



Predictable Ratings, Puzzling Power

On Subjectivity, Regulation, and Why Sovereign Ratings Matter

Master Thesis

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Abstract

Sovereign credit ratings move government bond yields and command considerable attention from policymakers, yet it is unclear why. Using a long-run panel of 143 countries, I show that ratings are highly predictable from a small set of economic and political fundamentals, explaining around 85% of variation in ratings in the cross-section, and up to 95% with country fixed effects. The residual “subjective” component does not help predict sovereign defaults beyond the near future, and it systematically disadvantages lower-rated, typically poorer countries. If ratings add little information about default risk, their influence on borrowing costs must operate through other channels. I argue that these are certification and coordination. I provide evidence for the former by studying how the use of ratings in banking regulation shapes the rating–yield relationship. Using a local projections difference-in-differences design, I find that the spread between high- and low-rated non-EU sovereigns widened following both the December 2010 announcement of Basel III’s Liquidity Coverage Ratio and its January 2015 implementation, while the 2013 refinement that weakened the rule produced a slight compression. EU sovereigns, exempt under EU law and with spreads dominated by the euro crisis, show no significant response. The results offer indicative evidence that the certification role of ratings in banking regulation is one channel through which ratings affect sovereign borrowing costs.

Keywords: Sovereign Credit Ratings, Sovereign Bond Yields, Banking Regulation, Information and Market Efficiency

JEL Codes: G12, G14, G24, G28

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1 Introduction

What are the determinants of sovereign ratings, and how much do they affect a country’s borrowing cost? These have been the central questions on sovereign ratings since [Cantor & Packer \(1996\)](#). Addressing them with a new, larger panel, I find that the answers point to a third and more important question — why do ratings matter at all? — which is the question this paper sets out to answer.

Sovereign ratings are opinions about a country’s creditworthiness issued by private credit rating agencies (CRAs), dominated by the Big Three: Fitch, Moody’s, and S&P. Following a large literature, I use an annual panel of 143 countries over 25 years to show that ratings are largely reproducible from a handful of economic and political fundamentals. Regressing ratings on GDP per capita, ten-year average growth, the current account and external debt as shares of GDP, default history, and World Bank measures of government effectiveness and the rule of law yields an R^2 of around 85%, rising to 95% with country fixed effects, pointing to persistence in ratings beyond the persistence in fundamentals. Defining the fitted value as the “objective” rating and the residual as the “subjective” component, I show in a probit model that the objective part is useful in predicting default at horizons of one to five years, while the subjective part is significantly informative only in the near future. I then show a strong correlation between ratings and borrowing cost graphically, before estimating that ratings are significantly correlated with borrowing cost in a panel regression. This is true for both countries’ current effective interest rate on outstanding debt and their yield, also after controlling for fundamentals. A one notch higher rating is associated with a 40 basis points lower yield for developed countries and a 60 basis points lower yield for developing countries.

I distinguish three channels through which ratings might affect borrowing cost: information, coordination, and certification. If ratings add little information about default risk that is not already public, the information channel cannot be what makes them powerful. So what does? I note that ratings may serve as a coordination device for the self-fulfilling beliefs about default probability that have been emphasized in the sovereign-debt literature ([Calvo 1988](#), [Obstfeld 1996](#), [Barta 2025](#)), but I do not test this channel directly. My empirical focus is certification, the third channel: that is the use of ratings in rules that grant high-rated bonds a regulatory advantage, independent of their underlying risk ([Partnoy 1999](#)). Certification operates through banking regulation, central-bank collateral frameworks, and the portfolio rules of institutional investors.

Specifically, I ask whether the rating related changes introduced with Basel III affected the relationship between ratings and yields. The new Liquidity Coverage Ratio (LCR) mandates that banks hold high-quality liquid assets (HQLA), mainly central-bank reserves and highly-rated sovereign bonds, which should raise demand for the bonds of high-rated sovereigns and widen the spread between high- and low-rated countries. Using a local-

projections difference-in-differences design (Dube et al. 2025), I find a pattern consistent with this mechanism across four regulatory events. The spread between high- and low-rated non-EU sovereigns widens after the December 2010 announcement of Basel III and again after the LCR’s January 2015 implementation, while the January 2013 refinement that weakened the rule produces a slight compression, and the preliminary December 2009 consultation shows no significant response. EU sovereigns’ spreads are a special case as EU legislation includes an exception that lets banks classify all member states’ debt as HQLA irrespective of the rating and the euro crisis dominates the spread movements over this period. As expected, they show no significant response.

I also consider the role of the increase in minimum capital requirements for banks, announced together with the new LCR and implemented over the course of 2013 and 2014. The minimum capital requirement is defined relative to risk-weighted assets, with higher risk weights being applied to lower-rated bonds which makes holding them more expensive in terms of capital. The higher implicit capital cost of holding low-rated countries’ bonds does not show up in significant widening of spreads between different countries in lower rating groups, which might however be due to the small sample size and the staggered implementation.

Finally, I examine the consequences of the subjectivity in ratings that the residual reveals. Because it systematically favors higher-rated (typically developed) countries and disadvantages lower-rated (typically developing) ones, it may raise developing countries’ borrowing costs and pose risks to financial stability, because genuine risk is mispriced.

The paper proceeds as follows. Section 2 situates the work in the literature and gives further context on the history of ratings, the channels and on Basel III. Section 3 describes the data. Section 4 presents the methodology and results for the determinants of ratings; section 5 does the same for the rating–yield relationship; section 6 for the Basel III analysis. Section 7 concludes.

2 Literature

2.1 History of sovereign ratings

Creditors have always been sensitive to the risk of sovereign default, being compensated with higher returns on riskier bonds (Meyer et al. 2022). Early measures of sovereign creditworthiness date back to the French bank *Crédit Lyonnais* in the late 19th century (Flandreau 2003). Modern sovereign ratings emerged alongside the interwar boom in internationally traded government bonds, with Moody’s issuing its first sovereign rating in 1918 and the other agencies following shortly after. Rating activity collapsed with the defaults of the 1930s and the bank-loan-dominated Bretton Woods era, recovering only from the late 1980s. The reference work on this history is Gaillard (2012): *A Century of Sovereign*

Ratings. Two features stand out for what follows. First, despite the merger of Poor’s and Standard Statistics and decades of methodological refinement, the same three agencies (Fitch, Moody’s, and S&P) still dominate sovereign ratings today. Second, and more importantly for this paper, the determinants of ratings have remained remarkably stable over the century that Gaillard documents, with a small, fixed set of fundamentals being able to accurately predict them, as I show in section 4.

2.2 Determinants of ratings

There is a vast literature on the determinants of sovereign ratings summarized in [De Moor et al. \(2018\)](#). In the first comprehensive study [Cantor & Packer \(1996\)](#) find that ratings can to a large part be explained by an OLS regression on a handful of macroeconomic variables, confirmed by [Afonso et al. \(2011\)](#) who add political variables and refine earlier approaches by using an ordered probit model. The consensus in the literature is that a large part of ratings, 80 to 95%, can be explained by a small number of fundamentals in a simple regression framework ([De Moor et al. 2018](#)).

However, many authors have pointed to significant room for subjectivity and thus for bias remaining in the last 5 to 20% ([Luitel et al. 2016](#), [Fuchs & Gehring 2017](#), [De Moor et al. 2018](#)). Credit rating agencies are transparent about the fact that their rating committees apply professional judgment to the underlying “objective” rating. For example Fitch explicitly states that it applies a “qualitative overlay” of ± 3 -notch adjustments to the predicted rating from its sovereign rating model based on quantitative fundamentals ([Fitch Ratings 2025](#)).

It is thus natural to suspect a possibility of bias in the application of this subjective judgment. While some studies simply classify the residual of the regression of ratings on fundamentals as the subjective part of ratings ([Vernazza & Nielsen 2015](#)), others try to assess the factors influencing the subjective component in more detail. [Fuchs & Gehring \(2017\)](#) study the difference in rating between the American Big Three and other Western CRAs as well as the Chinese competitor. They find a home bias mainly driven by language differences between issuer and CRAs’ residence countries and not by the degree of export interest or bank exposure. [De Moor et al. \(2018\)](#) identify the subjective component in ratings directly via variables for lobbying power as well as trade and cultural proximity. [Luitel et al. \(2016\)](#) argue that data availability or modeling issues could lead to larger room for subjectivity and thus bias for developing countries.

A further potential source of bias lies in the institutional-quality indexes that figure prominently in rating models, which leave room for manipulation.¹ Focusing on the weights given to fundamentals rather than their selection, [Lysenko \(2025\)](#) argues that Sub-Saharan

¹One example is the alleged manipulation of China’s score in the World Bank’s Doing Business indicator. See <https://www.ft.com/content/029b75dc-86a0-4ebb-956b-a3135b6c510d> (visited 11.05.2026).

Africa’s low ratings are driven mainly by heavy weights on GDP per capita and institutional quality, which may not be the true drivers of default. Tennant et al. (2020) document another asymmetry: agencies are slower to upgrade and quicker to downgrade developing countries for a given change in fundamentals. Ratings also respond to political leadership. Following Block & Vaaler (2004) and Vaaler et al. (2006), Barta & Johnston (2018) find a higher probability of downgrades for left-wing leaders and after electoral victories of left parties, which they attribute to agencies pricing in the perceived risk of “negative policy surprises” early in order to keep ratings stable thereafter. This is consistent with their finding of no parallel reaction in yields, since markets can adjust instantaneously. Following this literature, I analyze the determinants of sovereign ratings on a large new dataset covering all three agencies and a range of specifications.

Predicting defaults. The stated purpose of ratings is to assess a borrower’s creditworthiness as accurately as possible. In S&P’s words, ratings are “forward-looking opinions about an issuer’s relative creditworthiness” that let investors “form a view on [...] the relative likelihood of whether an issuer may repay its debts on time and in full.”² The most natural way to test this accuracy, and in particular whether the subjective component adds anything useful to the objective one, is to ask how well each predicts actual defaults. I take up this test in section 4, following Vernazza & Nielsen (2015). The alternative of testing them against credit default swaps implied ratings (Gaillard 2014) is complicated by the high volatility of CDS relative to ratings, and I do not pursue it.³

2.3 Ratings and borrowing cost

We care about sovereign ratings because they influence borrowing cost. But do they really, and how? Ratings are frequently invoked in political discourse, and the fear of a downgrade appears to shape, or at least to justify, the actions of countries’ leaders (UNCTAD 2025).⁴

A substantial literature establishes that ratings are correlated with borrowing cost and argues the link is at least partly causal. Higher default risk should raise the interest rate demanded, so a higher rating, as a signal of lower default probability, should lower it. Beginning with Cantor & Packer (1996), who regress yield spreads on ratings and fundamentals in a 1995 cross-section, studies have consistently found a negative correlation, with rating changes often anticipated by spread movements. Gaillard (2012) similarly finds ratings and

²S&P, *Understanding Credit Ratings*, <https://www.spglobal.com/ratings/en/credit-ratings/about/understanding-credit-ratings> (visited 17.05.2026).

³As Gaillard (2012) notes, agencies appear to rate “through the cycle,” smoothing over short-term shifts in risk perception that CDS reflect immediately.

⁴Asked about further joint EU borrowing, German chancellor Friedrich Merz said: “[...] we would jeopardize the credit rating of the Federal Republic of Germany as well. We are currently still the only country in all of Europe that has a Triple A rating [...]. But I don’t want to, and I mustn’t, put that at risk.” (Podcast *Machtwechsel*, 18.02.2026.)

the JP Morgan EMBIG spread index to be interdependent, and [Afonso et al. \(2012\)](#) show that yields react significantly to rating-change announcements. In a first differences panel regression with monthly data of spreads on lagged spreads, ratings, VIX and FFR [Bussière & Ristiniemi \(2012\)](#) find a significant correlation between changes in spreads and ratings.

Two-way causality. Causality also runs the other way. Lower borrowing cost reduces debt-servicing expenditure, improves the fiscal balance and lowers the debt level, which should reduce default risk and thus raise ratings, lowering borrowing cost further. This feedback generates the pro-cyclicality of sovereign ratings, whereby shocks to default probability are amplified through ratings and can become self-fulfilling ([Tennant et al. 2020](#)). The phenomenon is best documented in sovereign debt crises where rating downgrades can support a negative spiral with higher interest rates ([Gärtner et al. 2011](#), [Griffith-Jones & Kraemer 2021](#)). However, it has also been argued that ratings in general are rather stable, more stable than other financial indicators, limiting their pro-cyclicality ([Gaillard 2014](#)).

Taking stock, both the apparent ease of reproducing ratings from a few fundamentals and the two-way causality between ratings and yields raise the question of how much ratings matter, and why. Answering it requires studying the channels through which ratings influence borrowing cost in more detail.

2.4 Why ratings matter

The studies above establish a correlation and potentially causal relation between ratings and borrowing cost, but they do not explore the channels through which ratings actually influence it. Following [UNCTAD \(2025\)](#) and [Barta \(2025\)](#), I suggest a framework distinguishing three channels: (1) an information channel, in which ratings convey additional information about a country's default probability; (2) a coordination channel, in which ratings serve as a focal point for investors' expectations; and (3) a certification channel, in which ratings determine whether and how a bond may be held or used. I discuss each in turn, set the first aside in light of the results above, treat the second only briefly, and study one dimension of the third, banking regulation, empirically.

Information. Traditionally, the role of credit rating agencies is seen as bridging the information gap between issuers and investors by signaling the quality of a bond, that is, the default probability of its issuer ([Marandola & Sinclair 2017](#)). There is evidence that ratings did convey such information historically: [Bernstein et al. \(2026\)](#) show that ratings carried valuable information about credit risk when they were introduced for railroad securities in the early twentieth century. The information channel is also the explanation most commonly invoked in the ratings literature (e.g., [Cantor & Packer 1996](#), [Afonso et al. 2012](#)).

However, much has changed since then. Today's investors in government bonds have

far more information about issuers and their default probability than buyers of a 1920s railroad bond did. As I show in this paper, following the empirical literature discussed above, sovereign ratings can be reproduced with high accuracy from a handful of publicly available fundamentals, and the remaining residual does not help predict defaults beyond a short horizon. If ratings add little information about default risk that is not already public, the information channel cannot be the main reason they matter for borrowing cost. This motivates turning to the other two channels.

Coordination. The second explanation, and the least explored in the economics literature, is the role of ratings as a coordination mechanism. The starting point is that a sovereign’s default probability is at least partly endogenous to beliefs about it: if investors expect default and demand higher interest rates, the higher borrowing cost makes the debt less sustainable and raises the actual probability of default, a self-fulfilling dynamic (Calvo 1988, Obstfeld 1996). Because of this, an investor’s optimal action depends on what other investors believe and do, so each must form expectations about others’ expectations, as in the classic Keynesian beauty contest (Allen et al. 2006). In such a setting there can be multiple consistent equilibria, a low-yield “good” equilibrium and a high-yield “bad” one and what selects between them is not fundamentals alone but a shared focal point. Ratings can serve as exactly this focal point: a widely observed, common signal that participants can coordinate their beliefs around (Tennant et al. 2020). As (Barta 2025, p. 1) puts it, ratings provide “an anchor for market participants’ expectations about ‘safe assets’,” thereby “manufacturing gravity.” Carlson & Hale (2005) formalize this in a global game theory model, showing how ratings as a coordination device can support and select among multiple equilibria.

