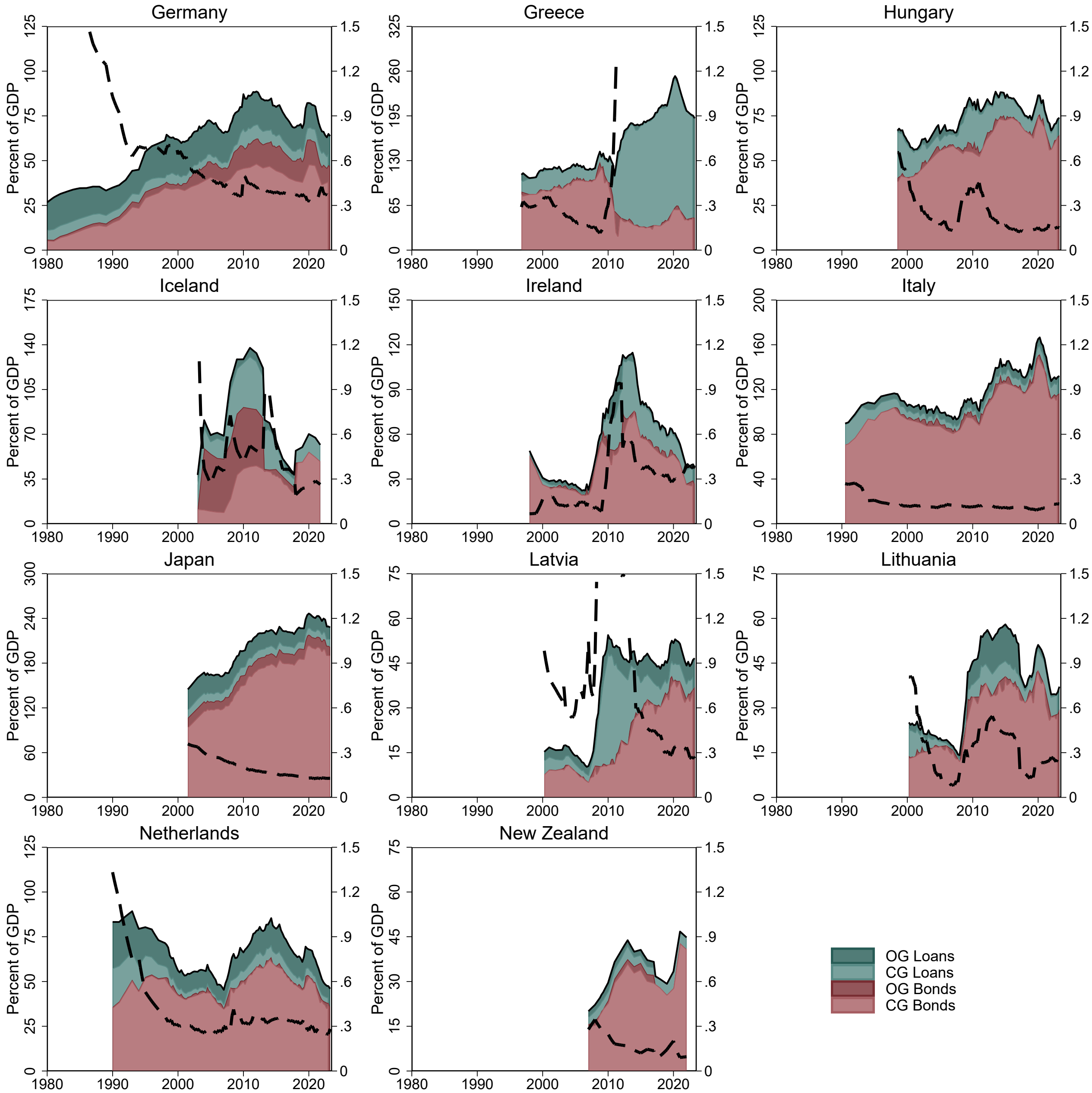
| Country | (1) OECD Flows | (2) OECD Balances | (3) Quarterly Yields | (4) Daily Yields | (5) Distress |
|---|---|---|---|---|---|
| Australia | 1988-2024 | 1988-2024 | 1988-2024 | 1988-2024 | 1988-2017 |
| Austria | 1995-2024 | 1996-2024 | 1996-2024 | 1996-2024 | 1996-2017 |
| Belgium | 1973-2024 | 1974-2024 | 1974-2024 | 1993-2024 | 1974-2017 |
| Bulgaria | 1995-2023 | 1996-2023 | 2004-2023 | 2002-2023 | - |
| Canada | 1970-2024 | 1975-2024 | 1975-2024 | 1994-2024 | 1975-2017 |
| Colombia | 1997-2024 | 1997-2024 | 2003-2024 | 2002-2024 | - |
| Czech Republic | 1993-2024 | 1995-2024 | 2000-2024 | 2000-2024 | 2003-2017 |
| Denmark | 1995-2024 | 1995-2024 | 1995-2024 | 1995-2024 | 1995-2017 |
| Estonia | 1995-2024 | 1996-2024 | 1997-2024 | - | - |
| Finland | 1987-2024 | 1981-2024 | 1988-2024 | 1994-2024 | 1981-2017 |
| France | 1978-2024 | 1978-2024 | 1978-2024 | 1986-2024 | 1978-2017 |
| Germany | 1973-2024 | 1974-2024 | 1974-2024 | 1974-2024 | 1974-2017 |
| Greece | 1995-2024 | 1996-2024 | 1997-2024 | 1998-2024 | 1996-2017 |
| Hungary | 1991-2024 | 1992-2024 | 1999-2024 | 2003-2024 | 1998-2017 |
| Iceland | 2004-2023 | 2004-2023 | 2004-2022 | 2004-2023 | 2004-2017 |
| Ireland | 1999-2024 | 1999-2024 | 1999-2024 | 1999-2024 | 1999-2017 |
| Italy | 1980-2024 | 1980-2024 | 1991-2024 | 1991-2024 | 1980-2017 |
| Japan | 1974-2024 | 1974-2024 | 2002-2024 | 1974-2024 | 1974-2017 |
| Latvia | 1995-2024 | 1996-2024 | 2001-2024 | - | - |
| Lithuania | 1995-2024 | 1996-2024 | 2001-2024 | 2006-2024 | - |
| Netherlands | 1988-2024 | 1991-2024 | 1991-2024 | 1993-2024 | 1991-2017 |
| New Zealand | 2008-2022 | 2008-2022 | 2008-2022 | 2008-2022 | 2008-2017 |
| Norway | 1995-2024 | 1982-2024 | 1985-2024 | 1994-2024 | 1982-2017 |
| Poland | 1995-2024 | 1996-2024 | 2001-2024 | 1999-2024 | 1998-2017 |
| Portugal | 1995-2024 | 1996-2024 | 1996-2024 | 1996-2024 | 1996-2017 |
| Romania | 1995-2023 | 1996-2023 | 2005-2023 | 2007-2023 | - |
| Slovakia | 1995-2024 | 1996-2024 | 2000-2024 | 2007-2024 | 2003-2017 |
| Slovenia | 1995-2024 | 1996-2024 | 2002-2024 | 2007-2024 | - |
| Spain | 1981-2024 | 1974-2024 | 1980-2024 | 1994-2024 | 1974-2017 |
| Sweden | 1995-2024 | 1981-2024 | 1987-2024 | 1997-2024 | 1981-2017 |
| Switzerland | 2000-2024 | 2000-2024 | 2000-2024 | 2000-2024 | 2000-2017 |
| United Kingdom | 1987-2024 | 1988-2024 | 1988-2024 | 1988-2024 | 1988-2017 |
| United States | 1960-2024 | 1961-2024 | 1964-2024 | 1961-2024 | 1967-2017 |

*Notes:* This table shows our sample coverage by country. Columns (1) and (2) refer to flows and balances, respectively, and indicate the years for which both bond and loan data are available for the respective item in the OECD financial accounts. Columns (3) and (4) refer to ten-year constant maturity government bond yields at quarterly and daily frequency, respectively. Column (5) refers to the financial distress index from Romer and Romer (2017).

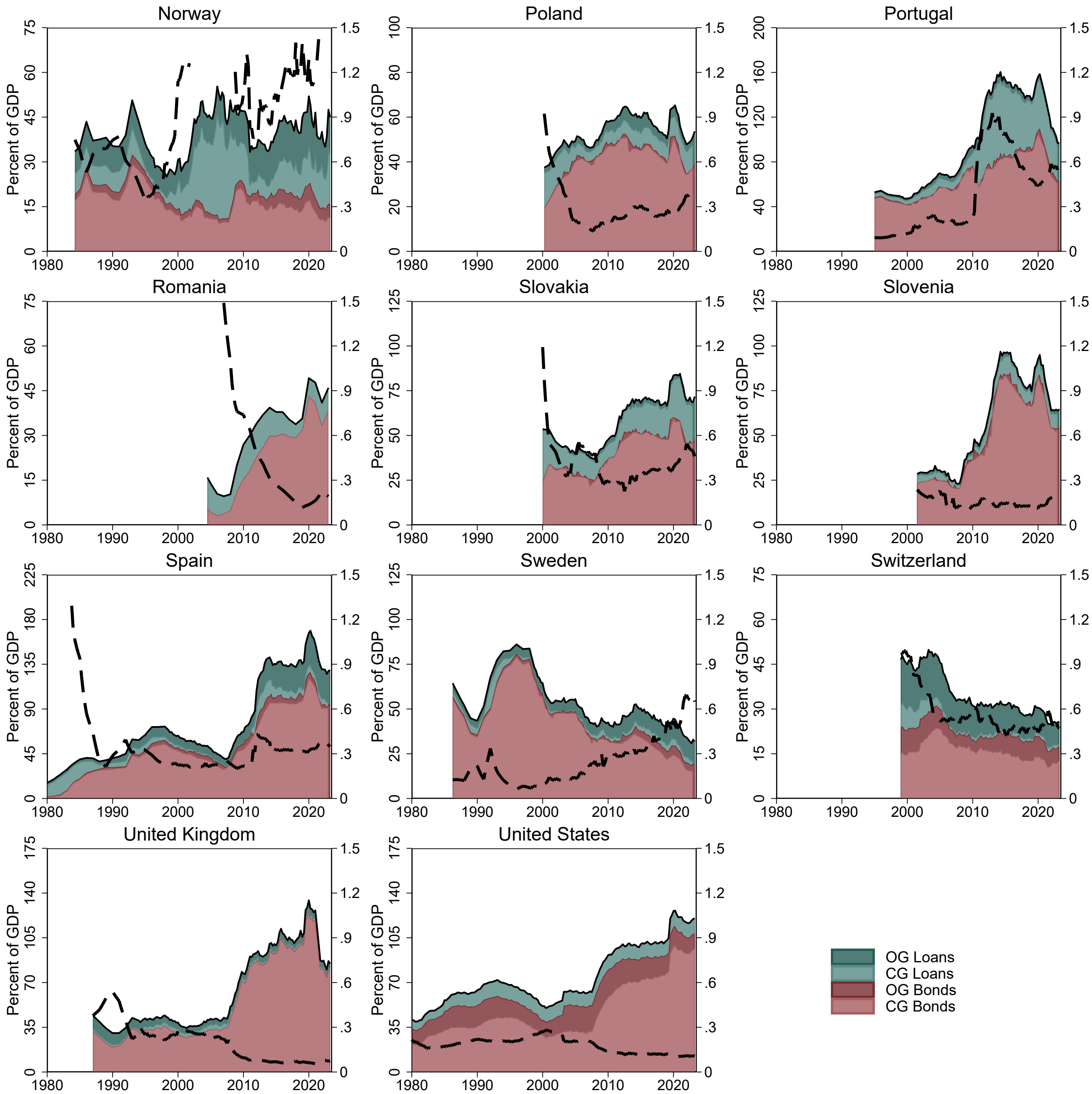
**Figure A1.1:** *Government loans and bonds by country, remaining countries*




*Notes:* This figure shows the stock of government debt relative to GDP, broken down by financing instrument, between 1980 and 2024 for all countries in our sample. Across panels, government bond liabilities are shown in red (bottom area), liabilities in the form of loans in green (top area). Lighter areas represent the portion of the respective instrument issued by the central government (CG), and the darker areas summarize the remaining other levels of the government (OG). The dotted black line shows the loan-bond ratio of the general government on a secondary vertical axis on the right.