Barta (2025) goes on to argue that a failure of ratings to predict a sovereign default is thus not driven by a failure to assess the fundamentals correctly but rather by the expansion and contraction of the liquidity cycle. The coordination channel deserves further attention in the economics literature. I do not test it directly here, focusing instead on the certification channel, but I return to it as a priority for future work in the conclusion.

Certification. Increasingly, attention has shifted to the certification role of ratings, which stems from their use in (1) banking regulation, (2) central-bank collateral frameworks, (3) the portfolio rules of institutional investors, and (4) repo markets (Griffith-Jones & Kraemer 2021, UNCTAD 2025).

Some authors describe an over-reliance on ratings in rules and regulation (Masciandaro 2011) or call for public rating agencies (UNCTAD 2025). While the literature exploring the certification channel in economics is still relatively small, the idea was already popularized almost three decades ago in the legal literature by (Partnoy 1999, p. 683): “I argue that credit ratings are valuable, not because they contain valuable information, but because they

grant issuers ‘regulatory licenses.’ In simple terms, a good rating entitles the issuer (and the investors in a particular issue) to certain advantages related to regulation.” This advantage takes two forms, often combined: only bonds above a rating threshold are eligible to be held or used in a given context, or different haircuts apply depending on the rating. The mechanism is then simple: a rule makes a rating confer an advantage, which raises demand for the bond and thus its price, lowering the yield and the issuing sovereign’s borrowing cost.

I focus on the certification channel, and specifically on how banking regulation shapes the relationship between ratings and government bond yields. Before turning to banking regulation, I briefly discuss the parallel case of central-bank collateral rules.

ECB collateral rules. Lending to banks against collateral such as government bonds is a central tool of monetary policy. During the creation of the European Monetary Union the criteria for collateral eligibility were intensely debated, and in the end all member states’ bonds were effectively accepted unconditionally, contributing to the well-known compression of euro-area yields from 1999 onward ([van’t Klooster 2023](#)). This changed in July 2005, when the ECB made eligibility conditional on private credit ratings and introduced haircuts, in what [van’t Klooster \(2023\)](#) calls a turn to a “market-based approach.” When during the euro crisis the Greek rating fell below the eligibility threshold, the ECB granted special exceptions, using them as bargaining instruments ([van’t Klooster 2023](#)). With a two-way fixed-effects panel, [Schuster \(2023\)](#) shows that the widening of the spread between euro-area periphery and core countries coincided with the announcement of this change to the collateral framework. [de Boer et al. \(2025\)](#) likewise stress the role of ECB collateral rules in shaping sovereign spreads, pointing to the large discretion the ECB exercises over them and contrasting this with its more visible interventions through quantitative easing, while noting that spreads might be considerably smaller absent the differential treatment by rating.

2.5 The role of banking regulation

“Well-intentioned but perhaps shortsighted new regulatory requirements implemented in the aftermath of the financial crisis have significantly increased the mandated safe asset holdings of financial institutions, especially banks and insurance companies, under the Basel III criteria currently being phased-in.” ([Caballero et al. 2017](#), p. 42)

While often alluded to such as in the above quote, it is less often studied in detail how Basel III increased global demand for safe assets, and specifically for highly-rated sovereign bonds. Banking regulation, through minimum capital requirements and liquidity rules, shapes which assets banks hold and in what quantity, and thus the demand for and price of those assets. I briefly summarize the Basel framework, its implementation, and the relevant literature.

The Basel framework. Tooze (2018) situates the Basel Accords in the context of the loosening of capital controls after Bretton Woods, which intensified international banking competition and produced a race to the bottom in capital requirements that threatened financial stability. In response, the United States and the United Kingdom agreed in 1986 on the need for a common international baseline, out of which the first Basel Accord emerged in 1988. It set a minimum capital ratio of 8% of assets, risk-weighted on institutional criteria such as OECD membership or domestic-currency funding for sovereign bonds (BCBS 1988). The Basel Accords⁵ are regulatory packages agreed by the Basel Committee on Banking Supervision (BCBS), whose members account for 90% of global banking assets, with national implementation monitored by the Committee’s Regulatory Consistency Assessment Programme.⁶ The Financial Stability Institute (2015) documents implementation in non-member countries, which is more limited given the rules’ complexity (Jones & Zeitz 2017).⁷ Basel II followed in 2004, keeping the 8% ratio but changing the risk-weighting methodology to rely more on banks’ internal models and on private credit ratings, with risk weights on government bonds depending on their rating (BCBS 2004). Countries remained free to assign lower risk weights to domestic government bonds funded in domestic currency, regardless of rating, and to let their banks extend this treatment to other such sovereigns. For a rating to be used in regulation, it must be issued by a nationally recognized rating agency. In practice: the Big Three account for around 99% of sovereign ratings, so the regulation-relevant rating is effectively always one of theirs (Malewska 2021).

Basel III and its mechanism. After the 2008 financial crisis, the standards were updated again with Basel III in 2010, which raised the minimum capital requirement to 10.5% and improved its quality, as well as introducing two liquidity requirements, the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR) (BCBS 2010a;b). Some rules were further revised later, resulting in Basel III.1 in 2017 (BCBS 2017); I focus on Basel III.

Two changes plausibly raised the importance of high ratings for yields. The increase in minimum capital relative to rating-based risk-weighted assets made it more costly for banks to hold lower-rated (higher-risk-weight) bonds, which may have reduced their demand for them and widened spreads across rating groups. More directly, the LCR requires banks to hold a stock of high-quality liquid assets (HQLA) larger than the 30-day net cash outflows in a stress scenario. HQLA consist mainly of central-bank reserves and highly-rated sovereign bonds (BCBS 2022), so the rule raises bank demand for high-rated sovereigns and should widen the spread between high- and low-rated countries. The precise specification

⁵Basel I, II, III and III.1, also sometimes referred to as Basel III Endgame or Basel IV.

⁶RCAP Basel III Implementation Dashboard https://www.bis.org/bcbs/implementation/rcap_reports.htm.

⁷All countries studied in the LP-DiD implemented the Basel III reforms, see appendix section A.10.

is described in the respective methodology section.

Literature and evidence. Most work on the announcement and implementation of Basel III has examined consequences for banks rather than for sovereigns, studying stock-price reactions (Bruno et al. 2018), liquidity creation (Roberts et al. 2018), creditors’ beliefs via CDS (Simion et al. 2024), and bank risk and profitability (Krettek 2025).

Literature interested in sovereign debt has criticized its preferential treatment, which they argue leads banks to under-price risk from sovereign exposure (Kirschenmann et al. 2020, Hülsewig & Steinbach 2024), with high domestic exposure feeding a “sovereign-bank diabolic loop” (Brunnermeier et al. 2016).

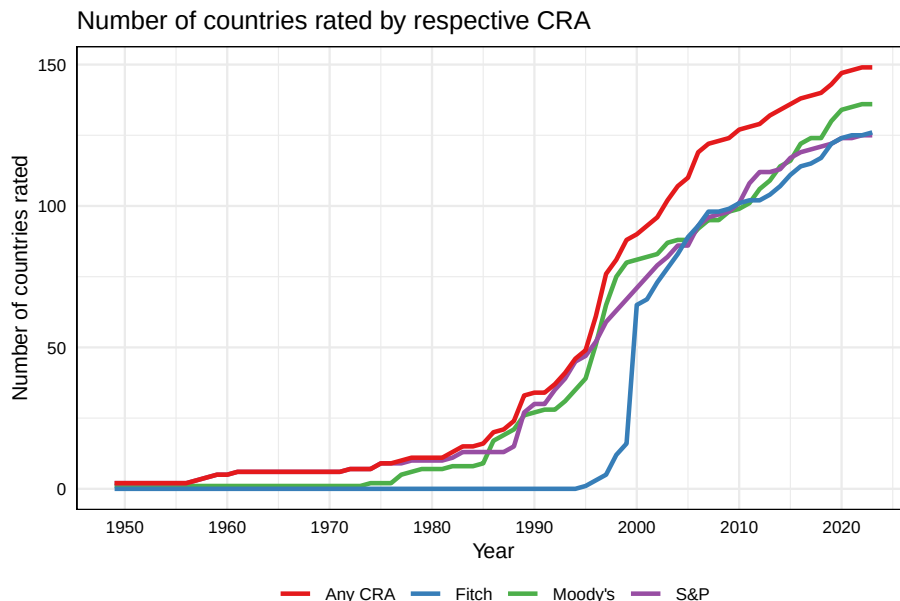
Evaluating the reforms, the BCBS (2022) finds that banks raised capital ratios mainly by increasing capital rather than reducing risk-weighted assets, and that they raised HQLA holdings. This makes it plausible that Basel III affected the rating-yield relationship chiefly through the LCR raising demand for high-rated sovereigns, rather than through reduced demand for low-rated bonds via the capital requirements. Consistent with this, de Bandt & Chahad (2016) conclude from studying a DSGE model that banks have an incentive to hold more highly-rated sovereign bonds.

3 Data

My main dataset consists of annual data on ratings, fundamentals, and debt distress events and is used to assess the determinants of sovereign ratings and compare the objective to the subjective component’s ability to predict default events. I also use it to show the correlation between effective interest rates and ratings, controlling for fundamentals. For this purpose I add the annual average of some financial variables from the monthly dataset. The second dataset is monthly and includes ratings, yields, the VIX (a measure for volatility in the US stock market as a proxy for risk aversion of investors) and the federal funds rate (FFR) and annual data on debt holding structure as well as the fundamentals mentioned earlier. It is used to study the correlation between ratings and yields and to assess the effect of changes in banking regulation.

Ratings. The rating data I use are long-term foreign currency sovereign issuer credit ratings (“ratings”) by Fitch, Moody’s, and Standard & Poor’s. I web-scrape rating action data from *The Global Economy* and *Trading Economics*, two publicly available sources. The alphanumeric ratings from AAA to D are converted to numeric ratings from 21 to 1, one unit per rating notch, as is standard in the literature (see table A1 in the appendix). From the rating actions I construct an unbalanced monthly panel with the rating for 154 countries from 1948 to 2024, taking the end of period rating in case of multiple ratings in a given period, keeping 143 countries in the conditionally balanced panel with fundamentals.

While only a handful of countries are rated in the first decades after WWII, the number of countries rated significantly increases throughout the 1980s and 1990s, as shown in figure 1. For my main ratings regression I use the average of all ratings available for a country in a given period. The rating relevant for regulation (rrr) in the case of two ratings being available is the lower rating and for three or more being available it is the second-highest rating (BCBS 2004, p. 36). Most countries are rated by all Big Three, where the rrr diverges on average by only 0.005 notches from the average rating.

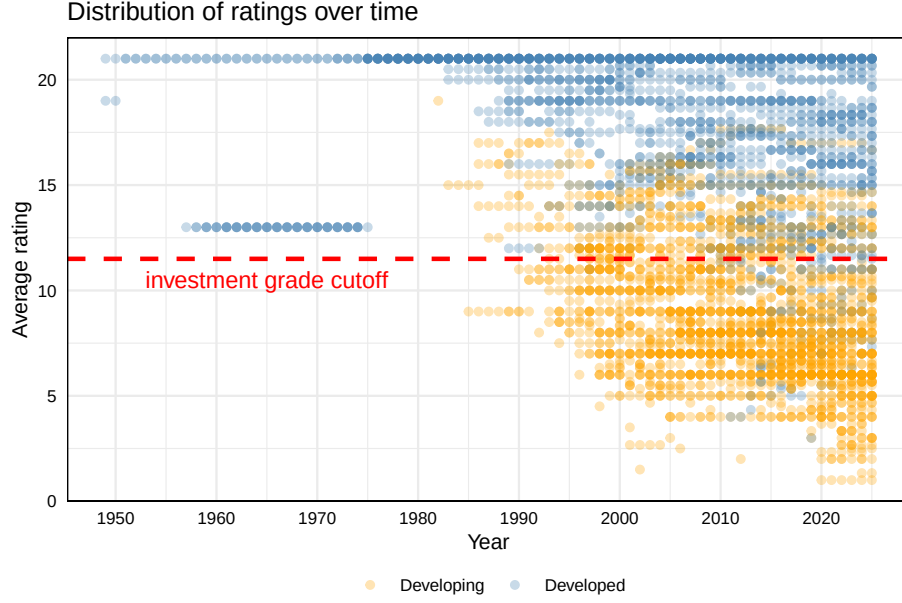


Note: The number of countries rated was very low during the Bretton Woods era and increased significantly from the 1980s on. Most countries are rated by all of the Big Three CRAs.

Figure 1. Number of countries rated.

Figure 2 shows the distribution of ratings over time. Every dot represents the rating of one country in a given year. Again, the increase in the number of countries rated over the 1980s and 1990s becomes apparent, as well as the wide distribution of ratings. Developing countries (orange) in general receive much lower ratings than developed countries (blue). Almost no developed country receives a rating below the investment grade cutoff, a common threshold for inclusion in institutional investors' portfolios (dotted red line).

Fundamentals. For the economic fundamentals I rely on the data of the [World Inequality Database \(2026\)](#) and [Nieves & Sodano \(2024\)](#) for external debt. For the political indicators I use the World Bank's Worldwide Governance Indicators ([World Bank 2025](#)). The default history indicator is constructed to weigh recent defaults more than ones long past. It takes the value 1 in years of default and decreases exponentially thereafter [Asonuma & Trebesch \(2016\)](#) (see table A5 for default events). For an overview of the variables construction and



Note: Every dot represents the average rating by the Fitch, Moody's, and S&P of one country in a given year. Developed countries usually receive much higher ratings than developing countries. The former are almost always above the investment grade cutoff, a common threshold for institutional investors.

Figure 2. Distribution of ratings over time.

sources see table A2 in the appendix.

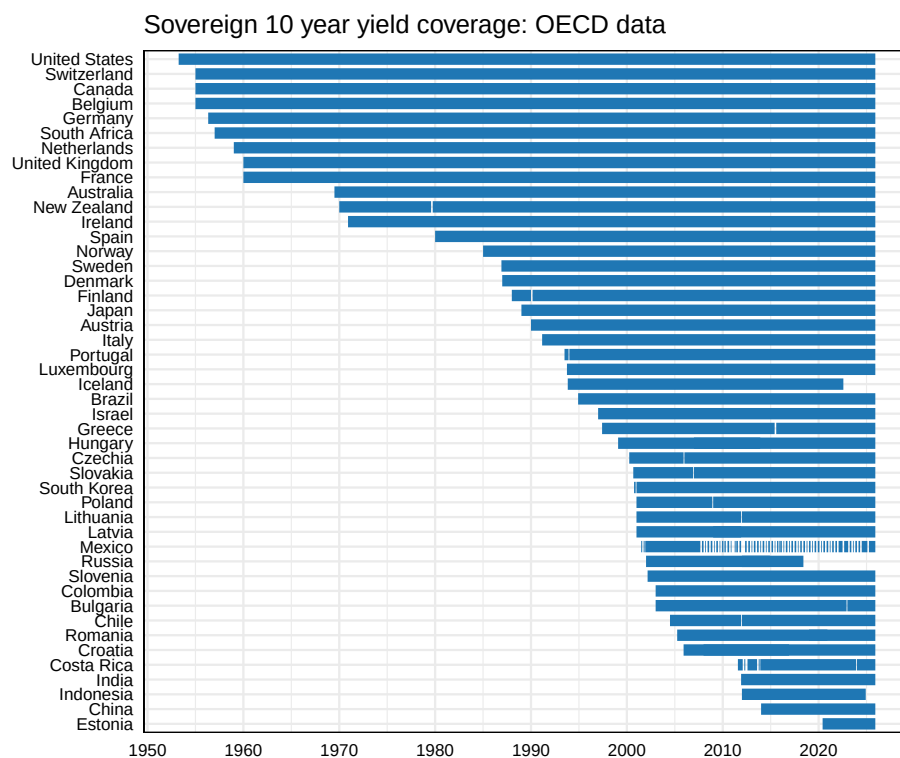
The dataset for the ratings regressions is a sample of 143 countries that is balanced conditional on the country being rated in a given year. That is, I use all countries for whom I have complete data for my baseline regression variables in all years that said country is rated by at least one of the three CRAs. Table A3 in the appendix displays the average as well as the min and max of each variable used in the ratings regression. If I had restricted the sample to countries who are already rated in 1996 I would obtain a sample of 61 countries, mainly more developed ones because they were rated earlier. However, changing the sample to this strictly balanced one does not substantially change my results relative to the conditionally balanced sample (see appendix table A6).

Interest rates. The interest rates data I use are constructed from the IMF's Public Finances in Modern History Database (Mauro et al. 2015). I calculate the effective interest rate countries had to pay on their outstanding debt by year as interest paid on public debt as a share of GDP divided by the average of gross public debt as a share of GDP from the current and the last year.

$$\text{interest rate}_{i,t} = \frac{\text{interest}_{i,t}/\text{GDP}_{i,t}}{\frac{1}{2} (\text{debt}_{i,t}/\text{GDP}_{i,t} + \text{debt}_{i,t-1}/\text{GDP}_{i,t-1})}$$

As the structure of borrowing sources and the timing of borrowing vary a lot between countries, the different determinants of this effective interest rate also vary. It also might include interest paid on concessional debt from international institutions like the IMF, so the comparability between countries is somewhat limited in terms of the “market response to ratings”. However, it is the interest rate that is actually effective in government’s expenses. I also study an alternative effective interest rate only for market based funding as a robustness (see appendix A3). Another important limitation is that there might be other reasons for low effective interest rates in a given country, such as debt moratoria or restructurings, as well as currency and term structure effects, and grace periods.

Yields. For the second part of the analysis, the study of the relationship of ratings and countries borrowing cost and how banking regulation affects that relationship, I focus on 10 year government bond yields. They are the benchmark for the current marginal borrowing cost of a sovereign on the international financial market. My main source for yield data is the [OECD \(2026\)](#), which covers yields for 46 countries. The coverage varies widely between countries. However, for most countries the key period I am interested in from 2005-2020 is covered. I display the coverage in figure 3. I will refer to this yield data sample as the OECD yield data.



Note: This shows the coverage of monthly 10 year yield data by country in the OECD data.

Figure 3. OECD yield data coverage.

For most developing countries there are no long-run 10 year government bond yield series available, because of the limited depth and width of their bond market. So, the best data I could obtain are yields on individual bonds. The financial data service Refinitiv provides daily yield data for all bonds that have not matured to date. That means effectively that the only yield I can obtain for a country in 2005 is that for a bond with at least $(2026 - 2005 =) 21$ years until maturity. Thus, there are only very few countries for which I have data for before 2010 and in these cases it is always the yield of a bond with a time to maturity larger than 10 years. This makes the data harder to compare to the 10 year yield index I use for other countries. I try to make the best use of the data by taking what is available and where possible extrapolate and interpolate between multiple bonds. E.g., if there is one bond with 8 years to maturity and one with 15 on a given date I draw a line between the value at 10 years. The coverage of the dataset I compile with this method is displayed in figure 4. I will refer to this yield data sample as that for emerging markets and developing economies (EMDEs). The quality and coverage of yield data in this sample becomes better over time. From 2009 on I have a dozen countries, and more than 30 from 2020 on.

Debt holding structure. For calibrating the exposure of a country to changes in banking regulation I am interested in the share of its debt held by domestic and by foreign banks, plotted in figure 5. The holding structure of sovereign debt is surprisingly opaque given the amount of discipline that the bondholders are able to instill in the leaders of sovereign countries (Arbogast 2020, Fang et al. 2025). The most comprehensive database for the aggregate counter-party sectors for government debt is provided by the IMF’s Sovereign Debt Investor Base dataset (Arslanalp & Tsuda 2012; 2014). They provide an annual breakdown by domestic central bank, domestic banks, domestic non-banks, foreign official sector, foreign banks, and foreign non-banks from 1989 to 2024 for 24 advanced economies and 85 emerging economies.

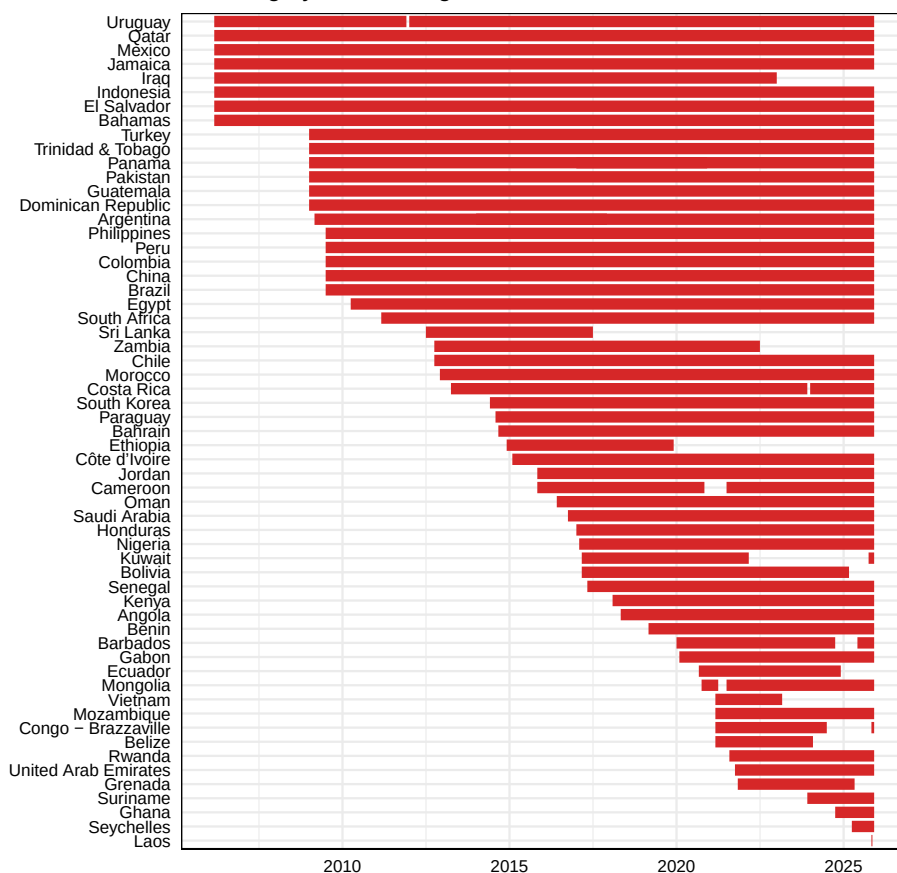
4 Subjectivity in ratings

4.1 Methodology - Determinants of ratings

As discussed before, ratings can be very well approximated with already a small number of economic and political fundamentals. I use an OLS, an ordered logit and an ordered probit model outlined below to show this for my annual conditionally balanced sample of 143 sovereigns. OLS used to dominate in earlier work and has the advantage of clearer interpretability of coefficient size, while the ordered logit and probit models dominate in recent work and are better suited to capture the ordinal structure of the dependent variable.

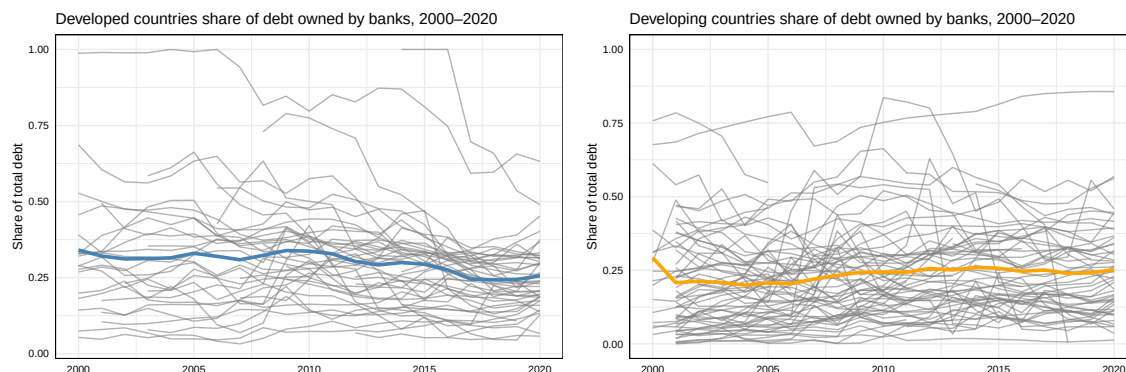
The baseline OLS regression is:

Sovereign yield coverage for EMDE: Refinitiv data



Note: This shows the coverage of monthly yield data by country in the EMDE data. The yield data for these countries is constructed from individual bond yield data from Refinitiv. The yield is taken from the bond with a time to maturity closest to 10 years and at least 5 years. Where several bonds are available I interpolate.

Figure 4. EMDE yield data coverage.



Note: Displaying the share of government debt held by domestic and foreign banks together by country and year, from the IMF Sovereign Debt Investors base dataset, with the average in blue and orange, respectively. Developed countries (left), developing countries (right).

Figure 5. Share of government debt held by domestic and foreign banks.

$$\text{rating}_{i,t} = \alpha + \delta_t + \beta' X_{i,t} + \varepsilon_{i,t} \quad (1)$$

I use the average rating across agencies by country and year. α is the intercept. δ_t captures year fixed effects. β' is a vector of the coefficients for my fundamentals $X_{i,t}$ and $\varepsilon_{i,t}$ is the error term. Including country fixed effects in the model somewhat increases its accuracy, which means that there is persistence in countries' credit ratings beyond fundamentals, as I show in the robustness checks (table A8). However, it obscures the question we are interested in, which is precisely what justifies higher ratings for some countries than for others. Including country fixed effects would lead to making no use of the cross-sectional variation. The coefficients' meaning would be reduced to how much a higher GDP per capita is correlated with a higher rating in a given country instead of the general effect of a higher GDP per capita on ratings. Not using country fixed effects allows me to calculate how well ratings can be explained by a small number of fundamentals *in general*.

The linear model might predict ratings outside the ordinal scale with a maximum of 21 (AAA) and a minimum of 1 (C or D) which I therefore exclude from further analysis. To check the robustness of the OLS estimates, I also run a pooled ordered logit and a pooled ordered probit model that are more adapted to the ordinal ratings scale.

$$\text{rating}_{i,t}^* = \beta' X_{i,t} + \delta_t + \varepsilon_{i,t} \quad (2)$$

$$\text{rating}_{i,t} = \begin{cases} 1, & \text{if } \text{rating}_{i,t}^* \leq \mu_1 \\ 2, & \text{if } \mu_1 < \text{rating}_{i,t}^* \leq \mu_2 \\ \vdots & \\ J, & \text{if } \mu_{J-1} < \text{rating}_{i,t}^*, \end{cases} \quad (3)$$

where $\text{rating}_{i,t}^*$ is a latent creditworthiness index, μ_j are estimated cut-points and $\varepsilon_{i,t}$ follows a logistic distribution in the ordered logit and a standard normal distribution in the ordered probit.

4.2 Methodology - Predictions

Having shown that ratings are largely reproducible from fundamentals, I test whether the residual carries any information useful for assessing creditworthiness. The natural test, as motivated in the literature section, is how well the objective and subjective components predict actual defaults. I follow [Vernazza & Nielsen \(2015\)](#), who regress a default dummy on the lagged fitted value of a rating regression (the objective component) and its residual (the subjective component) in a probit model. [De Moor et al. \(2018\)](#) apply the same logic with their explicitly estimated subjective component and find it useful at horizons up to

five years; [Bussière & Ristiniemi \(2012\)](#) find that ratings carry no predictive power for debt-distress events beyond fundamentals two years ahead. My contribution is to apply this test to a substantially larger panel.

I regress the default dummy on the lagged values of the objective and the subjective component at horizons of one to five years in this pooled probit model:

$$\begin{aligned} \text{default}_{i,t}^* &= \alpha + \beta_1(\text{objective}_{i,t-\tau}) + \beta_2(\text{subjective}_{i,t-\tau}) + \varepsilon_{i,t} \\ \text{default}_{i,t} &= \mathbf{1}[\text{default}_{i,t}^* > 0]; \quad i = 1, \dots, N; \quad t = 1, \dots, T; \quad \tau \in \{1, 2, 3, 4, 5\}, \end{aligned} \quad (4)$$

A caveat is the small number of default events in the sample — 26 episodes in total, listed in table A5 in the appendix. This rarity is inherent to the object of study: sovereign defaults are genuinely uncommon events, which is precisely why predicting them is hard and doing it well, valuable. While the small count limits statistical power, defaults are the outcome that ratings are meant to predict, so testing the components directly against realized defaults remains the most appropriate test of their informational content.

4.3 Results - Determinants of ratings

The rating of a country is largely determined by just a handful of economic and political indicators. Table A7 in the appendix displays the results for the specification chosen by [Gaillard \(2012\)](#), [Afonso et al. \(2011\)](#), [Vernazza & Nielsen \(2015\)](#), [De Moor et al. \(2018\)](#), [Tennant et al. \(2020\)](#) and my baseline specification. The coefficients' signs go in the same expected direction across specifications, mostly with similar magnitudes and they all show similar R^2 , explaining around 80-90% of the actual average rating. I choose a baseline specification that captures the consensus in the literature using (expected sign in parentheses): logged GDP per capita (+), the average of GDP growth over the last 10 years (+), the current account as share of GDP (+), external debt as a share of GDP (-), default history (-), government effectiveness (+) and the rule of law (+).

Table 1 displays the coefficients across OLS, pooled ordered logit and probit specifications all yielding relatively similar results. Approximately 80-85% of sovereign ratings can be explained by a handful of objective and quantifiable economic and political indicators. This means that around 15% do not correspond to any measurable indicator. Thus, there is room for bias. As discussed in the methodology I include year fixed effects but no country fixed effects in the baseline. They do improve the R^2 to up to 95% but the regression then no longer captures the determinants of ratings *in general*. In table A8 in the appendix I show the baseline regression across different fixed effects specifications. Table A9 in the appendix shows the OLS estimates for the determinants of individual CRAs' ratings compared to the average. The coefficients for fundamentals are persistent across agencies.