*Notes:* Continuation of Figure A1.1, part (2/3).




*Notes:* Continuation of Figure A1.1, part (3/3).

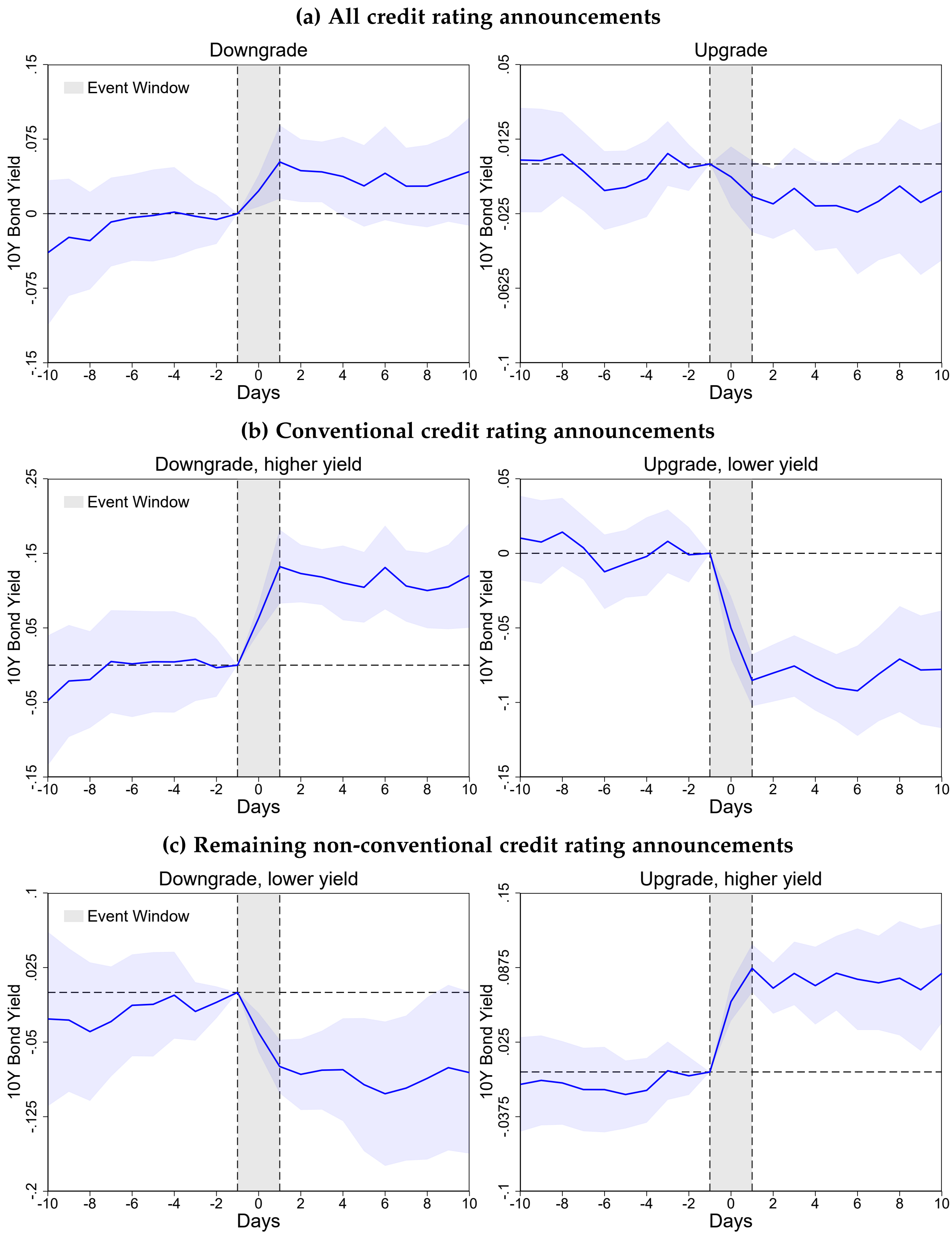
## A2. Credit rating announcements and bond yields

**Table A2.2:** *Summary statistics for quarterly yield change surprises*

| | Mean | Median | Std. Dev. | Min | Max | Obs | Countries |
|---|---|---|---|---|---|---|---|
| $YCS_{i,t}^{\mathcal{H}}$ | 0.157 | 0.071 | 0.286 | 0.005 | 1.971 | 278 | 28 |
| $YCS_{i,t}^{\mathcal{L}}$ | -0.111 | -0.065 | 0.173 | -1.463 | -0.004 | 297 | 29 |
| $YCS_{i,t}^{\mathcal{HD}}$ | 0.224 | 0.101 | 0.364 | 0.005 | 1.971 | 140 | 26 |
| $YCS_{i,t}^{\mathcal{HU}}$ | 0.088 | 0.058 | 0.129 | 0.006 | 1.235 | 140 | 26 |
| $YCS_{i,t}^{\mathcal{LU}}$ | -0.104 | -0.067 | 0.165 | -1.463 | -0.008 | 197 | 28 |
| $YCS_{i,t}^{\mathcal{LD}}$ | -0.120 | -0.062 | 0.183 | -1.440 | -0.004 | 104 | 24 |

*Notes:* This table presents summary statistics for all constructed yield change surprise time series, as described in the text. The series are aggregated to quarterly frequency by summing all surprises within a quarter. All statistics correspond to observations with non-zero yield change surprises only. The last two columns indicate the number of non-zero surprises across the sample and the number of countries with at least one non-zero surprise of the respective type.

**Figure A2.2:** *Daily event study of government bond yields around credit rating announcements, exclude Euro crisis countries*




*Notes:* This figure presents daily event study regression results based on Equation 2, as specified in the text. The left-hand side variables are leads and lags of the daily ten-year constant maturity bond yield, which are projected on a rating announcement indicator with the OLS estimates being provided by the solid blue lines. The horizontal axis indicates the lead or lag of the left-hand side variables, relative to the rating announcement. The blue shaded areas indicate confidence bands at the 95% level, based on standard errors clustered by country and time. The left and right columns show estimates for credit rating downgrades and upgrades, respectively. The first row shows all up- and downgrades. The second and third row split the sample based on whether yields increase or decreases within the indicated two-day event window. We exclude the GIIPS countries (Greece, Italy, Ireland, Portugal, Spain) from the estimation sample.

## A3. Additional results and robustness on loan-bond substitution

### A3-1 Reduced form results

**Table A3.3:** *Reduced-form estimates of yield changes on the loan-bond ratio using the high-frequency yield surprise*

| | Pooled IV | | | | Sign restriction | | | | Sign restriction violated | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\Delta Y_{i,t}^{\Delta>0}$ | | $\Delta Y_{i,t}^{\Delta<0}$ | | $\Delta Y_{i,t}^{\Delta>0}$ | | $\Delta Y_{i,t}^{\Delta<0}$ | | $\Delta Y_{i,t}^{\Delta>0}$ | | $\Delta Y_{i,t}^{\Delta<0}$ | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| $YCS_{i,t}^{\mathcal{H}}$ | 0.072*** | 0.066*** | | | | | | | | | | |
| | (0.011) | (0.013) | | | | | | | | | | |
| $YCS_{i,t}^{\mathcal{L}}$ | | | -0.048*** | -0.030** | | | | | | | | |
| | | | (0.018) | (0.014) | | | | | | | | |
| $YCS_{i,t}^{\mathcal{HD}}$ | | | | | 0.076*** | 0.064*** | | | | | | |
| | | | | | (0.012) | (0.014) | | | | | | |
| $YCS_{i,t}^{\mathcal{LU}}$ | | | | | | | 0.003 | 0.006 | | | | |
| | | | | | | | (0.014) | (0.014) | | | | |
| $YCS_{i,t}^{\mathcal{HU}}$ | | | | | | | | | 0.022 | 0.070*** | | |
| | | | | | | | | | (0.021) | (0.016) | | |
| $YCS_{i,t}^{\mathcal{LD}}$ | | | | | | | | | | | -0.111*** | -0.077*** |
| | | | | | | | | | | | (0.018) | (0.016) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| FAPs Official lending | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ |
| Observations | 3097 | 2976 | 3097 | 2976 | 3097 | 2976 | 3097 | 2976 | 3097 | 2976 | 3097 | 2976 |

*Notes:* This table presents quarterly reduced-form regression results based on Equation 8, where we project directly on bond yield surprises. The left-hand side variable is the change in the loan-bond ratio between $t-1$ and $t+4$. The regressors are the yield change surprises, where superscripts $\mathcal{H}$ and $\mathcal{L}$ indicate positive and negative surprises, respectively. We refer to these cases as pooled IV. The additional superscripts $\mathcal{D}$ and $\mathcal{U}$ refer to rating downgrades and rating upgrades, respectively. Sign restriction refers to those surprises for which rating and yield changes agree in their sign. When indicated, we also control comprehensively for official lending, as described in the text. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

**Table A3.4:** *Reduced-form estimates of yield changes on loan issuance using the high-frequency yield surprise*

| | Pooled IV | | | | Sign restriction | | | | Sign restriction violated | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\Delta Y_{i,t}^{\Delta>0}$ | | $\Delta Y_{i,t}^{\Delta<0}$ | | $\Delta Y_{i,t}^{\Delta>0}$ | | $\Delta Y_{i,t}^{\Delta<0}$ | | $\Delta Y_{i,t}^{\Delta>0}$ | | $\Delta Y_{i,t}^{\Delta<0}$ | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| $YCS_{i,t}^{\mathcal{H}}$ | 2.212*** | 1.409*** | | | | | | | | | | |
| | (0.302) | (0.398) | | | | | | | | | | |
| $YCS_{i,t}^{\mathcal{L}}$ | | | -1.046* | -0.160 | | | | | | | | |
| | | | (0.547) | (0.190) | | | | | | | | |
| $YCS_{i,t}^{\mathcal{HD}}$ | | | | | 2.529*** | 1.442*** | | | | | | |
| | | | | | (0.339) | (0.382) | | | | | | |
| $YCS_{i,t}^{\mathcal{LU}}$ | | | | | | | 1.154*** | 1.032*** | | | | |
| | | | | | | | (0.400) | (0.344) | | | | |
| $YCS_{i,t}^{\mathcal{HU}}$ | | | | | | | | | -0.615 | 0.885 | | |
| | | | | | | | | | (0.439) | (0.678) | | |
| $YCS_{i,t}^{\mathcal{LD}}$ | | | | | | | | | | | -3.998 | -1.974*** |
| | | | | | | | | | | | (.) | (0.345) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| FAPs Official lending | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ |
| Observations | 3097 | 2976 | 3097 | 2976 | 3097 | 2976 | 3097 | 2976 | 3097 | 2976 | 3097 | 2976 |