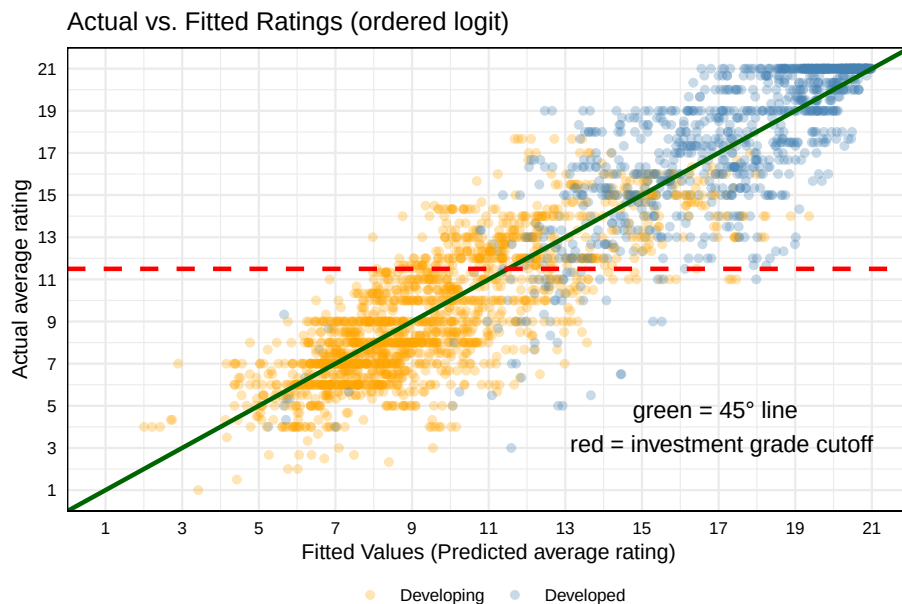
	OLS	Ordered Logit	Ordered Probit
log GDP per capita	1.081*** (0.187)	0.657*** (0.046)	0.355*** (0.026)
GDP growth 10y avg	0.047* (0.026)	0.035*** (0.007)	0.023*** (0.004)
CA / GDP	3.501*** (0.943)	4.187*** (0.340)	2.263*** (0.182)
External debt / GDP	-3.407*** (0.546)	-2.975*** (0.177)	-1.751*** (0.100)
Default History	-2.725*** (0.756)	-2.296*** (0.226)	-1.272*** (0.116)
Government Effectiveness	2.135*** (0.540)	2.220*** (0.139)	1.216*** (0.078)
Rule of Law	1.328*** (0.486)	0.865*** (0.122)	0.547*** (0.069)
Num. Obs.	2809	2809	2809
R ²	0.841		

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Note: Displaying the OLS, ordered logit and ordered probit regression coefficients of the average rating regressed on the baseline fundamentals including year fixed effects. Using the conditionally balanced annual dataset of 143 countries over 25 years.

Table 1. Ratings determinants. OLS, ordered logit and ordered probit regressions.

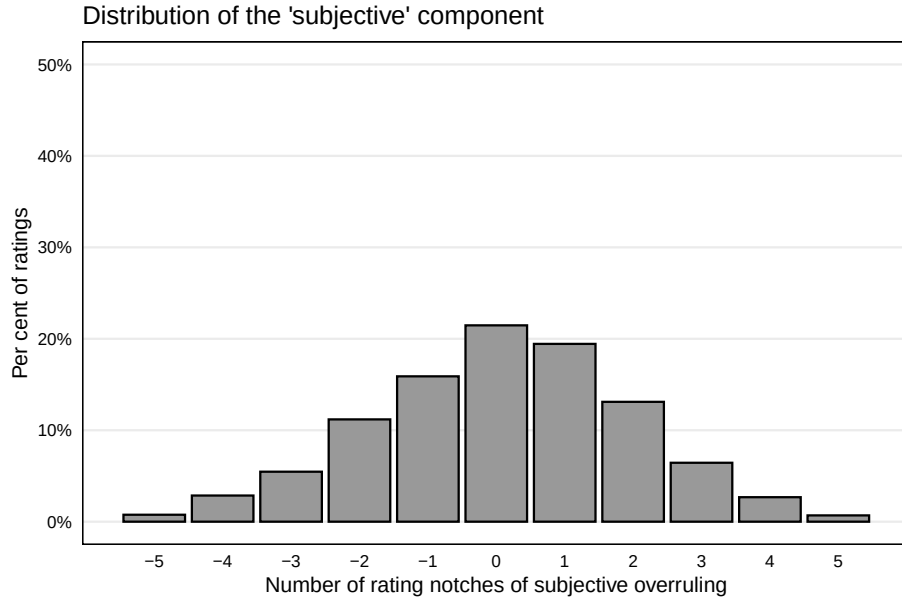
Plotting the actual rating assigned by the rating agencies against the fitted values from the ordered logit regression (the “objective” rating component) yields the pattern displayed in figure 6. Figure A1 in the appendix shows the same pattern for the fitted values from the OLS regression. Low-rated countries are on average rated too low compared to the objective fitted rating while high-rated countries are rated too high. The low-rated countries have more points below the green 45 degree line, while for the higher-rated countries more observations are above the line. Countries below the investment grade cutoff receive on average a rating 0.7 notches too low, while those above the threshold receive a rating 0.5 notches too high. This penalizes developing countries (in orange) because their ratings are generally lower and benefits rich countries (in blue) because they generally have a higher rating.



Note: Plotting the fitted (“objective”) ratings from the ordered logit regression of average ratings on fundamentals against the actual ratings. Below the green 45° line, actual ratings are “too low” given the fundamentals, while above they are “too high”. This benefits developed countries, who typically get a higher rating and penalizes developing countries.

Figure 6. Fitted (“objective”) ratings against the actual ratings.

As described in the methodology I call the fitted values from the baseline ordered logit regression the objective part of the rating and the residual the subjective part. It is important to note, however, that the residual cannot cleanly measure the rating committees’ judgment, but groups it together with measurement error and other fundamentals that I do not include. The latter should play a limited role, however, as the residual size is largely insensitive to including more fundamentals (see table A7 in the appendix). The residuals are in general roughly symmetrically distributed between positive and negative over-rulings of the objective part of the rating as shown in figure 7. In the appendix I show the residual frequency including country fixed effects, this leads substantially less over-rulings (see figure A2).



Note: The figure shows the frequency of rounded residual values (“subjective component”) from the baseline logit regression. Roughly 20% of residuals are around 0, many are ± 1 or 2 rating notches, almost no residuals are larger than ± 4 .

Figure 7. Distribution of subjective component.

4.4 Results - Predictions

Using the lagged subjective and objective part of ratings to predict default events at different horizons from 1 to 5 years, I find that the objective part is useful to predict default at all horizons (see table 2). A higher objective rating component is strongly correlated with a lower probability of default. The correlation gets somewhat weaker over time. The subjective part has a statistically significant correlation with defaults only for the one year lag. At 2 years the coefficient is only significant at the 10% level and thereafter the coefficients are not significant at all. Predicting defaults with lagged actual ratings does not increase the size of coefficients compared to the lagged objective rating (see table A10 in the appendix).

	1 year	2 years	3 years	4 years	5 years
Objective (lagged)	-0.486*** (0.107)	-0.230*** (0.070)	-0.153*** (0.046)	-0.123*** (0.037)	-0.110*** (0.034)
Subjective (lagged)	-0.332*** (0.093)	-0.155* (0.090)	-0.095 (0.091)	-0.096 (0.093)	-0.104 (0.084)
Num. Obs.	2,666	2,527	2,392	2,258	2,125
Pseudo R ²	0.370	0.210	0.143	0.116	0.107

*p<0.1; **p<0.05; ***p<0.01. Standard errors clustered by country in parentheses.

Note: Coefficients from the probit regression of default dummy on the objective (fitted value from ordered logit regression) and subjective (residual) component of ratings, lagged by 1 to 5 years respectively.

Table 2. Predicting defaults at horizons 1 to 5 years.

5 Relationship of ratings and borrowing cost

To study the relationship between borrowing cost and ratings, I first plot the average borrowing cost in terms of effective interest rates and of 10 year bond yields for each broad rating group and by development status. Then, I estimate the correlation controlling for fundamentals in panel regressions.

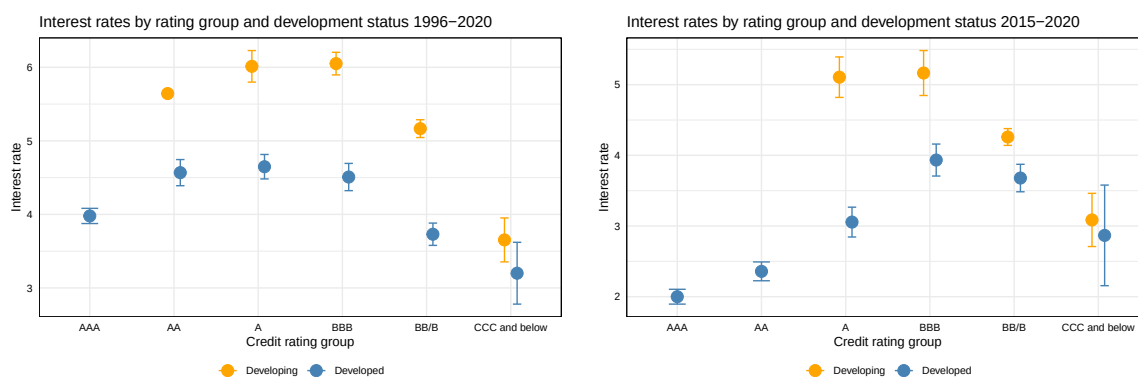
Correlation of ratings and effective interest rates. Figure 8 shows the average effective interest rate by rating group and development status in the conditionally balanced annual sample for the whole period 1996-2020 and for the 2015-2020 sub-period. At the higher end of the rating scale, there seems to be a correlation in the expected direction while for very low-rated countries we see surprisingly low effective interest rates. In the sub-period plot this reversal at the bottom seems to be a bit less strong, although still apparent.

This surprising pattern at the bottom has several possible explanations, most linked to the complex nature of the effective interest rate’s determinants. First, the rating is not the only determinant of effective interest rates and controlling for fundamentals there is a positive correlation between lower interest rates and higher ratings. Second, the effective interest rate might be artificially low for very low-rated countries because they receive help from multilateral lenders such as the IMF. I construct an effective interest rate on different forms of borrowing from the World Bank’s International Debt Statistics dataset. The effective interest rate on market based borrowing is indeed higher than that on bilateral and multilateral lending. Yet, the pattern for the correlation with ratings remains, with puzzlingly low effective interest rates for the lowest rating group (see appendix table A3). Third, the low effective rates for very low-rated countries could be explained by them postponing or restructuring debt repayments, grace periods or maturity and currency effects, leading to the surprisingly low effective interest rates today.

Another interesting pattern is that in the same rating group, developing countries on

average seem to face higher effective interest rates than developed countries. As I show in the panel regressions, not only is being a developing country positively correlated with higher interest rates, but the correlation of a worse rating and higher interest rates is also stronger for developing than for rich countries.

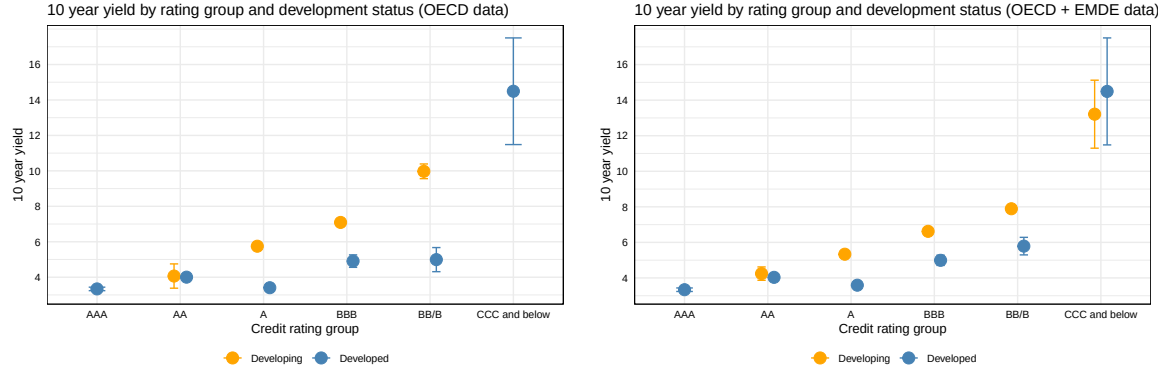
There seems to be an extra benefit to being a developed country that explains the lower effective interest rates and yields given a similar rating, also beyond fundamentals. The two main explanations for this phenomenon in the literature are (1) the “original sin”, i.e., the larger currency risk for emerging economies borrowing in foreign currency (Eichengreen & Hausmann 1999) and (2) the liquidity premia for developing countries against developed countries, who typically have deeper bond markets. This might be almost as important as default risk captured by ratings (Hund & Lesmond 2008).



Note: Effective interest rate computed as the interest payments divided by the debt stock, averaged over countries in the same rating group and with the same development status by year on the conditionally balanced panel. Left: 1996–2020. Right: 2015–2020. Excluding China which has a AA rating and puzzling low effective interest rates in some years (shown in appendix).

Figure 8. Effective interest rate by rating group and development status.

Correlation of ratings and yields. Figure 9 shows the average 10 year yield by rating group and development status. The left panel only shows countries with OECD 10 year yield data while the right also includes countries for whom I only have yield data constructed from individual bond yields. Including this data reduces the spread for developing countries, as the yield data I have for them is typically constructed from longer maturities (see explanation in the data section). As expected, both panels show the same pattern of higher yields for worse ratings. As the yield better captures the current marginal borrowing cost a country faces on the market and is not distorted by concessional rates from multilateral institutions, it makes sense that it is more cleanly correlated with ratings. As I show in the panel regressions, this pattern is also stable to controlling for a number of fundamentals. Again, within each rating group, the average borrowing cost of developing countries is higher than that of rich countries, which I also show in the panel regressions.



Note: 10 year yields by rating group and development status 1996-2020 (Left: only countries with OECD 10 year yield data, Right: Including all countries, also those with yield data constructed from individual bond yields).

Figure 9. Yields by rating group and development status.

5.1 Methodology - Panel regression

To analyze the relationship of sovereigns' ratings and borrowing costs in more detail, I estimate an OLS panel regression of both yields ($y_{i,t}$) and effective interest rates ($ir_{i,t}$) on ratings, controlling for the same fundamentals ($X_{i,t}$) that also determine the rating and including year fixed effects. This allows me to see how ratings are correlated with borrowing cost, beyond what is explained by fundamentals — which is exactly what is puzzling if the subjective part adds no useful information on default probability and what I suggest is explained by the coordination and certification channel.

The baseline specification for my OLS panel regression is:

$$y_{i,t} = \alpha + \beta rating_{i,t} + \gamma' X_{i,t} + \delta_t + \varepsilon_{i,t} \quad (5)$$

Where α is the intercept, β is the correlation of a one notch higher rating with a countries' borrowing cost in a given year, ceteris paribus. γ' captures the coefficient estimates for the correlation of fundamentals with borrowing cost and δ_t captures the year fixed effects.

I then also estimate the regression when only including ratings and when including only the fundamentals, as well as individually for developing and developed countries to capture the different correlations between borrowing cost and ratings observed graphically. In the appendix, I also show the results when including country fixed effects and when including the total debt share.

5.2 Results - Panel regression with IR.

The panel regression of effective interest rates on ratings and fundamentals produces the results presented in table 3. Across specifications including controls, a one-notch-higher rating is associated with effective interest rates lower by 0.15 to 0.30 percentage points.

Absent controls and year fixed effects only a very small share of effective interest rates is explained by ratings alone. Adding fundamentals substantially increases R^2 , although it is still moderate at only 20 to 25%. This points to a substantial number of other determinants of countries effective interest rates, which is confirmed by an increase of R^2 to over 70% when including country fixed effects (see appendix table A11). But again, as for the determinants of ratings I am interested in how much of the cross country variation in borrowing cost can be explained by ratings and not only the within country variation. Including country fixed effects leads to a somewhat smaller overall coefficient for ratings in model 3 of -0.16 instead of -0.29 (see appendix table A11). Splitting the sample between developed and developing countries, we see that the correlation of effective interest rates with ratings is larger for developing countries, as already observed in the descriptive statistics shown before.

The coefficients for the different fundamentals show some surprising correlations. The main explanation for them might be that there are many other determinants of effective interest rates and their complex nature. And as seen from the with / without country fixed effects comparison, there is a lot of country-specific persistence beyond ratings and fundamentals. As discussed before, effective interest rates in a given year are the result of different interest rates on different forms of lending at different points in time. The counterintuitive coefficients might be explained by some countries with very unfavorable fundamentals negotiating debt restructurings or moratoria that lead to artificially low effective interest rates today. This would explain why default history is correlated negatively with interest rates and why government effectiveness, log GDP per capita (in developing countries) and GDP growth (in developed countries) are correlated positively with interest rates.

Also, the external debt to GDP ratio is consistently negatively correlated with interest rates. To investigate this I estimate a model including also the total debt to GDP ratio. The regression estimates are displayed in table A11. In these specifications while the correlation of debt and interest rates is positive, as expected, that for external debt is even stronger negatively correlated. This points to the fact that there might be other unobserved characteristics that are both positively correlated with lower interest rates and with higher external debt such as general market confidence, but also, being more western aligned, having access to swap lines, etc.

The bottom line of this analysis is that there are many determinants of effective interest rates, high country-specific persistence and in all cases, higher ratings are negatively correlated with interest rates.

5.3 Results - Panel regression with yields.

Estimating the same regressions for 10 year yields instead of effective interest rates, we expect much larger correlation of the dependent variable with ratings and larger R^2 , which we indeed both observe in the coefficient estimates in table 4. In the baseline regression

	<i>Dependent variable:</i>				
	Interest rate				
	(1)	(2)	(3)	(4)	(5)
Average rating	−0.040*** (0.012)		−0.291*** (0.027)	−0.255*** (0.047)	−0.172*** (0.028)
Log GDP per capita		0.272*** (0.084)	0.570*** (0.087)	0.992*** (0.118)	−0.915*** (0.193)
GDP growth 10y avg		−0.006 (0.016)	0.004 (0.016)	−0.032 (0.021)	0.061*** (0.020)
CA over GDP		−2.784*** (0.512)	−1.518*** (0.514)	−0.530 (1.040)	−0.580 (0.472)
External debt over GDP		−1.391*** (0.282)	−2.343*** (0.289)	−3.109*** (0.635)	−0.940*** (0.255)
Default History		−0.769** (0.344)	−1.678*** (0.346)	−1.577*** (0.429)	−1.192 (0.803)
Government Effectiveness		0.131 (0.233)	0.831*** (0.236)	0.584* (0.345)	0.922*** (0.278)
Rule of Law		−0.654*** (0.207)	−0.336 (0.205)	0.197 (0.283)	0.190 (0.282)
Sample	Full	Full	Full	Developing	Developed
Observations	2,442	2,442	2,442	1,467	975
R ²	0.004	0.190	0.227	0.213	0.404

*p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses.

Note: Panel OLS regression of the effective interest rate on ratings and fundamentals including year fixed effects. Model 4 only developing countries, model 5 only developed countries.

Table 3. OLS regression of effective interest rates on average rating and fundamentals.

model 3, a one notch increase in ratings is associated with a decrease in yields by 40 basis points controlling for fundamentals. The ratings and fundamentals together explain about 70% of the observed 10 year yield which increases to almost 90% when including country fixed effects (see table A12 in the appendix). Again, the correlation of ratings and yields seems to be stronger for developing countries than for developed countries, as seen from estimating the model on the sample split into developing countries (4) and developed countries (5).

Most fundamentals are correlated with yields in the expected way or show insignificant coefficients. As before, we observe the negative correlation of external debt with yields, while total debt is positively correlated (see appendix A12). This again might be explained by unobserved characteristics that are both positively correlated with lower yields and with higher external debt such as general market confidence, but also, being more western aligned, having access to swap lines, etc.

The other puzzles are the positive correlation of government effectiveness with yields observed for all samples and a positive correlation of yields with the growth of GDP and the rule of law in the developed countries subsample.

6 Banking regulation changes

6.1 Methodology - Local projections DID

After having established the strong relationship between ratings and yields, I turn to studying what causes this effect of ratings on yields. As ratings do not seem to add useful information for predicting defaults beyond what is known from fundamentals, the information channel does not seem to be driving the ratings - yield relationship. I argue that the main channels are rather coordination and certification, as discussed in the literature. To study the role of certification, I look at banking regulation and how changes introduced with Basel III impacted the relationship between ratings and yields.

The main changes relevant for this in Basel III are the introduction of the Liquidity Coverage Ratio (LCR) and the increase in minimum capital requirements. The LCR increases banks' mandated holdings of High Quality Liquid Assets (HQLA), which should increase banks demand for them and thus increase the difference in yields between high-rated countries' bonds and that of lower-rated countries. The composition of HQLA is central to this mechanism. At least 60% must be Level 1 assets, mainly central-bank reserves and sovereign bonds rated AAA to AA-, included without a haircut; the remainder may be Level 2A and, up to 15%, Level 2B assets, subject to haircuts of 15% and 25–50%, respectively. Sovereign bonds rated A+ to A- fall in the Level 2A category (BCBS 2013). In practice after the LCR implementation, most of banks' HQLA were CB reserves (~45%), Level 1 sovereign bonds (~45%) and Level 2A sovereign bonds (~10%) (BCBS 2022). Therefore, the main

	<i>Dependent variable:</i>				
	10 year yield				
	(1)	(2)	(3)	(4)	(5)
Average rating	−0.405*** (0.021)		−0.427*** (0.029)	−0.610*** (0.092)	−0.433*** (0.025)
Log GDP per capita		−1.360*** (0.149)	−0.724*** (0.141)	−0.828*** (0.295)	−0.222 (0.153)
GDP growth 10y avg		0.034* (0.020)	0.049*** (0.018)	−0.079** (0.039)	0.181*** (0.018)
CA over GDP		0.251 (0.488)	0.733* (0.440)	5.090 (3.520)	−0.798** (0.348)
External debt over GDP		−0.336 (0.243)	−1.300*** (0.228)	−1.354 (1.690)	−0.391** (0.187)
Default History		9.852*** (0.779)	7.117*** (0.725)	3.205 (2.326)	8.645*** (0.714)
Government Effectiveness		0.069 (0.320)	0.989*** (0.294)	2.228*** (0.834)	0.069 (0.258)
Rule of Law		−0.493* (0.287)	−0.198 (0.259)	−1.212** (0.551)	1.230*** (0.259)
Sample	Full	Full	Full	Developing	Developed
Observations	955	955	955	221	734
R ²	0.282	0.658	0.724	0.590	0.793

*p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses.

Note: Panel OLS regression of the effective 10 year yields (OECD data) on ratings and fundamentals including year fixed effects. Model 4 only developing countries, model 5 only developed countries.

Table 4. OLS regression of 10 year yields on ratings and fundamentals.

cutoff I study is between the Level 1 (AAA to AA-) and the non-Level 1 (A+ and below) rated countries.

Crucially for what follows, two exceptions soften the rating cutoff. A bank may treat its home sovereign’s domestic-currency debt as Level 1 regardless of the rating, and in the EU all member states’ bonds are eligible for Level 1 (European Commission 2015). As large shares of EU members’ bank-owned debt are held by banks under EU legislation, this might make the effect of the change in legislation less important for EU countries. Also, shortly after the announcement of Basel III, the euro crisis led to massive movements in the relative spreads of EU countries, which might also make the effect of the banking legislation change less visible in these countries.

To address this problem, I estimate my baseline LP-DiD regression both on the full sample and on the two sub-samples of only EU and only non-EU countries. This is equivalent to introducing an interaction term between the variable of interest and a dummy for being an EU member state.

The second important Basel III change is the increase in minimum capital requirement relative to risk weighted assets. It makes it more costly for banks to hold assets with higher risk weight (i.e., those with lower ratings, see the rating-groups-scale in the appendix table A14). This might decrease the demand for lower-rated bonds by banks and thus also lead to an increase in the difference in yields between different rating groups. Again, the EU legislation applies an exception to all member states’ sovereign bonds. Irrespective of their rating, they can be accepted in the zero risk weight category when calculating risk-weighted assets (RWA).

The key dates I study are the publication of a consultative document in December 2009 (a tightening) (BCBS 2009), the announcement of Basel III in December 2010 (a tightening) (BCBS 2010a;b), the refinement of the LCR in January 2013 (BCBS 2013), generally read as a weakening of the LCR by introducing the Level 2B category and redefining the denominator of cash outflows (Bruno et al. 2018, Simion et al. 2024, Krettek 2025), and the implementation of the LCR in January 2015.⁸ The increased capital requirements came into force across most jurisdictions over 2013–2014. Because of the large heterogeneity across major jurisdictions, it is not possible to study one precise treatment date.

To study the effect of the announcement and implementation of these changes on the yield spread between countries with different ratings I use a local projections differences-in-differences (LP-DiD) approach as presented in Dube et al. (2025). This methodology has an advantage over standard event study approaches with two-way fixed effects (TWFE) as used by Schuster (2023): it allows for a more flexible specification of controls.

The paper methodologically closest to this work is by Anyfantaki et al. (2025) who use a version of a LP-DiD on annual country yield movements to assess the effect of climate

⁸RCAP Basel III Implementation Dashboard, https://www.bis.org/bcbs/implementation/rcap_reports.htm.

shocks, employing country and time fixed effects and controlling for lagged country-level characteristics and yields. [Ortmans & Tripiier \(2021\)](#) use an LP-DiD on daily data to study the effect of ECB QE announcements on the relationship between the number of Covid-19 cases and eurozone countries' bond spreads.

Baseline specification. In the baseline specification I regress $\Delta y_{i,h} = y_{i,T+h} - y_{i,T-1}$ the difference between a country's yield spread over the reference German 10 year yield in the period h ($y_{i,T+h}$) and the spread in the reference period before the event ($y_{i,T-1}$) on a dummy variable of whether the country belongs to the low-rated countries not eligible to be included in Level 1 category of HQLA (NonLevel1_i) at every horizon h .

$$\Delta y_{i,h} = \alpha_h + \beta_h \text{NonLevel1}_i + \varepsilon_{i,h} \quad (6)$$

The rating dummy NonLevel1_i is held fixed at T to avoid post-treatment bias. $\varepsilon_{i,h}$ is a country and period specific error. Country fixed effects are captured by the differencing in the dependent variable, time fixed effects are captured by the period specific intercept α_h . The β_h coefficient captures the response in the yield of non-Level 1 countries relative to that of Level 1 countries h periods after the event in T . Positive values for β point to an increased spread between the borrowing cost of low and high-rated countries, relative to the reference period before the Basel III event $T-1$.

To study the more fine grid differentiation between rating groups relevant for the RWA I also estimate a model with responses in the spread differences for individual rating groups, relative to the baseline AAA group.

$$\Delta y_{i,h} = \alpha_h + \sum_{g=1}^5 \beta_h^g \cdot \mathbb{1}[\text{rg}_i = g] + \varepsilon_{i,h} \quad (7)$$

The β_h^g coefficient captures the response in the yield of countries in the respective group relative to that of AAA rated countries h periods after the event. Positive values for β point to an increased spread between the borrowing cost of low and high-rated countries, relative to the reference period before the Basel III event $T-1$. We would expect the effect to be strongest for the lowest rating group.

Controls. In addition to, the special case of the EU countries, the challenge of this approach is other factors impacting the relative movement of spreads, i.e. the parallel trends assumption. There are many factors that influence the relative movements of countries spreads other than changes in banking regulation. The first sanity check is to study the pre-trends of relative spread movements before the Basel events studied (i.e., periods $h < 0$) and see if they are significantly different from 0. Additionally I conduct a robustness analysis, including a number of different options to control for these other factors impacting

the spreads.

The first approach is to control for country-specific fundamentals that impact the relative evolution of its spreads. I do so by introducing a country-level vector of controls $X_{i,T-1}$ measured pre-treatment at $T - 1$ and held fixed across horizons: debt-to-GDP ratio, real GDP growth, current account-to-GDP ratio and default history. This gives the following specification:

$$\Delta y_{i,h} = \alpha_h + \beta_h \text{NonLevel}_i + \gamma'_h X_{i,T-1} + \varepsilon_{i,h} \quad (8)$$

Next, I explore the results when controlling for the dynamic in spreads over the 6 months prior to the event by introducing the variable $\Delta y_{i,T-1}^{\text{pre}} = y_{i,T-1} - y_{i,T-7}$.

$$\Delta y_{i,h} = \alpha_h + \beta_h \text{NonLevel}_i + \gamma_h \cdot \Delta y_{i,T-1}^{\text{pre}} + \varepsilon_{i,h} \quad (9)$$

Furthermore, I explore the possibility of controlling for the relative effect of the change in the global financial environment on the individual countries spreads, which has been shown to matter for the movement of spreads between countries (Gilchrist et al. 2022). Simply introducing the VIX (an index for US stock market volatility and frequently used measure for investors risk appetite) and the FFR (the federal funds rate) does not work because general horizon specific effects are already captured by α_h . I therefore estimate country-specific pre-treatment sensitivities to these measures over $t \in [T - 36, T - 1]$ and control for them.

$$\Delta y_{i,h} = \alpha_h + \beta_h \text{NonLevel}_i + \gamma_h^{\text{VIX}} \cdot \hat{\lambda}_i^{\text{VIX}} + \gamma_h^{\text{FFR}} \cdot \hat{\lambda}_i^{\text{FFR}} + \varepsilon_{i,h} \quad (10)$$

$$\hat{\lambda}_i^{\text{VIX}} = \frac{\widehat{\text{Cov}}(\text{spread}_{it}, \text{VIX}_t)}{\widehat{\text{Var}}(\text{VIX}_t)}$$

$$\hat{\lambda}_i^{\text{FFR}} = \frac{\widehat{\text{Cov}}(\text{spread}_{it}, \text{FFR}_t)}{\widehat{\text{Var}}(\text{FFR}_t)}$$