*Notes:* This table presents quarterly reduced-form regression results based on Equation 8, where we project directly on bond yield surprises. The left-hand side variable is the cumulative issuance of government loans relative to GDP from $t$ to $t+4$. The regressors are the yield change surprises, where superscripts $\mathcal{H}$ and $\mathcal{L}$ indicate positive and negative surprises, respectively. We refer to these cases as pooled IV. The additional superscripts $\mathcal{D}$ and $\mathcal{U}$ refer to rating downgrades and rating upgrades, respectively. Sign restriction refers to those surprises for which rating and yield changes agree in their sign. When indicated, we also control comprehensively for official lending, as described in the text. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

**Table A3.5:** *Reduced-form estimates of yield changes on bond issuance using the high-frequency yield surprise*

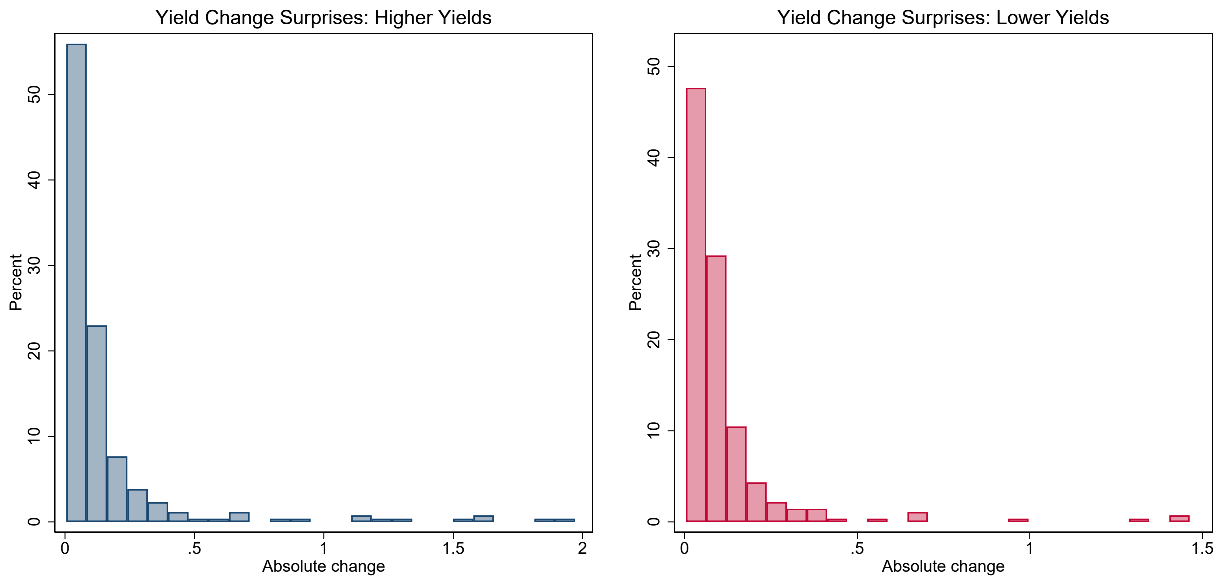
| | Pooled IV | | | | Sign restriction | | | | Sign restriction violated | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\Delta Y_{i,t}^{\Delta>0}$ | | $\Delta Y_{i,t}^{\Delta<0}$ | | $\Delta Y_{i,t}^{\Delta>0}$ | | $\Delta Y_{i,t}^{\Delta<0}$ | | $\Delta Y_{i,t}^{\Delta>0}$ | | $\Delta Y_{i,t}^{\Delta<0}$ | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| $YCS_{i,t}^{\mathcal{H}}$ | -2.073*** | -1.735*** | | | | | | | | | | |
| | (0.251) | (0.187) | | | | | | | | | | |
| $YCS_{i,t}^{\mathcal{L}}$ | | | 1.197** | 0.548 | | | | | | | | |
| | | | (0.565) | (0.350) | | | | | | | | |
| $YCS_{i,t}^{\mathcal{HD}}$ | | | | | -2.219*** | -1.718*** | | | | | | |
| | | | | | (0.253) | (0.231) | | | | | | |
| $YCS_{i,t}^{\mathcal{LU}}$ | | | | | | | 0.060 | -0.043 | | | | |
| | | | | | | | (0.548) | (0.568) | | | | |
| $YCS_{i,t}^{\mathcal{HU}}$ | | | | | | | | | -0.534 | -1.565** | | |
| | | | | | | | | | (0.679) | (0.717) | | |
| $YCS_{i,t}^{\mathcal{LD}}$ | | | | | | | | | | | 2.560*** | 1.310 |
| | | | | | | | | | | | (0.621) | (0.798) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| FAPs Official lending | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ |
| Observations | 3097 | 2976 | 3097 | 2976 | 3097 | 2976 | 3097 | 2976 | 3097 | 2976 | 3097 | 2976 |

*Notes:* This table presents quarterly reduced-form regression results based on Equation 8, where we project directly on bond yield surprises. The left-hand side variable is the cumulative issuance of government bonds relative to GDP from $t$ to $t+4$. The regressors are the yield change surprises, where superscripts $\mathcal{H}$ and $\mathcal{L}$ indicate positive and negative surprises, respectively. We refer to these cases as pooled IV. The additional superscripts $\mathcal{D}$ and $\mathcal{U}$ refer to rating downgrades and rating upgrades, respectively. Sign restriction refers to those surprises for which rating and yield changes agree in their sign. When indicated, we also control comprehensively for official lending, as described in the text. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

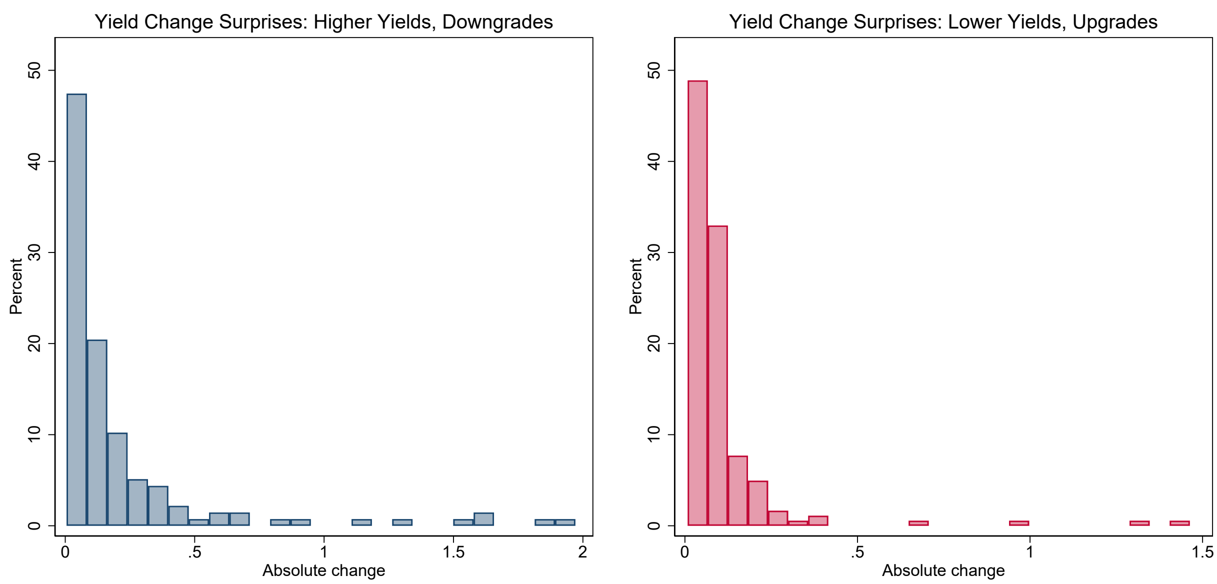
## A3-2 Yield change surprises

**Figure A3.3:** *Distribution of yield change surprises*

**(a) Surprises from all credit rating announcements (pooled IV)**




**(b) Surprises from conventional credit rating announcements (sign restricted IV)**




*Notes:* The figure shows the histograms of the absolute value of quarterly yield change surprises. Panel (a) shows the histograms based on all yield change surprises (used as pooled IVs), and panel (b) shows the histograms for the conventional cases in which credit rating and yield changes agree (used as sign-restricted IVs). The left plots shows the distribution of positive yield surprises and the right panel shows the distribution of negative yield surprises.

## A3-3 Sensitivity analysis

**Table A3.6:** *Causal effects of yield changes on government loan-bond portfolio choices, no controls*

| | $\Delta_5$ Loan-Bond ratio$_{i,t+4}$ | | | | $\Sigma_{j=0}^{4}$ Loan Issuance$_{i,t+j}$ | | | | $\Sigma_{j=0}^{4}$ Bond Issuance$_{i,t+j}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.082*** | | 0.072*** | | 2.665*** | | 2.453*** | | -1.976*** | | -1.713*** | |
| | (0.009) | | (0.006) | | (0.296) | | (0.290) | | (0.201) | | (0.171) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | -0.069 | | -0.020 | | -2.135* | | -0.428 | | 1.480 | | 0.537 |
| | | (0.043) | | (0.016) | | (1.236) | | (0.363) | | (1.044) | | (0.342) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 3299 | 3299 | 3299 | 3299 | 3299 | 3299 | 3299 | 3299 | 3299 | 3299 | 3299 | 3299 |

*Notes:* This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change in the loan-bond ratio between $t-1$ and $t+4$ in columns (1) to (4), the cumulative issuance of government loans relative to GDP from $t$ to $t+4$ in columns (5) to (8), and the cumulative issuance of government bonds relative to GDP over the same period in columns (9) to (12). The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y_{i,t}^{\Delta>0}$ and $\Delta Y_{i,t}^{\Delta<0}$ indicate that the bond yield change is further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. We omit all macroeconomic control variables to investigate whether the controls play an important role for identification. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

**Table A3.7:** *Causal effects of yield changes on government loan-bond portfolio choices, controlling for four quarterly lags of macroeconomic indicators*

| | $\Delta_5$ Loan-Bond ratio$_{i,t+4}$ | | | | $\Sigma_{j=0}^{4}$ Loan Issuance$_{i,t+j}$ | | | | $\Sigma_{j=0}^{4}$ Bond Issuance$_{i,t+j}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.063*** | | 0.055*** | | 1.815*** | | 1.734*** | | -1.804*** | | -1.656*** | |
| | (0.011) | | (0.010) | | (0.396) | | (0.377) | | (0.355) | | (0.327) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | -0.055 | | -0.012 | | -1.209 | | 0.148 | | 1.216 | | 0.267 |
| | | (0.047) | | (0.016) | | (1.193) | | (0.211) | | (1.023) | | (0.247) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 3107 | 3107 | 3107 | 3107 | 3107 | 3107 | 3107 | 3107 | 3107 | 3107 | 3107 | 3107 |