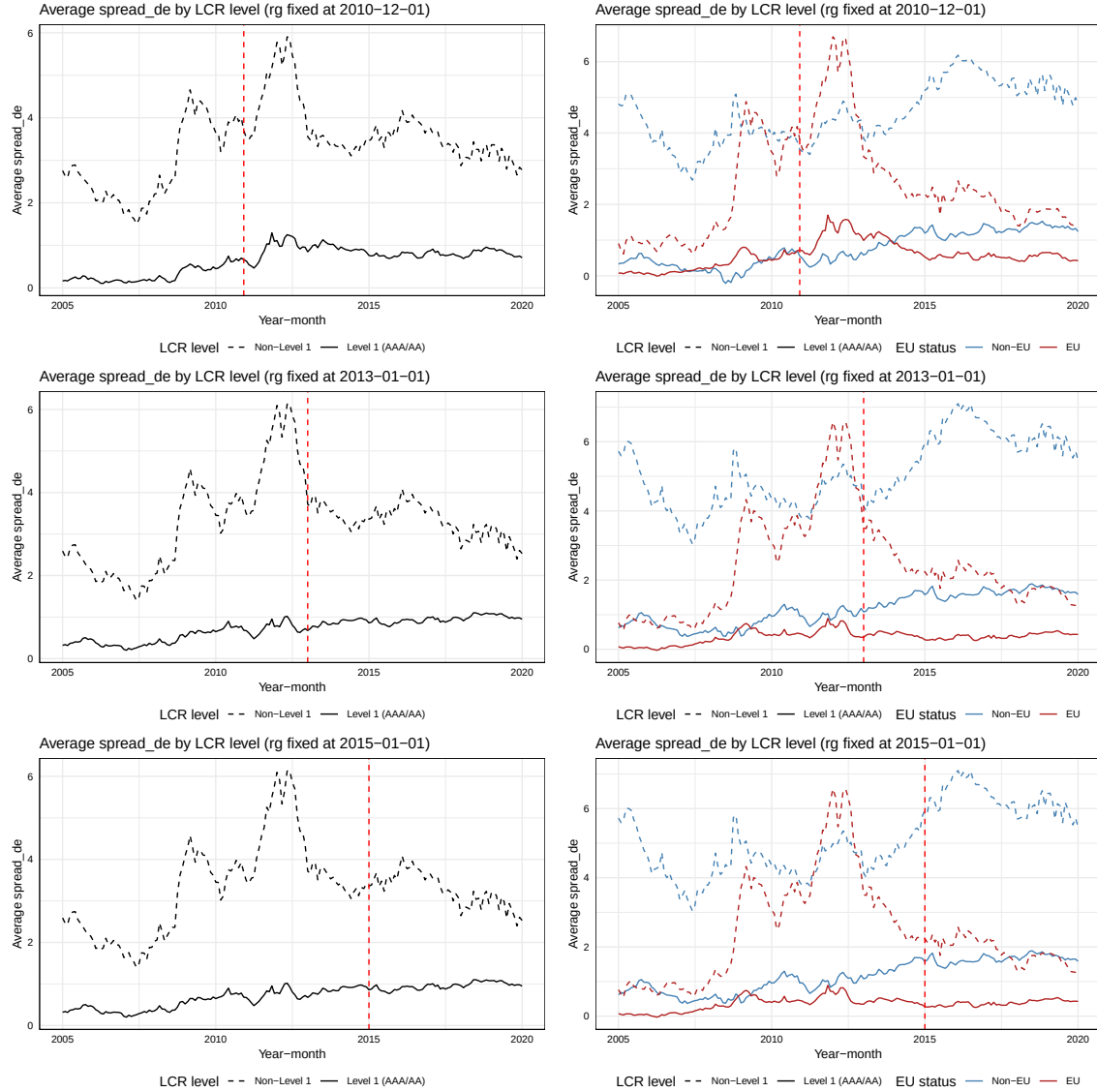
6.2 Results - Local projections DID

In this section I present the results of the LP-DiD estimations, studying the effect of Basel III banking regulation changes on the yield spread between high- and low-rated countries. All results in this section are estimated on the monthly panel of countries for which OECD yield data are available since at least 2007, to ensure consistency in the comparison groups and allow the study of pre-trends (see data section). I first present the estimates studying the effect along the Level 1 / non-Level 1 cutoff in the LCR, followed by the study across different rating groups that define the different risk weights in the minimum capital requirements.

The control AAA and the AA rating group correspond to the Level 1 group, so the rating groups A to CCC and below correspond to the non-Level 1 group.

LCR - Level 1. The announcement and implementation of the LCR in Basel III are thought to have increased the bank demand for HQLA ([Caballero et al. 2017](#), p. 42), leading to an increase in the spread between high and low-rated sovereign bonds. As discussed in the literature and the methodology, the effect might be more prominent in non-EU countries, as the EU made all EU members' bonds eligible for Level 1 in its legislation and the euro crisis in 2010-12 led to large spread spikes confounding the analysis.

Figure 10 displays the evolution of spreads by country group from 2005 to 2020. The country groups are based on having a Level 1 rating or not (fixed in T). To illustrate the difference in the evolution of spreads between EU and non EU countries, the graphs on the right show the evolution for these two groups separately. The countries in the respective groups are listed in detail in table A15 in the appendix.

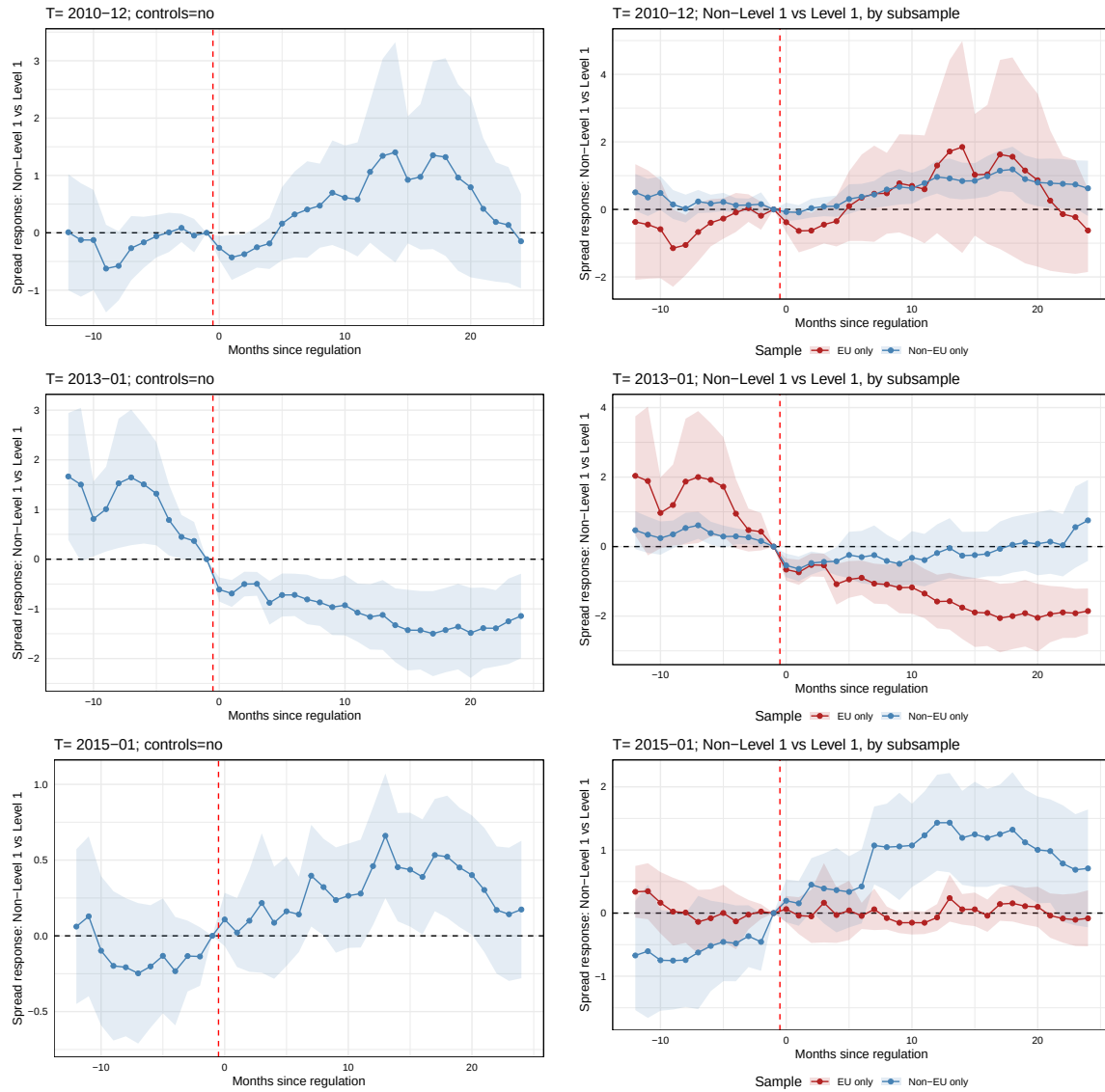


Note: Descriptive statistics of the evolution of average yield spreads over the benchmark German yield, countries with Level 1 rating (AAA to AA-) solid line, countries non-Level 1 (below AA-) dashed line. Left: full sample, right: EU countries in red and non-EU in blue. Level 1 status fixed in 2010 (top), 2013 (middle) and 2015 (bottom).

Figure 10. Evolution of spreads by country group.

Figure 11 then shows the estimation results for the Basel III announcement in December 2010, January 2013 and the LCR implementation in 2015. Positive coefficients mean an increase in the spread of low-rated (non-Level 1) countries' spreads over the spreads of high-rated (Level 1) countries, relative to the difference between the two groups in the reference period T-1 before the event. As expected, the response of non-Level 1 countries' spreads in the full sample has large variation and is not significant, although positive over the medium run. The breakdown in EU and non-EU countries reveals that the former,

as expected, do not show a significant response, while outside the EU there is a significant increase in the spread difference after both the reform announcement (2010) and the implementation (2015). Immediately after the January 2013 announcement, the spreads compressed somewhat. This is in line with the literature seeing 2013 as a weakening of the LCR regulation (e.g., Bruno et al. 2018) and thus further strengthens the evidence pointing to the certification channel being active in determining the importance of ratings for yields.



Note: Local projection difference in difference estimates for the effect of the different Basel III events (Top: December 2010, middle: January 2013, bottom: January 2015) on yield spreads of non-Level 1 (below AA-) relative to Level 1 rated countries (AAA to AA-). Positive coefficients mean an increased spread of between low and high-rated countries, relative to the spread in (T-1). Left: full sample, right: separately for EU (red) and non-EU countries (blue).

Figure 11. LP-DiD Level 1

The pre-trends across specification are not significantly different from zero. However, one can still suspect that there are other forces beyond ratings and the change in banking regulation that influence the relative evolution of spreads. To support the indicative evidence in these estimates, I include country-specific controls for macro economic fundamentals at T-1, for the change in the spread over the six month before the event and for the sensitivity of spreads to the VIX and the FFR as discussed in the methodology. Under all of these specifications the observed pattern largely stays the same. Yet, adding the controls in this setting of an already small sample does reduce the significance in some cases, see figures A6 and A7 in the appendix.

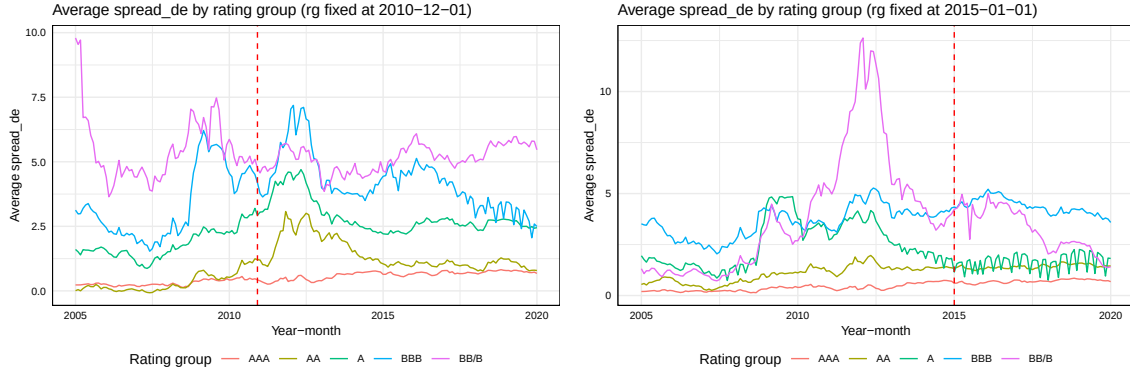
The estimations for the publication in December 2009 of the consultative documents regarding Basel III are shown in the appendix, including descriptive statistics on the evolution of spreads around the events and the group composition. The 2009 event does not show significant responses, possibly because it was only consultative and not an agreed standard.

The results presented here seem to show that Basel III, through the introduction of the LCR, increased the demand for HQLA and thus increased spreads between high and low-rated countries. This supports the hypothesis, that the certification function of ratings is one of the channels through which ratings affect borrowing cost and thus part of the explanation for why ratings matter.

RWA - Rating Group. To study the effect on the evolution of spreads on a more fine grid level, I also estimate the responses in the spreads of individual rating groups relative to the AAA benchmark. Differences between rating groups within the non-Level 1 group would point to a potential role for the different risk-weights that are applied to assets whose importance might have been amplified by the increase in the minimum capital requirements relative to RWA. We would thus expect the announcement and introduction of Basel III to lead to an increase in the spread between the borrowing cost of high and low-rated countries i.e. positive β_h^g coefficients, more positive the lower the rating.

The study of the spread evolution by rating group is somewhat complicated by the fact that this further differentiation leaves so few observations per group that one cannot further split them in EU and non-EU countries. And as discussed, the EU estimates might be over-shadowed by the special treatment in EU legislation and the euro crisis.

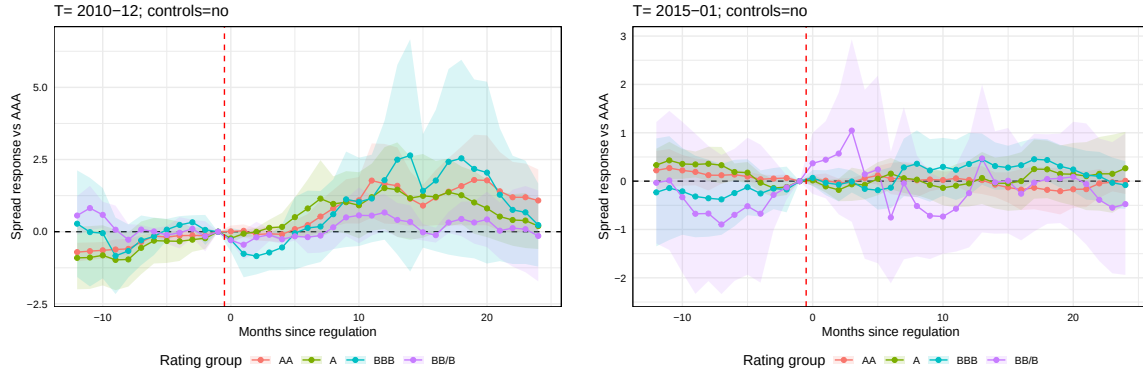
Figure 12 shows the evolution of spreads by rating group (fixed in T). The rating group composition for all events are displayed in table A16 in the appendix.



Note: Descriptive statistics for the evolution of yield spreads over the benchmark German yield. The panels show the average spread by rating group (fixed relative to the events in 2010-12, left and 2015-01, right) from 2005 to 2020.

Figure 12. Evolution of spreads as rating group 2005 to 2020.

The estimated changes in the difference of the spread of countries in lower rating groups over that of AAA-rated countries are generally not significant for either the 2010 announcement or the 2015 implementation event. This mirrors the results in the full-sample for the non-Level 1 / Level 1 split estimated before. The reason could thus be the EU specificities. While the coefficients estimated for the 2010 event generally point in the expected direction, those for 2015 are all around zero, see figure 13.



Note: Local projection difference in difference estimates for the effect of the December 2010 Basel III announcement (left) and the January 2015 LCR implementation (right) on yield spreads. Plotting the response in the spread by rating group relative to the response of AAA rated countries. Positive coefficients mean an increased spread of this rating group over the spread of AAA rated countries, relative to the spread in T-1.

Figure 13. LP-DiD for December 2010 Basel III announcement and January 2015 LCR implementation by rating group.

In the appendix I also study the evolution of spreads by rating group adding the controls discussed in the methodology. This does however also not improve the significance (see figure A15 in the appendix). Looking at the evolution of spreads by rating group after the 2009 and the 2013 event, also does not produce significant responses (see appendix figure A16).

All of this points to the fact that the increase in the minimum capital requirements relative to rating based risk weighted assets might not be the main channel for Basel III's effect of the relationship of ratings and yields. This is also in line with the findings that this measure mostly lead to an increase in banks capital and not a reduction in RWA (BCBS 2022).

Debt holding structure. The main channel for banking regulation to affect the rating–yield relationship runs through bank demand: regulation changes how willing banks are to hold bonds of a given rating. This shift in demand changes how ratings move yields. To study this channel in more detail, I examine data on the debt holding structure of sovereign debt. In particular, I look at the share of countries' debt held by foreign banks (as domestic banks may be allowed an exceptional unconditional eligibility for domestic bonds).

I first study the interaction between the non-Level-1 dummy and the share of a countries' debt held by foreign banks, including the EU / non-EU sample split, as displayed in the equation 11. We would expect a stronger response in the relative spread in countries with a larger exposure to foreign banks and thus a positive δ_h coefficient. However, due to the small sample size, introducing the interaction also increases the variation considerably. The estimated results for the interaction term are non-significant and around zero (see appendix figure A11).

$$\Delta y_{i,h} = \alpha_h + \beta_h^{NE} \text{NonLevel1}_i + \delta_h \text{FB}_i + \gamma_h (\text{NonLevel1}_i \times \text{FB}_i) + \varepsilon_{i,h} \quad (11)$$

Another option I explore is to study the response of the share of countries' debt held by foreign banks directly, instead of looking at yield responses (see appendix section A.11). The response in the foreign bank share in non-EU countries is insignificantly different between high- and low-rated countries. Estimates for EU countries are also mostly insignificant but seem to move much more, likely for other reasons (see figure A13).

There are several reasons for the lack of clear results on the change of the debt holding structure. First, the small sample, which is then further split into different groups, allows for only limited significance in results. Second, the foreign bank share only captures changes relative to other holders of government debt and not absolute changes in the amount of high-rated bonds held by banks, which have increased significantly (BCBS 2022). More can be done here by studying the movement in banks' balance sheets directly.

7 Conclusion

This paper set out from a puzzle. Sovereign ratings are largely reproducible from a handful of economic and political fundamentals — around 85% of the variation of ratings in the

cross-section, and up to 95% with country fixed effects — and the residual “subjective” component does not help predict default beyond a short horizon. Yet ratings are robustly correlated with borrowing costs even after controlling for fundamentals. If they add little to public information already available about default risk, why do they move yields?

A first contribution is conceptual: I bring together a scattered literature into a single framework of three channels through which ratings might affect borrowing costs: information, coordination, and certification. The empirical results then point away from the first and toward the third. Having shown that ratings are largely reproducible from fundamentals and that the residual does not predict default beyond a one- to two-year horizon, I set the information channel aside, leave coordination for future work, and test certification through banking regulation. Using an LP-DiD design around four Basel III events, I find that the spread between high- and low-rated sovereigns widened after the December 2010 announcement and the January 2015 implementation of the Liquidity Coverage Ratio. The 2013 refinement that weakened the rule produced a slight compression. A pattern in which tightening widens spreads and weakening compresses them is consistent with the LCR raising bank demand for high-rated bonds. As increased minimum capital requirements were met mainly by adding capital rather than shedding risk-weighted assets (BCBS 2022), the capital-requirement channel should be weak, and indeed my rating-group estimates show no clear response — the widening is at the Level-1 cutoff, relevant for the LCR. Because EU law admits all member states’ bonds to Level 1 regardless of rating, the certification hypothesis predicts no statistically significant rating-based response among EU sovereigns — and indeed none appears. However, this null is equally consistent with the euro crisis, which considerably distorted EU spreads over this period, simply masking any response.

These findings matter beyond the academic question of what ratings are for. They are not neutral: their subjective component runs systematically against lower-rated countries, which are typically poorer ones. Countries below the investment-grade cutoff receive ratings that are, on average, roughly 0.7 notches below their objective value. Since ratings are correlated with yields even after controlling for fundamentals, this bias may translate into higher borrowing costs for these countries — costs driven not by measurable risk but by the rating itself. This depends on ratings mattering independent of their information content, which is precisely what the banking-regulation evidence in this paper suggests they do. When ratings are written into regulation, any unjustified component they carry is amplified and propagated into the financial system, letting genuine risk go mispriced. The same certification channel that makes ratings powerful also makes their room for subjectivity consequential.

Several questions remain open. The coordination channel deserves direct testing. The debt-holding structure, which should be the proximate mechanism linking regulation to demand, is too coarsely measured here to deliver clear results. Studying banks’ balance

sheets directly is the natural next step, as is weighing the relative importance of the certification and coordination channels. Most importantly, if ratings carry an unjustified subjective component and ratings are embedded in the rules governing the world's banks, the financial-stability implications warrant far more scrutiny than they have received.

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A Appendix

A.1 Definitions, sources and descriptive statistics

Numeric	Grade	S&P / Fitch	Moody's
21	Investment	AAA	Aaa
20	Investment	AA+	Aa1
19	Investment	AA	Aa2
18	Investment	AA-	Aa3
17	Investment	A+	A1
16	Investment	A	A2
15	Investment	A-	A3
14	Investment	BBB+	Baa1
13	Investment	BBB	Baa2
12	Investment	BBB-	Baa3
11	Speculative	BB+	Ba1
10	Speculative	BB	Ba2
9	Speculative	BB-	Ba3
8	Speculative	B+	B1
7	Speculative	B	B2
6	Speculative	B-	B3
5	Speculative	CCC+	Caa1
4	Speculative	CCC	Caa2
3	Speculative	CCC-	Caa3
2	Speculative	CC	Ca
1	Speculative	C, D, SD	C

Note: All default and near-default categories (S&P/Fitch: C, D, SD; Moody's: C) are coded as 1. Withdrawn (WR/WD) and Not Rated (NR) are coded as missing.

Table A1. Mapping of credit ratings to numerical scale.

Variable	Definition	Source
Average rating	Simple average of available ratings from Fitch, S&P and Moody's transformed to a 21 to 1 scale (21 = AAA, 1 = D)	Trading Economics, The Global Economy
GDP	GDP in current ("nominal") USD at current market exchange rate ($GDP = gdp_lcu \times price_index / exrate$; same for following monetary aggregates)	WID
GDP per capita	GDP / population (in thousands)	WID
Exchange rate	Market exchange rate, LCU to USD	WID
Price index	National income price index	WID
Exports	Exports of goods and services	WID
Imports	Imports of goods and services	WID
Revenue	Total public revenue	WID
Debt	General government liabilities	WID
Population	Total population	WID
CA	Current account	WID
Budget Balance	Gross savings of the general government	WID
Foreign reserves	Foreign exchange reserve assets	WID
External debt	External liabilities	Nievas & Sodano (2024)
Developed	Dummy for being a high-income country	World Bank
Government Effectiveness	Government Effectiveness (−2.5 to 2.5)	World Bank WGI
Rule of Law	Rule of Law (−2.5 to 2.5)	World Bank WGI
Regulatory Quality	Regulatory Quality (−2.5 to 2.5)	World Bank WGI
Political Stability	Political Stability (−2.5 to 2.5)	World Bank WGI
Default history	1 in year of default; 0.8^i for i years after default	Asonuma & Trebesch (2016)
Interest rate	(Interest paid on public debt / GDP) divided by (Gross public debt / GDP)	IMF
10-year yield (OECD)	Monthly yield on 10-year bond	OECD
10-year yield (Refinitiv)	Yield of the bond with outstanding maturity closest to 10y, or interpolation based on daily yield data for individual bonds (monthly); coverage: 65 EMDEs	Refinitiv
Foreign bank share	Share of debt of country i held by a foreign bank, following Arslanalp & Tsuda (2012; 2014)	IMF Sovereign Debt Investor Base
VIX	CBOE Volatility Index	FRED
FFR	Federal Funds Effective Rate	FRED

Note: WID: World Inequality Database. IMF: International Monetary Fund. ECB: European Central Bank. FRED: Federal Reserve Bank of St. Louis. WGI: Worldwide Governance Indicators. LCU: local currency unit.

Table A2. Definition and source of variables used.

Statistic	N	Mean	St. Dev.	Min	Max
log GDP	2,809	25.06	1.97	20.37	30.70
log GDP per Capita	2,809	8.91	1.35	5.58	12.07
GDP Growth	2,809	5.82	12.04	-62.04	65.86
GDP Growth (10y Avg)	2,809	7.44	5.02	-11.29	29.63
BB / Revenue	1,553	0.09	0.16	-0.92	1.19
log Inflation	2,809	0.06	0.21	-0.36	7.43
Developed Dummy	2,809	0.38	0.49	0	1
CA / GDP	2,809	-0.01	0.13	-0.53	1.13
Debt / GDP	2,809	0.59	0.37	0.04	2.62
Trade / GDP	2,809	0.87	0.52	0.14	4.39
Budget Balance / GDP	1,553	0.03	0.05	-0.13	0.43
Exports / GDP	2,809	0.42	0.28	0.06	2.28
Foreign Reserves / GDP	2,809	0.17	0.17	0.00	1.40
External Debt / GDP	2,809	0.26	0.23	0.0001	2.41
Default Last Year	2,809	0.02	0.14	0	1
Default History	2,809	0.06	0.18	0.00	1.00
Default Memory	2,809	0.02	0.14	0	1
Government Effectiveness	2,809	0.33	0.90	-1.89	2.47
Political Stability	2,809	0.13	0.86	-2.81	1.76
Rule of Law	2,809	0.25	0.93	-2.33	2.12
Regulatory Quality	2,809	0.35	0.86	-2.39	2.25

Note: Descriptive statistics for the conditionally balanced sample (1996 to 2020). This is excluding all countries with variables from the baseline regression missing in a year they are rated, giving 143 countries.

Table A3. Descriptive statistics conditionally balanced sample (1996 to 2020).

Statistic	N	Mean	St. Dev.	Min	Max
log GDP	10,120	23.38	2.39	16.26	30.99
log GDP per Capita	10,120	7.60	1.75	2.49	12.22
GDP Growth	9,967	8.11	14.04	-66.45	240.07
GDP Growth (10y Avg)	8,590	8.11	6.09	-14.13	52.92
BB / Revenue	2,300	0.08	0.18	-1.29	1.19
CA / GDP	9,349	-0.01	0.12	-2.24	1.13
Debt / GDP	8,304	0.52	0.37	0.00	2.62
log Inflation	10,048	0.12	0.41	-13.80	21.52
Developed Dummy	11,330	0.26	0.44	0	1
Default Last Year	11,759	0.05	0.23	0	1
Trade / GDP	9,349	0.72	0.51	0.05	4.39
Budget Balance / GDP	2,598	0.03	0.05	-0.14	0.43
Exports / GDP	9,349	0.34	0.27	0.01	2.28
Foreign Reserves / GDP	8,415	0.13	0.17	0.00	2.13
External Debt / GDP	8,262	0.24	0.24	0.0001	3.00
Default History	11,759	0.08	0.24	0.00	1.00
Default Memory	11,759	0.05	0.23	0	1
Government Effectiveness	4,010	0.14	0.93	-2.09	2.47
Political Stability	4,043	0.03	0.88	-3.18	1.76
Rule of Law	4,057	0.08	0.95	-2.33	2.12
Regulatory Quality	4,016	0.15	0.91	-2.39	2.31

Note: Descriptive statistics for the full sample (1948 to 2025). Coverage for the World Bank WGI starts only in 1996, default event data in 1960, etc.

Table A4. Descriptive statistics full sample (1948 to 2025).

Country	Default years	N years
Argentina	2001–2005	5
Argentina	2019–2020	2
Barbados	2018–2019	2
Belize	2006–2007	2
Belize	2012–2013	2
Belize	2016–2017	2
Belize	2020	1
Cameroon	2003	1
Dominican Republic	2004–2005	2
Ecuador	1999–2000	2
Ecuador	2008–2009	2
Ecuador	2020	1
Greece	2011–2012	2
Honduras	1998–2001	4
Moldova	2001–2004	4
Mongolia	2017	1
Mozambique	2015–2019	5
Pakistan	1998–1999	2
Peru	1996–1997	2
Russia	1998–2000	3
Serbia	2004	1
Seychelles	2010	1
Ukraine	1998–2000	3
Ukraine	2015–2016	2
Uruguay	2003	1
Vietnam	1997	1

Note: Sovereign default events by country from the [Asonuma & Trebesch \(2016\)](#) dataset during the period studies with the conditionally balanced dataset from 1996 to 2020.

Table A5. Sovereign default events by country, 26 in total.

A.2 Rating determinants

	Dependent variable: average rating					
	OLS (cb)	OLS (b)	OL (cb)	OL (b)	OP (cb)	OP (b)
log GDP per capita	1.081*** (0.187)	0.962*** (0.264)	0.822*** (0.050)	0.776*** (0.078)	0.355*** (0.026)	0.360*** (0.039)
GDP growth 10y avg	0.047* (0.026)	0.038 (0.043)	0.045*** (0.009)	0.023 (0.014)	0.023*** (0.004)	0.018*** (0.006)
CA / GDP	3.500*** (0.943)	2.230** (0.937)	3.862*** (0.340)	3.171*** (0.469)	2.258*** (0.182)	2.182*** (0.263)
External debt / GDP	-3.409*** (0.546)	-2.824*** (0.598)	-2.755*** (0.181)	-2.250*** (0.222)	-1.752*** (0.100)	-1.459*** (0.122)
Default History	-2.724*** (0.756)	-5.703*** (1.312)	-2.709*** (0.235)	-5.697*** (0.503)	-1.274*** (0.116)	-2.983*** (0.255)
Government Effectiveness	2.135*** (0.540)	1.855*** (0.638)	2.065*** (0.141)	1.765*** (0.188)	1.215*** (0.078)	1.065*** (0.108)
Rule of Law	1.329*** (0.486)	1.490*** (0.521)	0.823*** (0.123)	1.355*** (0.173)	0.548*** (0.069)	0.733*** (0.099)
Num. Obs.	2809	1525	2809	1525	2809	1525
R ²	0.841	0.823				

Standard errors in parentheses.* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A6. Rating Determinants with conditionally balances (cb) and balanced (b) panel for OLS, Ordered Logit (OL) and Ordered Probit (OP).