*Notes:* This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change in the loan-bond ratio between $t-1$ and $t+4$ in columns (1) to (4), the cumulative issuance of government loans relative to GDP from $t$ to $t+4$ in columns (5) to (8), and the cumulative issuance of government bonds relative to GDP over the same period in columns (9) to (12). The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y_{i,t}^{\Delta>0}$ and $\Delta Y_{i,t}^{\Delta<0}$ indicate that the bond yield change is further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. We include four lags of all macroeconomic control variables. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

**Table A3.8:** *Causal effects of yield changes on government loan-bond portfolio choices, controlling for four quarterly lags of macroeconomic indicators and bond and loan issuance*

| | $\Delta_5$ Loan-Bond ratio$_{i,t+4}$ | | | | $\Sigma_{j=0}^{4}$ Loan Issuance$_{i,t+j}$ | | | | $\Sigma_{j=0}^{4}$ Bond Issuance$_{i,t+j}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.064*** | | 0.054*** | | 1.843*** | | 1.704*** | | -1.962*** | | -1.755*** | |
| | (0.010) | | (0.009) | | (0.374) | | (0.354) | | (0.399) | | (0.371) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | -0.054 | | -0.014 | | -1.145 | | 0.153 | | 1.305 | | 0.267 |
| | | (0.047) | | (0.017) | | (1.138) | | (0.183) | | (1.098) | | (0.237) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 3094 | 3094 | 3094 | 3094 | 3094 | 3094 | 3094 | 3094 | 3094 | 3094 | 3094 | 3094 |

*Notes:* This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change in the loan-bond ratio between $t-1$ and $t+4$ in columns (1) to (4), the cumulative issuance of government loans relative to GDP from $t$ to $t+4$ in columns (5) to (8), and the cumulative issuance of government bonds relative to GDP over the same period in columns (9) to (12). The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y_{i,t}^{\Delta>0}$ and $\Delta Y_{i,t}^{\Delta<0}$ indicate that the bond yield change is further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. We include four lags of all macroeconomic control variables, as well as four lags of loan and bond issuance, respectively. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

**Table A3.9:** *Causal effects of yield changes on government loan-bond portfolio choices, estimating the effects of positive and negative yield changes jointly*

| | $\Delta_5$ Loan-Bond ratio$_{i,t+4}$ | | $\Sigma_{j=0}^{4}$ Loan Issuance$_{i,t+j}$ | | $\Sigma_{j=0}^{4}$ Bond Issuance$_{i,t+j}$ | |
|---|---|---|---|---|---|---|
| | Pooled IV | Sign Res. IV | Pooled IV | Sign Res. IV | Pooled IV | Sign Res. IV |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.061*** | 0.060*** | 1.714*** | 1.737*** | -1.655*** | -1.725*** |
| | (0.012) | (0.008) | (0.364) | (0.327) | (0.311) | (0.258) |
| $\Delta Y_{i,t}^{\Delta<0}$ | 0.002 | -0.009 | 0.360 | 0.198* | -0.170 | 0.310 |
| | (0.013) | (0.008) | (0.301) | (0.116) | (0.352) | (0.257) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 3169 | 3169 | 3169 | 3169 | 3169 | 3169 |

*Notes:* This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change in the loan-bond ratio between $t-1$ and $t+4$ in columns (1) to (4), the cumulative issuance of government loans relative to GDP from $t$ to $t+4$ in columns (5) to (8), and the cumulative issuance of government bonds relative to GDP over the same period in columns (9) to (12). The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y_{i,t}^{\Delta>0}$ and $\Delta Y_{i,t}^{\Delta<0}$ indicate that the bond yield change is further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. We include both positive and negative yield changes in a joint specification, and instrument both accordingly. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

**Table A3.10:** *Causal effects of yield changes on government loan-bond portfolio choices, excluding large yield change surprises*

| | $\Delta_5$ Loan-Bond ratio$_{i,t+4}$ | | | | $\Sigma_{j=0}^{4}$ Loan Issuance$_{i,t+j}$ | | | | $\Sigma_{j=0}^{4}$ Bond Issuance$_{i,t+j}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.085** | | 0.088** | | 2.738* | | 2.891** | | -2.427** | | -2.186** | |
| | (0.039) | | (0.040) | | (1.402) | | (1.311) | | (1.185) | | (1.060) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | -0.003 | | 0.029 | | -1.128 | | 2.262** | | -3.161 | | -1.333 |
| | | (0.036) | | (0.025) | | (2.081) | | (0.931) | | (2.925) | | (1.054) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 3155 | 3155 | 3155 | 3155 | 3155 | 3155 | 3155 | 3155 | 3155 | 3155 | 3155 | 3155 |

*Notes:* This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change in the loan-bond ratio between $t-1$ and $t+4$ in columns (1) to (4), the cumulative issuance of government loans relative to GDP from $t$ to $t+4$ in columns (5) to (8), and the cumulative issuance of government bonds relative to GDP over the same period in columns (9) to (12). The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y_{i,t}^{\Delta>0}$ and $\Delta Y_{i,t}^{\Delta<0}$ indicate that the bond yield change is further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. We exclude observations with extreme bond yield surprises, i.e., surprises below the 2.5th and above 97.5th percentile of the surprise distribution. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

**Table A3.11:** *Causal effects of yield changes on government loan-bond portfolio choices, Jackknife exercise excluding one country at a time*

| | $\Delta_5$ Loan-Bond ratio$_{i,t+4}$ | | $\Sigma_{j=0}^{4}$ Loan Issuance$_{i,t+j}$ | | $\Sigma_{j=0}^{4}$ Bond Issuance$_{i,t+j}$ | |
|---|---|---|---|---|---|---|
| | Pooled IV | Sign Res. IV | Pooled IV | Sign Res. IV | Pooled IV | Sign Res. IV |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.06*** | 0.06*** | 1.90*** | 1.83*** | -1.74*** | -1.57*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.24) | (0.22) |
| Observations | 3169 | 3169 | 3169 | 3169 | 3169 | 3169 |
| *Leave-one-country-out coefficients for:* $\Delta Y_{i,t}^{\Delta>0}$ | | | | | | |
| ex. Australia | 0.06*** | 0.06*** | 1.89*** | 1.83*** | -1.75*** | -1.58*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.24) | (0.23) |
| ex. Austria | 0.06*** | 0.06*** | 1.89*** | 1.83*** | -1.73*** | -1.58*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.24) | (0.22) |
| ex. Belgium | 0.06*** | 0.06*** | 1.89*** | 1.83*** | -1.73*** | -1.57*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.24) | (0.22) |
| ex. Bulgaria | 0.06*** | 0.05*** | 1.90*** | 1.84*** | -1.66*** | -1.51*** |
| | (0.01) | (0.01) | (0.36) | (0.36) | (0.20) | (0.19) |
| ex. Canada | 0.06*** | 0.06*** | 1.89*** | 1.82*** | -1.73*** | -1.56*** |
| | (0.01) | (0.01) | (0.34) | (0.34) | (0.23) | (0.22) |
| ex. Colombia | 0.06*** | 0.05*** | 1.88*** | 1.82*** | -1.74*** | -1.58*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.24) | (0.23) |
| ex. Czech Republic | 0.06*** | 0.06*** | 1.89*** | 1.83*** | -1.73*** | -1.57*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.23) | (0.22) |
| ex. Denmark | 0.06*** | 0.06*** | 1.89*** | 1.83*** | -1.74*** | -1.57*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.23) | (0.21) |
| ex. Finland | 0.06*** | 0.06*** | 1.91*** | 1.85*** | -1.76*** | -1.60*** |
| | (0.01) | (0.01) | (0.35) | (0.36) | (0.25) | (0.23) |
| ex. France | 0.06*** | 0.06*** | 1.88*** | 1.82*** | -1.75*** | -1.58*** |
| | (0.01) | (0.01) | (0.34) | (0.34) | (0.24) | (0.22) |
| ex. Germany | 0.06*** | 0.06*** | 1.91*** | 1.84*** | -1.74*** | -1.57*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.24) | (0.22) |
| ex. Greece | 0.06*** | 0.06*** | 2.27*** | 2.39*** | -2.01*** | -1.89*** |
| | (0.01) | (0.01) | (0.58) | (0.56) | (0.40) | (0.39) |
| ex. Hungary | 0.06*** | 0.06*** | 1.96*** | 1.91*** | -1.77*** | -1.61*** |
| | (0.01) | (0.01) | (0.36) | (0.38) | (0.25) | (0.23) |
| ex. Iceland | 0.06*** | 0.05*** | 1.89*** | 1.81*** | -1.68*** | -1.54*** |
| | (0.01) | (0.01) | (0.35) | (0.34) | (0.20) | (0.20) |
| ex. Ireland | 0.06*** | 0.05*** | 1.90*** | 1.82*** | -1.69*** | -1.52*** |
| | (0.01) | (0.01) | (0.36) | (0.36) | (0.26) | (0.22) |
| ex. Italy | 0.06*** | 0.06*** | 1.91*** | 1.84*** | -1.74*** | -1.57*** |
| | (0.01) | (0.01) | (0.35) | (0.35) | (0.24) | (0.22) |
| ex. Japan | 0.06*** | 0.06*** | 1.89*** | 1.83*** | -1.76*** | -1.59*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.25) | (0.23) |
| ex. Lithuania | 0.06*** | 0.05*** | 1.83*** | 1.78*** | -1.71*** | -1.55*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.28) | (0.25) |
| ex. Netherlands | 0.06*** | 0.06*** | 1.91*** | 1.84*** | -1.75*** | -1.58*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.24) | (0.22) |
| ex. New Zealand | 0.06*** | 0.06*** | 1.90*** | 1.83*** | -1.78*** | -1.58*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.25) | (0.22) |
| ex. Norway | 0.06*** | 0.05*** | 1.86*** | 1.79*** | -1.75*** | -1.59*** |
| | (0.01) | (0.01) | (0.32) | (0.33) | (0.24) | (0.22) |
| ex. Poland | 0.06*** | 0.06*** | 1.90*** | 1.84*** | -1.77*** | -1.60*** |
| | (0.01) | (0.01) | (0.35) | (0.36) | (0.26) | (0.23) |
| ex. Portugal | 0.06*** | 0.05*** | 1.71*** | 1.65*** | -1.66*** | -1.49*** |
| | (0.01) | (0.01) | (0.21) | (0.19) | (0.17) | (0.13) |
| ex. Slovakia | 0.06*** | 0.06*** | 1.87*** | 1.81*** | -1.71*** | -1.55*** |
| | (0.01) | (0.01) | (0.33) | (0.34) | (0.23) | (0.21) |
| ex. Slovenia | 0.06*** | 0.06*** | 1.89*** | 1.83*** | -1.72*** | -1.55*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.24) | (0.21) |
| ex. Spain | 0.06*** | 0.05*** | 1.86*** | 1.80*** | -1.73*** | -1.58*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.26) | (0.23) |
| ex. Sweden | 0.06*** | 0.06*** | 1.89*** | 1.83*** | -1.75*** | -1.58*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.24) | (0.22) |
| ex. Switzerland | 0.06*** | 0.06*** | 1.90*** | 1.83*** | -1.76*** | -1.59*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.24) | (0.22) |
| ex. United Kingdom | 0.06*** | 0.06*** | 1.90*** | 1.83*** | -1.76*** | -1.58*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.25) | (0.23) |
| ex. United States | 0.06*** | 0.06*** | 1.88*** | 1.82*** | -1.65*** | -1.48*** |
| | (0.01) | (0.01) | (0.34) | (0.35) | (0.21) | (0.17) |

*Notes:* This table presents quarterly IV regression results based on Equation 8, as specified in the text. The dependent variables are the change in the loan-bond ratio between $t-1$ and $t+4$ in columns (1) to (2), the cumulative issuance of government loans relative to GDP from $t$ to $t+4$ in columns (3) to (4), and the cumulative issuance of government bonds relative to GDP over the same period in columns (5) to (6). The regressors of interest is quarter-on-quarter changes in ten-year government bond yields interacted with an indicator variable that is only activated for positive yield changes. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case. The sign restricted IV uses only positive yield surprises due to credit rating downgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. The top row replicates the baseline results from Table 4. In the remaining rows, we execute a Jackknife exercise, where we always exclude all observation from the stated country and re-estimate the regression with all remaining observations. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

**Table A3.12:** *Causal effects of yield changes on government loan-bond portfolio choices, pre and post Euro crisis*

| | $\Delta_5$ Loan-Bond ratio$_{i,t+4}$ | | | | $\Sigma_{j=0}^{4}$ Loan Issuance$_{i,t+j}$ | | | | $\Sigma_{j=0}^{4}$ Bond Issuance$_{i,t+j}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **Panel A:** Pre-Euro Crisis (before 2009) | | | | | | | | | | | | |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.042*** | | 0.047*** | | 0.976** | | 1.012*** | | -1.313* | | -1.017* | |
| | (0.005) | | (0.010) | | (0.417) | | (0.302) | | (0.726) | | (0.549) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | -0.060 | | 0.027 | | -1.368 | | 0.783 | | -1.744 | | -0.962 |
| | | (0.126) | | (0.032) | | (2.788) | | (0.744) | | (2.812) | | (0.760) |
| Observations | 1475 | 1475 | 1475 | 1475 | 1475 | 1475 | 1475 | 1475 | 1475 | 1475 | 1475 | 1475 |
| **Panel B:** Post-Euro Crisis (2009 onwards) | | | | | | | | | | | | |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.059*** | | 0.052*** | | 1.677*** | | 1.621*** | | -1.272*** | | -1.198*** | |
| | (0.009) | | (0.008) | | (0.398) | | (0.399) | | (0.250) | | (0.225) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | -0.030 | | 0.004 | | -0.537 | | 0.541*** | | 0.798 | | -0.002 |
| | | (0.026) | | (0.005) | | (0.667) | | (0.130) | | (0.709) | | (0.206) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 1694 | 1694 | 1694 | 1694 | 1694 | 1694 | 1694 | 1694 | 1694 | 1694 | 1694 | 1694 |

*Notes:* This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change in the loan-bond ratio between $t-1$ and $t+4$ in columns (1) to (4), the cumulative issuance of government loans relative to GDP from $t$ to $t+4$ in columns (5) to (8), and the cumulative issuance of government bonds relative to GDP over the same period in columns (9) to (12). The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y_{i,t}^{\Delta>0}$ and $\Delta Y_{i,t}^{\Delta<0}$ indicate that the bond yield change is further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. We estimate these specifications with pre and post Euro crisis data. Before 2009 indicates that the latest data point is from the fourth quarter of 2009. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

**Table A3.13:** *Causal effects of yield changes on government loan-bond portfolio choices, pre and post Covid*

| | $\Delta_5$ Loan-Bond ratio$_{i,t+4}$ | | | | $\Sigma_{j=0}^{4}$ Loan Issuance$_{i,t+j}$ | | | | $\Sigma_{j=0}^{4}$ Bond Issuance$_{i,t+j}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | | Pooled IV | | Sign Res. IV | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **Panel A:** Pre-Covid (before 2019) | | | | | | | | | | | | |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.056*** | | 0.051*** | | 1.864*** | | 1.800*** | | -1.798*** | | -1.623*** | |
| | (0.010) | | (0.009) | | (0.342) | | (0.343) | | (0.250) | | (0.213) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | -0.033 | | 0.006 | | -0.765 | | 0.524*** | | 0.918 | | -0.024 |
| | | (0.029) | | (0.005) | | (0.865) | | (0.117) | | (0.877) | | (0.236) |
| Observations | 2673 | 2673 | 2673 | 2673 | 2673 | 2673 | 2673 | 2673 | 2673 | 2673 | 2673 | 2673 |
| **Panel B:** Post-Covid (2019 onwards) | | | | | | | | | | | | |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.064*** | | 0.048** | | 0.631** | | 1.230*** | | 0.988 | | 0.777 | |
| | (0.019) | | (0.021) | | (0.317) | | (0.476) | | (0.938) | | (0.904) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | -0.133 | | -0.468 | | -0.677 | | -0.393 | | -7.657 | | 17.774 |
| | | (0.185) | | (1.398) | | (1.726) | | (4.519) | | (16.673) | | (58.743) |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 496 | 496 | 496 | 496 | 496 | 496 | 496 | 496 | 496 | 496 | 496 | 496 |

*Notes:* This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change in the loan-bond ratio between $t-1$ and $t+4$ in columns (1) to (4), the cumulative issuance of government loans relative to GDP from $t$ to $t+4$ in columns (5) to (8), and the cumulative issuance of government bonds relative to GDP over the same period in columns (9) to (12). The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y_{i,t}^{\Delta>0}$ and $\Delta Y_{i,t}^{\Delta<0}$ indicate that the bond yield change is further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. We estimate these specifications with pre and post Covid-19 data. Before 2019 indicates that the latest data point is from the fourth quarter of 2019. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

## A3-4 Official lending

**Table A3.14:** *First stage estimates and weak instrument tests, controlling for official lending*

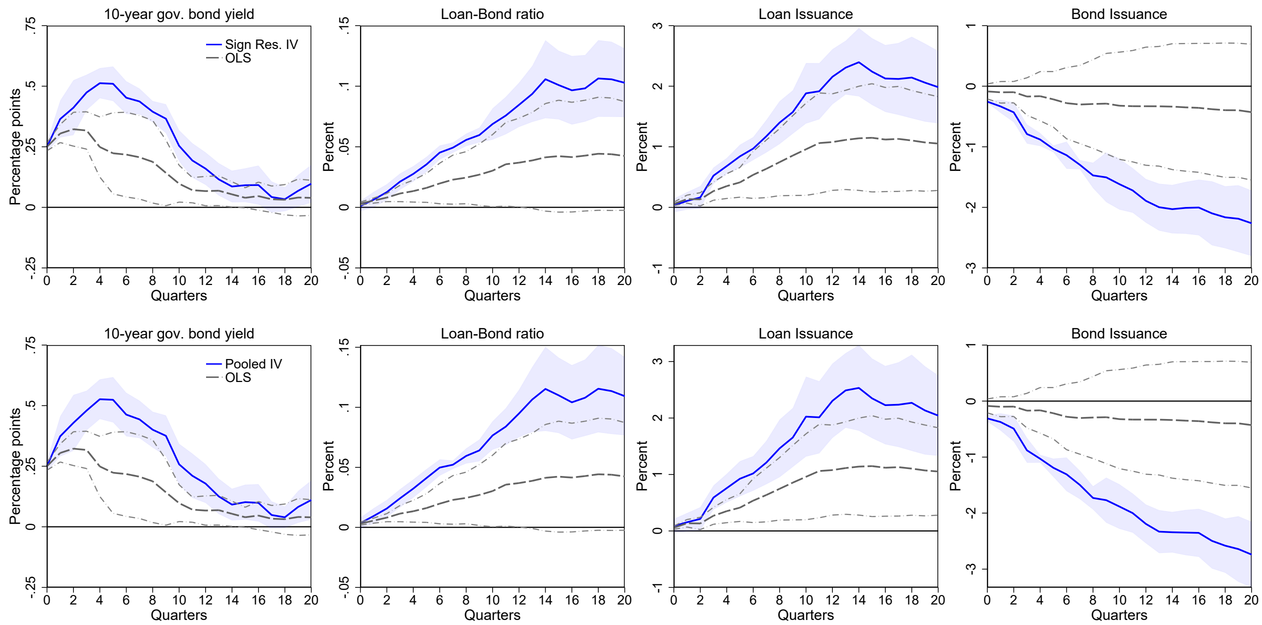
| | Pooled IV | | Sign restriction | | Sign restriction violated | |
|---|---|---|---|---|---|---|
| | $\Delta Y_{i,t}^{\Delta>0}$ | $\Delta Y_{i,t}^{\Delta<0}$ | $\Delta Y_{i,t}^{\Delta>0}$ | $\Delta Y_{i,t}^{\Delta<0}$ | $\Delta Y_{i,t}^{\Delta>0}$ | $\Delta Y_{i,t}^{\Delta<0}$ |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $YCS_{i,t}^{\mathcal{H}}$ | 1.127*** | | | | | |
| | (0.162) | | | | | |
| $YCS_{i,t}^{\mathcal{L}}$ | | -0.724* | | | | |
| | | (0.408) | | | | |
| $YCS_{i,t}^{\mathcal{HD}}$ | | | 1.312*** | | | |
| | | | (0.218) | | | |
| $YCS_{i,t}^{\mathcal{LU}}$ | | | | 2.381*** | | |
| | | | | (0.397) | | |
| $YCS_{i,t}^{\mathcal{HU}}$ | | | | | -0.300 | |
| | | | | | (0.270) | |
| $YCS_{i,t}^{\mathcal{LD}}$ | | | | | | -1.026*** |
| | | | | | | (0.273) |
| Within $R^2$ | 0.14 | 0.02 | 0.18 | 0.18 | 0.00 | 0.02 |
| Country FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Official lending | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Effective F | 45.12 | 5.02 | 33.82 | 33.69 | 13.01 | 13.27 |
| Montiel-Olea & Pflueger (2013) critical value | 30.13 | 30.13 | 30.13 | 30.13 | 30.13 | 30.13 |
| Observations | 3048 | 3048 | 3048 | 3048 | 3048 | 3048 |

*Notes:* This table presents quarterly first stage regression results based on Equation 8, as specified in the text. The left-hand side variables are the quarter-on-quarter change in the ten-year government bond yield, conditioning on positive ($\Delta > 0$) or negative ($\Delta < 0$) yield changes as indicated by the superscript. The regressors are the yield change surprises, where superscripts $\mathcal{H}$ and $\mathcal{L}$ indicate positive and negative surprises, respectively. We refer to these cases as pooled IV. The additional superscripts $\mathcal{D}$ and $\mathcal{U}$ refer to rating downgrades and rating upgrades, respectively. Sign restriction refers to those surprises for which rating and yield changes agree in their sign. We also control comprehensively for official lending, as described in the text. The effective F statistic and the critical value correspond to the Montiel-Olea and Pflueger (2013) weak instrument test at the 1% significance level. An F statistics above the critical value allows rejecting the null of weak instruments. The within $R^2$ indicates the fraction of variation that is explained by the yield surprise after taking out fixed effects and control variables. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

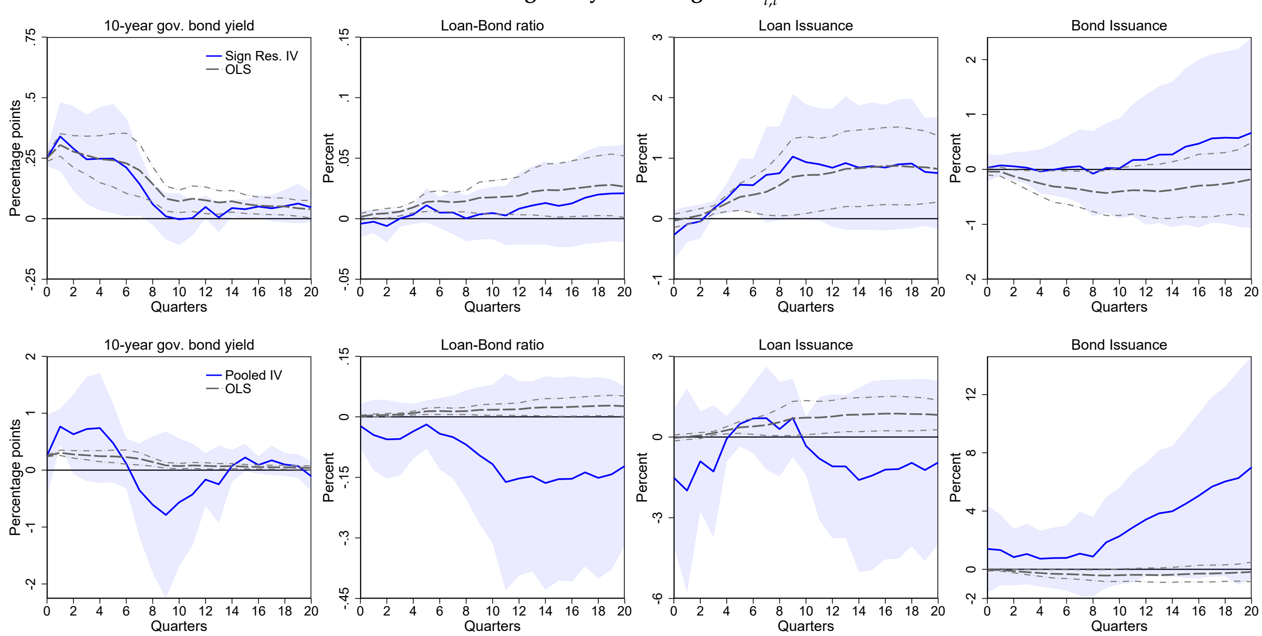
## A3-5 Dynamic responses

**Figure A3.4:** *Dynamic causal effects of yield changes on government loan-bond portfolio choices, comparison with OLS estimates*

**(a) Positive yield changes ($\Delta Y_{i,t}^{\Delta>0}$)**



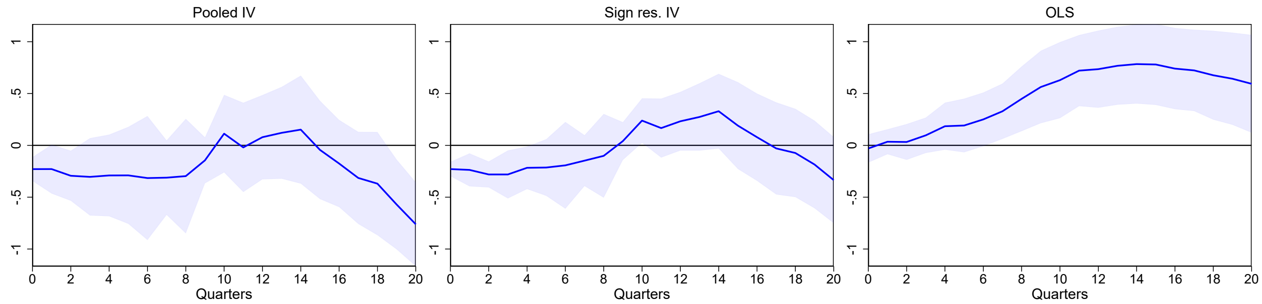

**(b) Negative yield changes ($\Delta Y_{i,t}^{\Delta<0}$)**



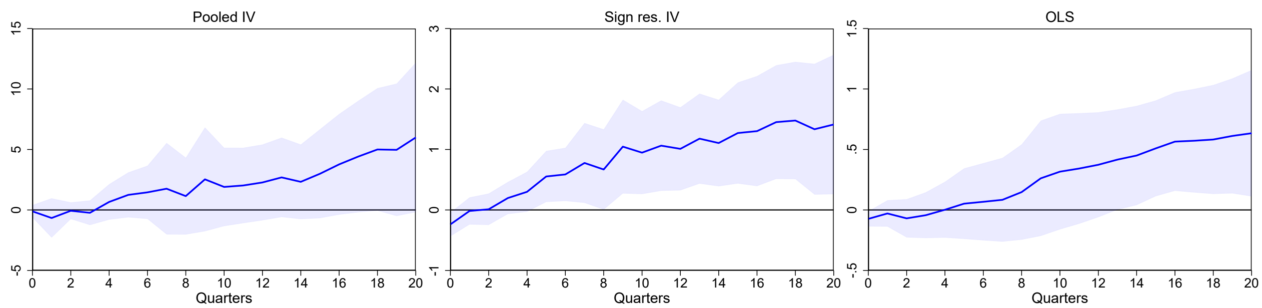

*Notes:* This figure presents quarterly IV local projections based on Equation 8, as specified in the text. The left-hand side variables are the change in the ten-year government bond yield and the loan-bond ratio between $t-1$ and $t+h$ in the left panels, and the cumulative issuance of government loans and bonds relative to GDP from $t$ to $t+h$ in the right panels. The $h$-quarter lead is indicated on the horizontal axis. The top and bottom rows show the responses to an initial increase and decrease of bond yields by 0.25 percentage points, respectively. Positive yield changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV, uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The IV estimates are given as solid blue lines. For comparison, we also present corresponding OLS estimates as dashed gray lines. We include lagged macroeconomic indicators as control variables and further control comprehensively for official lending, as described in the text. The blue shaded areas and dashed gray lines indicate confidence bands at the 95% level, based on standard errors clustered by country and time.

**Figure A3.5:** *Dynamic causal effects of yield changes on total government debt*

**(a) Positive yield changes ($\Delta Y_{i,t}^{\Delta>0}$)**



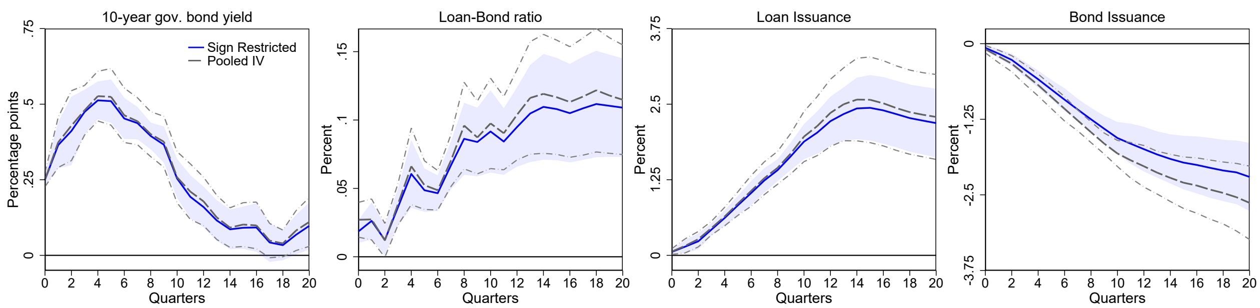

**(b) Negative yield changes ($\Delta Y_{i,t}^{\Delta<0}$)**



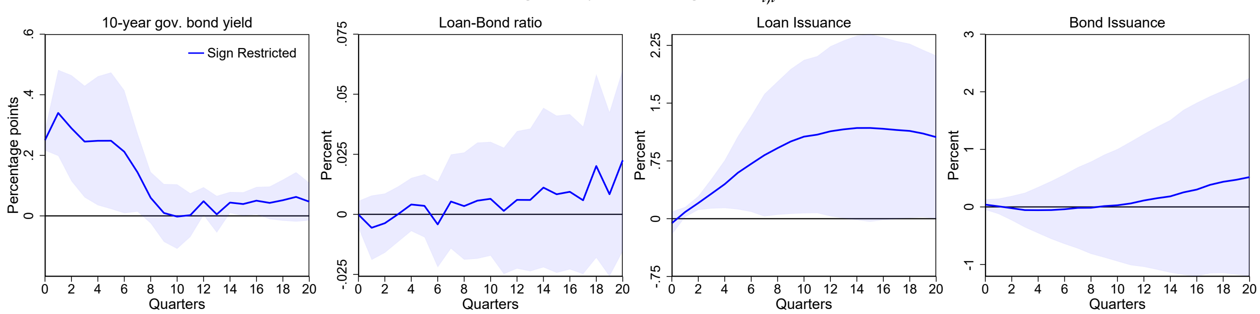

*Notes:* This figure presents quarterly instrumental variable local projections based on Equation 8, as specified in the text. The left-hand side variable is the cumulative issuance of total government debt relative to GDP from $t$ to $t+h$. The $h$-quarter lead is indicated on the horizontal axis. The top and bottom rows show the effects of an initial increase and decrease of bond yields by 0.25 percentage points, respectively. Positive yield changes are instrumented with all positive bond yield surprises in the pooled IV case, the left panels, and analogously for negative changes. The sign restricted IV, the middle panels, uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The right panels show OLS estimates for comparison. We include lagged macroeconomic indicators as control variables and further control comprehensively for official lending, as described in the text. The blue shaded areas and dashed gray lines indicate confidence bands at the 95% level, based on standard errors clustered by country and time.

**Figure A3.6:** *Dynamic causal effects of yield changes on government loan-bond portfolio choices, focusing on central government debt*

**(a) Positive yield changes ($\Delta Y_{i,t}^{\Delta>0}$)**




**(b) Negative yield changes ($\Delta Y_{i,t}^{\Delta<0}$)**




*Notes:* This figure presents quarterly IV local projections based on Equation 8, as specified in the text. The left-hand side variables are the change in the ten-year government bond yield and the loan-bond ratio between $t-1$ and $t+h$ in the left panels, and the cumulative issuance of government loans and bonds relative to GDP from $t$ to $t+h$ in the right panels. The $h$-quarter lead is indicated on the horizontal axis. The top and bottom rows show the responses to an initial increase and decrease of bond yields by 0.25 percentage points, respectively. Positive yield changes are instrumented with all positive bond yield surprises in the pooled IV case, the dashed gray line, and analogously for negative changes. The sign restricted IV, the solid blue line, uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The government debt variables are computed at the level of the central government. We include lagged macroeconomic indicators as control variables and further control comprehensively for official lending, as described in the text. The blue shaded areas and dashed gray lines indicate confidence bands at the 95% level, based on standard errors clustered by country and time.

## A4. Government creditors and financial stability

### A4-1 Unveiling approach.

**Data.** In addition to the stock of government debt by instrument, the OECD's financial accounts also contain the financial balance sheets of all other sectors in the economy (households, non-financial corporations, the financial sector, the government, and the rest of the world). In the financial accounts, assets and liabilities at the instrument level perfectly match each other. This allows us to build on the "unveiling" methodology introduced by Mian et al. (2020) and extended by Diebold and Richter (forthcoming) to determine the direct and ultimate counterparties holding government debt.

**Setup.** In short, this process involves the proportional allocation of sectoral liabilities to the assets of all other sectors at the instrument level. While bonds, and especially loans, are often held as assets by financial intermediaries, these intermediaries are not the ultimate counterparties providing financing. Instead, intermediaries may finance their assets with, for example, deposits, bonds, equity, etc., on the liability side of their balance sheets. Thus, an intermediary's assets are ultimately financed by the sectors that hold its liabilities as assets on their own balance sheets. Following Mian et al. (2020), we assume that ultimate financing sectors ($u$) can only be domestic households, the government, or the rest of the world ($u \in HH, GG, RoW$). Accordingly, all assets of the financial and non-financial corporate sectors can be allocated to these three ultimate counterparties.

**Unveiling example.** The underlying unveiling approach is described in detail in Diebold and Richter (forthcoming) and Mian et al. (2020). Thus, we only provide an instructive example to explain the approach in our setting. While the general unveiling approach applies to each individual financial instrument listed in the financial accounts data (deposits, bonds, loans, shares, insurance and pension products, gold and SDRs, derivatives and options, other accounts), our example focuses exclusively on bonds. Further, for simplicity, let us not distinguish between financial and non-financial corporations and suppose there is only a single intermediate sector. When we want to allocate the government's bond liabilities to its financing sectors, the first step is to assign the bonds to direct counterparties. Let us assume there are bonds worth 100 dollars in the government's balance sheet *liabilities*. The balance sheets of the remaining sectors indicate that of all bond *assets* in the entire economy (excluding the government itself), 60%, 30%, and 10% are held by the intermediate sector, the rest of the world (foreign sector), and domestic households, respectively.

The first step of the unveiling proportionally allocates the 100 dollars outstanding government bond liabilities to the asset holdings of the other sectors according to these shares.

In the second unveiling step, we want to "unveil" the role of the intermediate sector, which is owned by the ultimate counterparties (households, government, rest of the world). Let us assume that the intermediate sector is financing itself exclusively with deposits, while households hold 50% of all deposits in the economy, the foreign sector holds 40%, and the government holds 10%. Again, we can obtain this data from the balance sheets of the ultimate counterparties. Thus, we assign the intermediate sector's deposit liabilities to the ultimate counterparties according to their respective shares in total deposit holdings. Households would now be assumed to hold 40% of the government's bonds, 10% directly, and 30% indirectly via owning 50% of the intermediate sector's liabilities, which in turn holds 60% of the government's bonds. Similarly, the foreign sector would be assumed to hold 54% of the government's bond liabilities, 30% directly, and 24% via holding 40% of the financial sector's 60% bond share. The government, not financing itself directly, would be assumed to have financed itself indirectly with 6% via its share in the financial sector.[34]

### A4-2 Unveiled government liabilities across countries

**Bonds.** Table A4.15 shows the cross-country average results for both unveiling stages for government bonds and loans in panels A and B, respectively. On average, governments have outstanding bond debt of 51.1% of GDP. According to the first stage of the unveiling, 3.4% is held by households, 14.6% by the rest of the world, 31.3% by financial corporations, and 1.21% by non-financial corporations. In the second stage, the direct holdings of financial and non-financial corporations are reallocated to the three ultimate counterparties. The counterparties' holdings then consist of the sum of their direct and indirect holdings. This shows that 19.2% of all government bonds are held by households, 26.82% by the rest of the world, while the government (indirectly) holds 4.5% of its own debt. Thus, households hold 19.2-3.4=15.8% of government bonds indirectly through the corporate sector.

**Loans.** Panel B contains the corresponding information for the 16.3% of outstanding loans relative to GDP. As expected, most of these loans are directly held by financial corporations, making the assignment to ultimate counterparties in the second-stage unveiling particularly relevant for loans. This unveiling step suggests that 5.9% of the loans are ultimately financed by the domestic

[34] An example of the government financing itself might be via (partially) government-owned banks or other corporations that are government-owned.

**Table A4.15:** *Government debt, unveiling stages*

| | *Total* | *Households* | *Foreign Sector* | *Government* | *Financial Sector* | *Corporates* |
|---|---|---|---|---|---|---|
| **Panel A: Bonds** | | | | | | |
| First Stage (direct holdings) | 51.08 | 3.38 | 14.64 | 0.00 | 31.28 | 1.21 |
| Second Stage (total holdings=direct+indirect) | 51.08 | 19.17 | 26.82 | 4.50 | 0.00 | 0.00 |
| **Panel B: Loans** | | | | | | |
| First Stage (direct holdings) | 16.33 | 0.14 | 3.46 | 0.00 | 11.06 | 1.57 |
| Second Stage (total holdings =direct+indirect) | 16.33 | 5.93 | 8.50 | 1.91 | 0.00 | 0.00 |

*Notes:* This table shows the average allocation of government liabilities for the two separate stages of the proportional unveiling approach described in Subsection A4. Panel A displays the allocation for bonds, and Panel B presents the allocation for loans. In both panels, the first row allocates the entirety of government liabilities (shown for reference in the first column) to households, the foreign sector, the financial sector, and the non-financial corporate sector, thus excluding the government itself. The second row reallocates the direct holdings of the corporate sectors (financial and non-financial) to the three ultimate counterparties: households, the foreign sector, and the government. The figures for the ultimate counterparties in the second row of both panels, thus, represent the total amount of government debt ultimately financed by these sectors, combining both direct and indirect holdings of government debt.

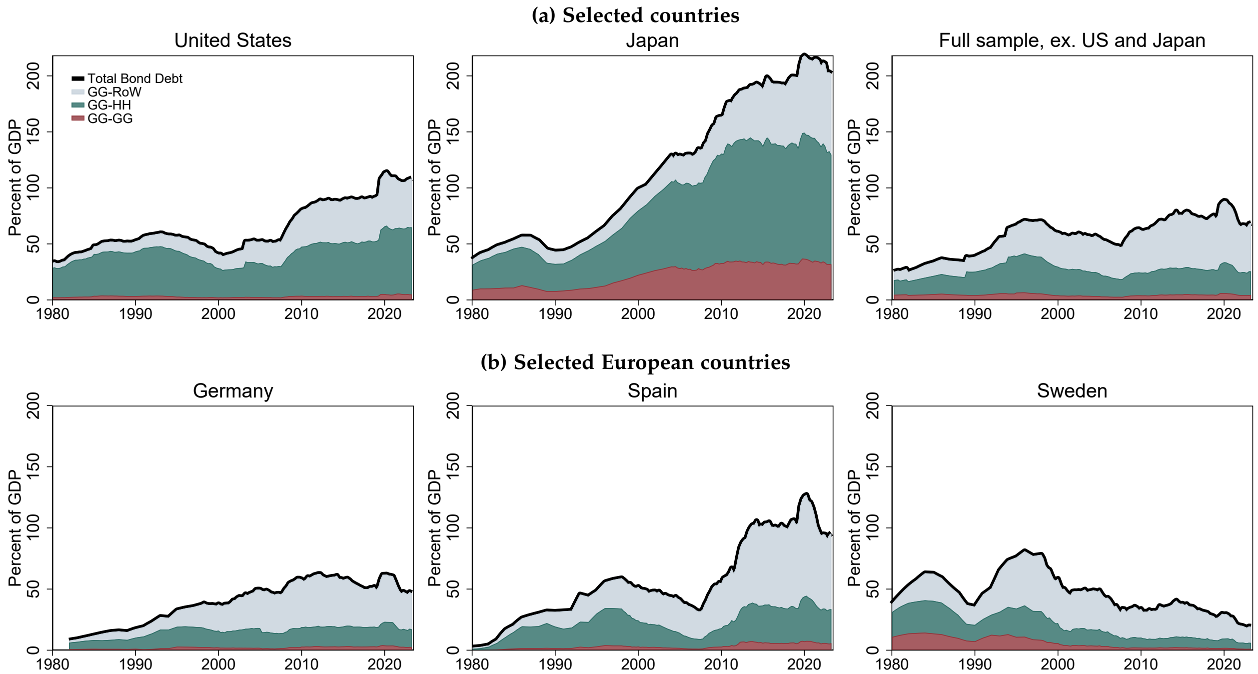
household sector while 8.5% are ultimately financed from abroad. Overall, bond financing is more important both in total liabilities and for each ultimate counterparty individually. However, loans still make up a significant fraction of government debt, both on the governments' liability side and on the asset sides of other sectors.

### A4-3 Unveiled government liabilities over time

The above results focus on sample averages. To also understand within-country variation, we show the evolution of bonds and loans over time for the same selected set of countries as in Figure 1, in Figure A4.7 and Figure A4.8, respectively. All panels show liabilities held by the rest of the world in gray (top area), by domestic households in green (middle area), and by the government itself in red (bottom area). Total government debt in the respective instrument category is indicated by the solid black line.

**Bonds.** Focusing on bonds in Figure A4.7, a clear trend toward increasing international funding is apparent, particularly among the group of European countries shown in the second row. By the end of our sample in 2024, government bonds ultimately financed from abroad make up the largest fraction of total government debt in all three European countries displayed. In contrast, the United States and Japan stand out due to their high levels of bond funding ultimately provided by domestic households, which, by the end of the sample period, constitute the largest share of their government bond liabilities. With the exception of Japan, none of these countries exhibit a substantial portion of government bond debt being indirectly financed by the government itself.

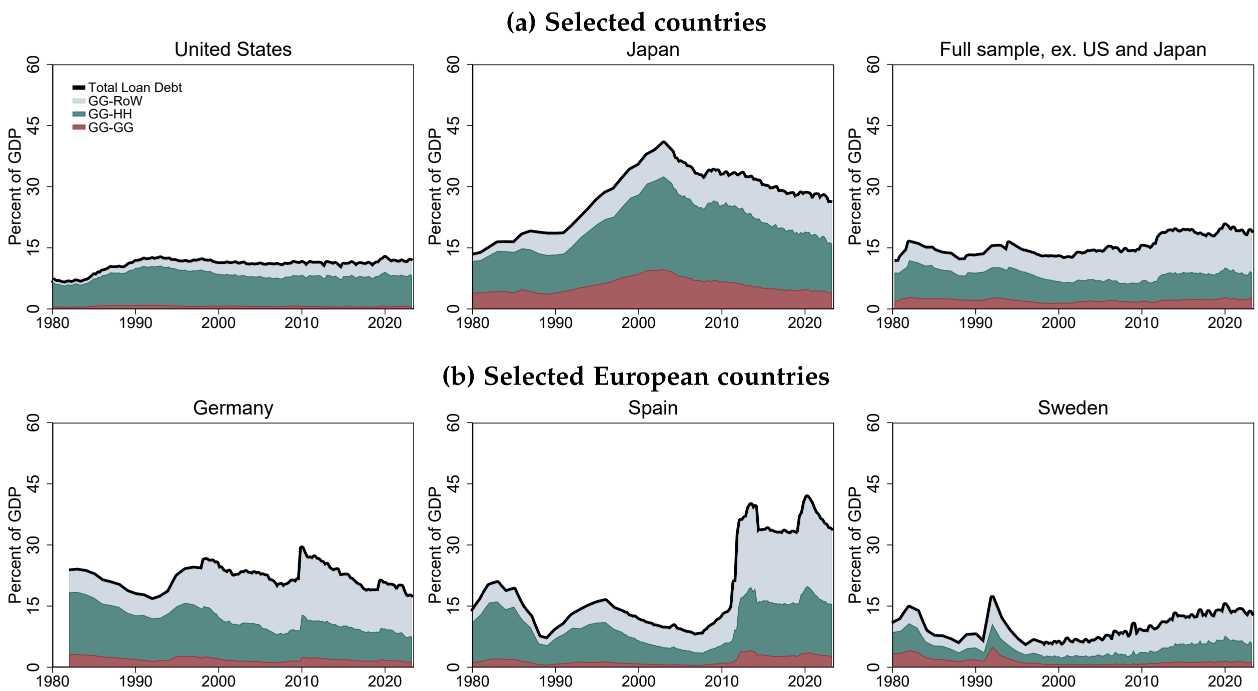
**Figure A4.7:** *Unveiled government bond holdings by country*




*Notes:* This figure shows the stock of government bond debt relative to GDP, broken down by ultimate financing counterparty, between 1980 and 2024 for selected countries. Panel (a) displays series for the United States, Japan, and a sample average excluding the United States and Japan. Panel (b) presents series for Germany, Spain, and Sweden. Across panels, government bond liabilities ultimately financed by the government are shown in red (bottom area), bonds ultimately financed by the household sector in green (middle area), and bonds ultimately financed by the foreign sector in gray (top area). The solid black line indicates the total amount of government bond liabilities relative to GDP.

**Loans.** Figure A4.8 shows the unveiled time series for government loans. As expected, the level of loan liabilities relative to GDP is generally lower than for bonds. However, even the United States have a non-negligible share of loan liabilities financed from domestic households. In Japan, loan financing begins increasing in the early 1990s and continue to rise until the Great Financial Crisis, after which the trend reverses. This increase is primarily financed by domestic households. Considering the full sample excluding Japan and the United States, we find that the ratio of loans to GDP is remarkably stable over time and roughly equally financed by the domestic household and foreign sectors (rest of the world). In Germany, loans fluctuate around 20% of GDP, with a slight shift toward foreign holdings over time. In contrast, Spain and Sweden experience sharp increases following the Euro Crisis and the Scandinavian Financial Crisis in the 1990s, respectively. In Spain, this rise is financed by domestic households and the rest of the world. A similar pattern emerges in Sweden in the 1990s.

**Figure A4.8:** *Unveiled government loan holdings by country*




*Notes:* This figure shows the stock of government loan debt relative to GDP, broken down by ultimate financing counterparty, between 1980 and 2024 for selected countries. Panel (a) displays series for the United States, Japan, and a sample average excluding the United States and Japan. Panel (b) presents series for Germany, Spain, and Sweden. Across panels, government loan liabilities ultimately financed by the government are shown in red (bottom area), loans ultimately financed by the household sector in green (middle area), and loans ultimately financed by the foreign sector in gray (top area). The solid black line indicates the total amount of government loan liabilities relative to GDP.

## A4-4 Alternative unveiled data

**Table A4.16:** *Causal effects of yield changes on direct government debt holdings, including extreme observations*

| | $\Delta_5$ Direct Loans$^{FI\rightarrow GG}_{i,t+4}$ | | $\Delta_5$ Direct Loans$^{RoW\rightarrow GG}_{i,t+4}$ | | $\Delta_5$ Direct Bonds$^{FI\rightarrow GG}_{i,t+4}$ | | $\Delta_5$ Direct Bonds$^{RoTW\rightarrow GG}_{i,t+4}$ | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Panel A:** Sign Restricted IV | | | | | | | | |
| $\Delta Y^{\Delta>0}_{i,t}$ | 1.33*** | | 0.60*** | | -0.67*** | | -1.45*** | |
| | (0.21) | | (0.19) | | (0.08) | | (0.11) | |
| $\Delta Y^{\Delta<0}_{i,t}$ | | 0.55*** | | -0.06 | | 0.18 | | -0.20 |
| | | (0.16) | | (0.17) | | (0.17) | | (0.25) |
| **Panel B:** Pooled IV | | | | | | | | |
| $\Delta Y^{\Delta>0}_{i,t}$ | 1.33*** | | 0.66*** | | -0.84*** | | -1.55*** | |
| | (0.20) | | (0.20) | | (0.07) | | (0.14) | |
| $\Delta Y^{\Delta<0}_{i,t}$ | | -0.15 | | -1.26 | | 0.81 | | 0.56 |
| | | (0.29) | | (0.94) | | (0.58) | | (0.53) |
| Country fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 3014 | 3014 | 3014 | 3014 | 3014 | 3014 | 3014 | 3014 |

*Notes:*This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change between $t-1$ and $t+4$ in the stock of loans and bonds, relative to GDP. The superscript indicates whether these funds are provided to the government ($GG$) from the domestic financial sector ($FI$) or the foreign sector ($RoW$). The left-hand side variables account for direct holdings of government debt and we do not exclude extreme observations. These unveiled data are obtained using the approach from Mian et al. (2017) and Diebold and Richter (forthcoming). The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y^{\Delta>0}_{i,t}$ and $\Delta Y^{\Delta<0}_{i,t}$ indicate that the bond yield change is further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

**Table A4.17:** *Causal effects of yield changes on direct government debt holdings, only counterparty data*

| | $\Delta_5$ Direct Loans$^{FI\rightarrow GG}_{i,t+4}$ | | $\Delta_5$ Direct Loans$^{RoW\rightarrow GG}_{i,t+4}$ | | $\Delta_5$ Direct Bonds$^{FI\rightarrow GG}_{i,t+4}$ | | $\Delta_5$ Direct Bonds$^{RoW\rightarrow GG}_{i,t+4}$ | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Panel A:** Sign Restricted IV | | | | | | | | |
| $\Delta Y^{\Delta>0}_{i,t}$ | 1.00 | | 1.45*** | | -0.20 | | -2.47*** | |
| | (0.69) | | (0.44) | | (0.46) | | (0.54) | |
| $\Delta Y^{\Delta<0}_{i,t}$ | | 0.55 | | 0.36** | | 0.18 | | 0.14 |
| | | (0.42) | | (0.16) | | (0.21) | | (0.46) |
| **Panel B:** Pooled IV | | | | | | | | |
| $\Delta Y^{\Delta>0}_{i,t}$ | 0.93 | | 1.57*** | | -0.69 | | -3.09*** | |
| | (0.71) | | (0.45) | | (0.61) | | (0.71) | |
| $\Delta Y^{\Delta<0}_{i,t}$ | | 0.47 | | -0.68 | | -0.03 | | 1.35 |
| | | (0.58) | | (1.46) | | (0.30) | | (2.06) |
| Country fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 1630 | 1630 | 733 | 733 | 1193 | 1193 | 1363 | 1363 |

*Notes:*This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change between $t-1$ and $t+4$ in the stock of loans and bonds, relative to GDP. The superscript indicates whether these funds are provided to the government ($GG$) from the domestic financial sector ($FI$) or the foreign sector ($RoW$). We use only counterparty data from the OECD financial accounts. The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y^{\Delta>0}_{i,t}$ and $\Delta Y^{\Delta<0}_{i,t}$ indicate that the bond yield change is further interacted with an indicator variable that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. We also control comprehensively for official lending, as described in the text. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

## A4-5 Official lending

**Table A4.18:** *Causal effects of yield changes on government debt holdings, controlling for official lending*

**(a) Direct holdings**

| | $\Delta_5$ Direct Loans$_{i,t+4}^{FI\rightarrow GG}$ | | $\Delta_5$ Direct Loans$_{i,t+4}^{RoW\rightarrow GG}$ | | $\Delta_5$ Direct Bonds$_{i,t+4}^{FI\rightarrow GG}$ | | $\Delta_5$ Direct Bonds$_{i,t+4}^{RoW\rightarrow GG}$ | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Panel A:** Sign Restricted IV | | | | | | | | |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.96*** | | 0.21*** | | -0.12 | | -1.93*** | |
| | (0.33) | | (0.06) | | (0.44) | | (0.55) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | 0.24 | | 0.10*** | | 0.13 | | 0.10 |
| | | (0.15) | | (0.04) | | (0.15) | | (0.26) |
| **Panel B:** Pooled IV | | | | | | | | |
| $\Delta Y_{i,t}^{\Delta>0}$ | 1.00*** | | 0.06 | | -0.34 | | -1.95*** | |
| | (0.34) | | (0.11) | | (0.45) | | (0.57) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | -0.16 | | -0.05 | | 0.18 | | 0.43 |
| | | (0.29) | | (0.14) | | (0.22) | | (0.55) |
| Country fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Official lending | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 2804 | 2804 | 2804 | 2804 | 2804 | 2804 | 2804 | 2804 |

**(b) Total holdings (direct and indirect)**

| | $\Delta_5$ Total Loans$_{i,t+4}^{HH\rightarrow GG}$ | | $\Delta_5$ Total Loans$_{i,t+4}^{RoW\rightarrow GG}$ | | $\Delta_5$ Total Bonds$_{i,t+4}^{HH\rightarrow GG}$ | | $\Delta_5$ Total Bonds$_{i,t+4}^{RoW\rightarrow GG}$ | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Panel A:** Sign Restricted IV | | | | | | | | |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.40** | | 0.70*** | | -0.20 | | -2.02*** | |
| | (0.17) | | (0.16) | | (0.28) | | (0.64) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | 0.09 | | 0.26** | | 0.02 | | 0.17 |
| | | (0.07) | | (0.13) | | (0.12) | | (0.25) |
| **Panel B:** Pooled IV | | | | | | | | |
| $\Delta Y_{i,t}^{\Delta>0}$ | 0.44** | | 0.54*** | | -0.31 | | -2.18*** | |
| | (0.17) | | (0.21) | | (0.30) | | (0.68) | |
| $\Delta Y_{i,t}^{\Delta<0}$ | | -0.05 | | -0.11 | | 0.06 | | 0.49 |
| | | (0.09) | | (0.28) | | (0.15) | | (0.53) |
| Country fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Macro controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Official lending | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 2797 | 2797 | 2797 | 2797 | 2797 | 2797 | 2797 | 2797 |

*Notes:* This table presents quarterly IV regression results based on Equation 8, as specified in the text. The left-hand side variables are the change between $t-1$ and $t+4$ in the stock of loans and bonds, relative to GDP. The superscript indicates whether these funds are provided to the government ($GG$) from the domestic financial sector ($FI$), the foreign sector ($RoW$), or domestic households ($HH$). The top panel accounts for direct holdings, whereas the bottom panel shows total holdings, which include direct and indirect holdings via the corporate sector. These unveiled data are obtained using the approach from Mian et al. (2020) and Diebold and Richter (forthcoming). We exclude extreme observations, as indicated in Figure 4. The regressors of interest are quarter-on-quarter changes in ten-year government bond yields, where $\Delta Y_{i,t}^{\Delta>0}$ and $\Delta Y_{i,t}^{\Delta<0}$ indicate that the bond yield change is further interacted with an indicator that is only activated for positive and negative yield changes, respectively. Positive changes are instrumented with all positive bond yield surprises in the pooled IV case, and analogously for negative changes. The sign restricted IV uses only positive yield surprises due to credit rating downgrades, and only negative yield changes due to credit rating upgrades. The coefficients correspond to an initial change in bond yields by 0.25 percentage points. We also control comprehensively for official lending, as described in the text. Standard errors are in parentheses and clustered by country and time, and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.