	<i>Dependent variable: Average Rating</i>					
	Gaillard (1)	Afonso (2)	Vernazza (3)	DeMoor (4)	Tennant (5)	Baseline (6)
log GDP per Capita	1.060*** (0.054)	0.682*** (0.049)	0.574*** (0.062)	0.867*** (0.081)	0.467*** (0.077)	0.884*** (0.052)
log GDP		0.668*** (0.022)				
GDP Growth		0.006* (0.003)		0.018*** (0.004)	0.012*** (0.004)	
GDP Growth (10y Avg)			0.055*** (0.009)			0.033*** (0.009)
BB / Revenue					0.518 (0.356)	
CA / GDP			3.168*** (0.341)	2.736*** (0.467)	1.600*** (0.419)	3.760*** (0.325)
Debt / GDP	-2.274*** (0.122)	-2.748*** (0.111)	-1.993*** (0.132)	-1.806*** (0.149)	-2.133*** (0.149)	
log Inflation	-0.113 (0.210)				-2.028*** (0.592)	
Developed Dummy			1.918*** (0.164)			
Default Last Year			-2.671*** (0.299)			
Trade / GDP				-1.063*** (0.114)		
Budget Balance / GDP				-1.885 (1.233)		
Exports / GDP					0.000*** (0.000)	
Foreign Reserves / GDP				-0.492 (0.362)	-0.202 (0.329)	
External Debt / GDP						-3.797*** (0.196)
Government Effectiveness	3.851*** (0.083)	3.915*** (0.072)	3.030*** (0.160)	3.077*** (0.223)	2.432*** (0.217)	2.373*** (0.157)
Political Stability				-0.069 (0.101)		
Default History	-3.319*** (0.241)			-4.381*** (0.341)		-2.304*** (0.236)
Default Memory		-2.350*** (0.270)				
Rule of Law			0.618*** (0.148)	0.964*** (0.213)	0.747*** (0.205)	1.389*** (0.141)
Regulatory Quality					1.221*** (0.182)	
Observations	2,809	2,809	2,809	1,553	1,553	2,809
R ²	0.814	0.856	0.827	0.855	0.872	0.835

*p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses.

Table A7. OLS regression table comparison of different specifications from the literature.

	<i>Dependent variable:</i>			
	Average rating			
	(1)	(2)	(3)	(4)
log GDP per capita	0.884*** (0.052)	1.081*** (0.056)	0.673*** (0.064)	1.793*** (0.157)
GDP growth 10y avg	0.033*** (0.009)	0.047*** (0.011)	0.033*** (0.006)	0.011 (0.010)
CA / GDP	3.760*** (0.325)	3.501*** (0.321)	−0.209 (0.367)	−0.731** (0.361)
External debt / GDP	−3.797*** (0.196)	−3.407*** (0.199)	−3.990*** (0.177)	−3.621*** (0.180)
Default History	−2.304*** (0.236)	−2.725*** (0.239)	−1.440*** (0.189)	−1.392*** (0.184)
Government Effectiveness	2.373*** (0.157)	2.135*** (0.158)	1.251*** (0.149)	1.031*** (0.148)
Rule of Law	1.389*** (0.141)	1.328*** (0.139)	1.448*** (0.159)	1.264*** (0.158)
Year FE	No	Yes	No	Yes
Country FE	No	No	Yes	Yes
Observations	2,809	2,809	2,809	2,809
R ²	0.835	0.841	0.948	0.951

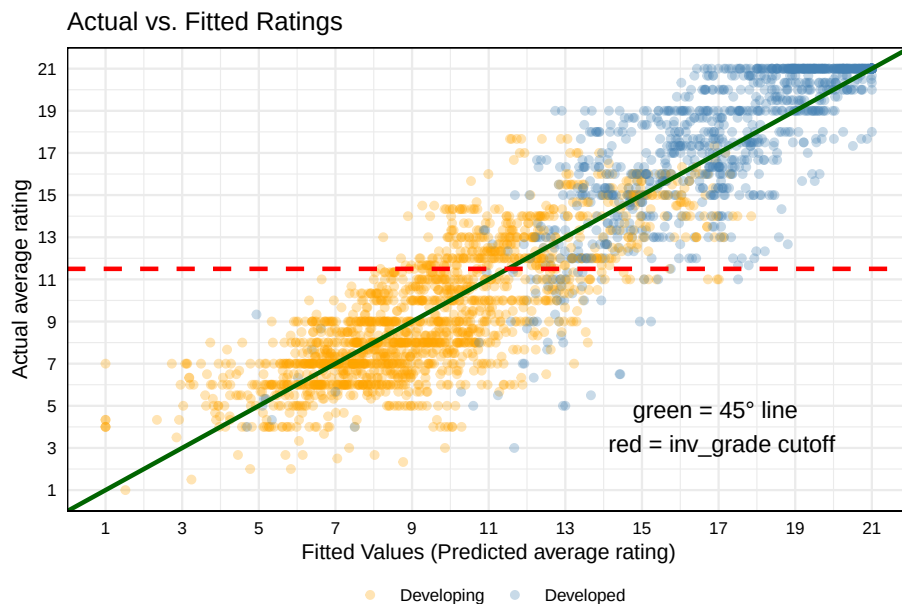
*p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses.

Table A8. OLS Estimates: Average Rating on Fundamentals with different FE.

	<i>Dependent variable:</i>			
	Average rating	fitchrating	moodyrating	sprating
	(1)	(2)	(3)	(4)
log GDP per capita	1.081*** (0.056)	1.408*** (0.064)	0.924*** (0.072)	1.158*** (0.065)
GDP growth 10y avg	0.047*** (0.011)	0.025** (0.012)	0.046*** (0.012)	0.016 (0.012)
CA / GDP	3.500*** (0.321)	2.866*** (0.368)	3.229*** (0.377)	3.807*** (0.354)
External debt / GDP	-3.409*** (0.199)	-3.291*** (0.212)	-3.864*** (0.230)	-3.804*** (0.208)
Default History	-2.724*** (0.239)	-3.151*** (0.296)	-2.884*** (0.278)	-3.243*** (0.285)
Government Effectiveness	2.135*** (0.158)	1.769*** (0.185)	2.334*** (0.185)	1.906*** (0.175)
Rule of Law	1.329*** (0.139)	1.244*** (0.160)	1.354*** (0.167)	1.431*** (0.156)
Rating	Avg.	Fitch	Moody's	S&P
Observations	2,809	2,045	2,398	2,330
R ²	0.841	0.852	0.815	0.847

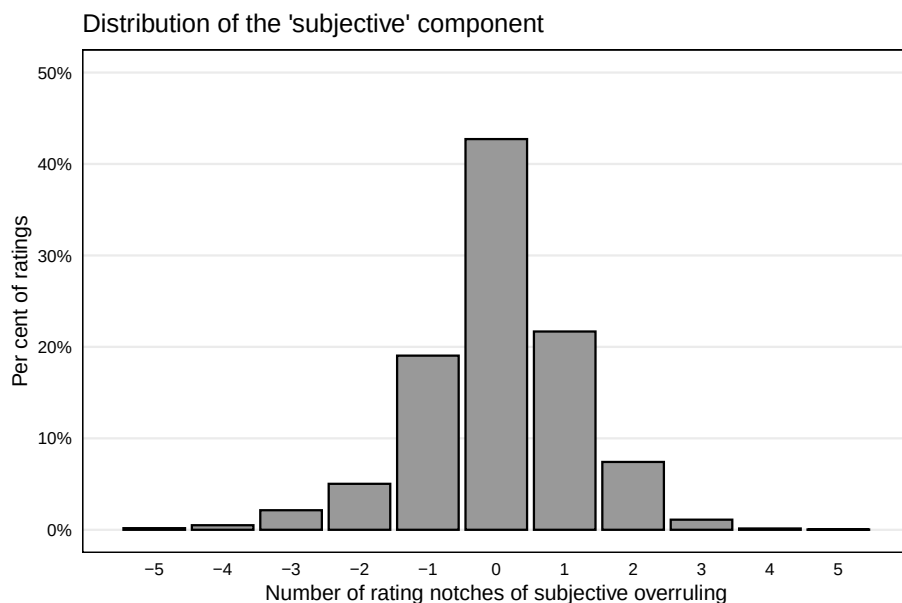
*p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses.

Table A9. OLS Estimates: Rating (Avg. and by agency) on Fundamentals



Note: Plotting the fitted (“objective”) ratings from the OLS regression of average ratings on fundamentals against the actual ratings (fitted values above 21 and below 1 are dropped). Below the green 45° line, actual ratings are “too low” given the fundamentals, while above they are “too high”. This benefits developed countries, who typically get a higher rating and penalizes developing countries.

Figure A1. Fitted (“objective”) ratings against the actual ratings (OLS).



Note: The figure shows the frequency of rounded residual values (“subjective component”) from the baseline OLS regression. Over 40% of residuals are around 0, some 20% are either + or - one rating notch, almost no residuals are larger than ± 3 .

Figure A2. Distribution of subjective component (including country FE).

A.3 Predicting default

	1 year	2 years	3 years	4 years	5 years
Avg. rating (lagged)	-0.393*** (0.076)	-0.199*** (0.057)	-0.135*** (0.039)	-0.115*** (0.034)	-0.108*** (0.032)
Num. Obs.	2,666	2,527	2,392	2,258	2,125
Pseudo R ²	0.345	0.201	0.137	0.115	0.107

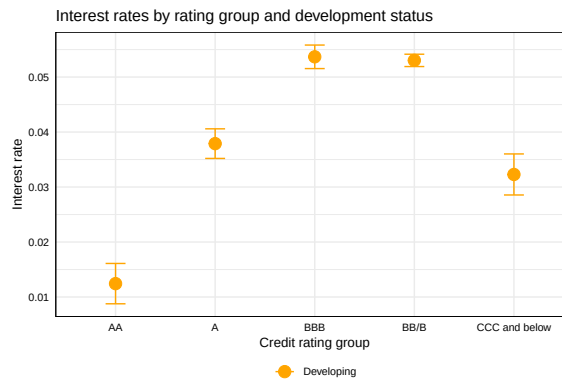
*p<0.1; **p<0.05; ***p<0.01. Standard errors clustered by country in parentheses.

Note: Coefficients from the probit regression of default dummy on the actual average rating, lagged by 1 to 5 years respectively.

Table A10. Predicting defaults at horizons 1 to 5 years with actual rating.

A.4 Effective market interest rates

As the effective interest rate includes the interest rate paid on different forms of borrowing, it might not properly show the effect of ratings on the interest rate countries have to pay on the market. To analyze this further, I compute the effective interest rates paid on market based lending from the World Bank International Debt Statistics. This does however not substantially change the pattern of effective interest rates by rating group observed in the main part. Figure A3 displays the average effective interest rate paid on market borrowing by rating group. There still is a surprisingly low rate paid by very low-rated countries, that might be explained by restructuring and interest moratoriums. However, there is a consistent wedge between the market rate and rate paid on bilateral and multilateral lending.



Note: Effective interest rate computed as the interest payments divided by the debt stock (for market based debt, excluding bilateral and multilateral interest payments and debt), averaged over countries in the same rating group by year on the conditionally balanced panel.

Figure A3. Effective interest rate on market borrowing by rating group 1996-2020.

Construction of creditor-specific effective interest rates For country i in year t ,

the effective rate on debt owed to creditor class c is

$$r_{i,t}^c = \frac{\text{INT}_{i,t}^c}{\frac{1}{2}(\text{DOD}_{i,t}^c + \text{DOD}_{i,t-1}^c)}, \quad (\text{A1})$$

where $\text{INT}_{i,t}^c$ is interest paid during year t to creditors of class c and $\text{DOD}_{i,t}^c$ is the corresponding year-end stock of debt outstanding and disbursed. Averaging the end-of-period stock with its lag corrects for the timing mismatch between within-year flows and point-in-time stocks, which would otherwise bias the implied rate downward when debt is growing.

I compute three creditor-specific rates: a *market* rate $r_{i,t}^{\text{mkt}}$ on debt owed to private creditors (bondholders, commercial banks, and other private lenders), a *multilateral* rate $r_{i,t}^{\text{mlat}}$ on debt owed to the World Bank, regional development banks, the IMF, and other multilateral institutions, and a *bilateral* rate $r_{i,t}^{\text{bil}}$ on government-to-government lending. The market rate is the cleanest measure of non-concessional borrowing cost; the multilateral rate captures the policy-driven concessional component; the bilateral rate is a hybrid of aid lending and quasi-commercial exposures. I also compute an aggregate rate on total PPG external debt as a benchmark. The implicit subsidy from concessional finance is summarised by the wedge

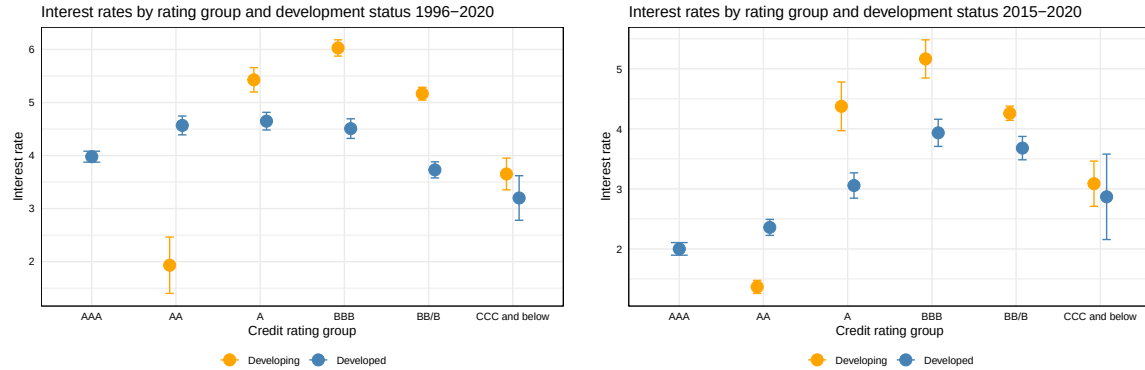
$$\omega_{i,t} = r_{i,t}^{\text{mkt}} - r_{i,t}^{\text{mlat}}, \quad (\text{A2})$$

which differences out country-specific risk and global rate conditions because both rates are observed for the same sovereign in the same year. To prevent small denominators from generating spurious rate spikes, observations with creditor-class stocks below USD 1 million are set to missing. Because IDS coverage is restricted to low- and middle-income economies reporting to the Debtor Reporting System, the resulting panel covers LMICs only and captures external rather than total public debt.

IDS series used. Interest flows and debt stocks come from the following series, all in current US dollars:

- Private creditors (market): DT.INT.PRVT.CD, DT.DOD.PRVT.CD
- Multilateral creditors: DT.INT.MLAT.CD, DT.DOD.MLAT.CD
- Bilateral creditors: DT.INT.BLAT.CD, DT.DOD.BLAT.CD
- Total PPG external debt: DT.INT.DPPG.CD, DT.DOD.DPPG.CD

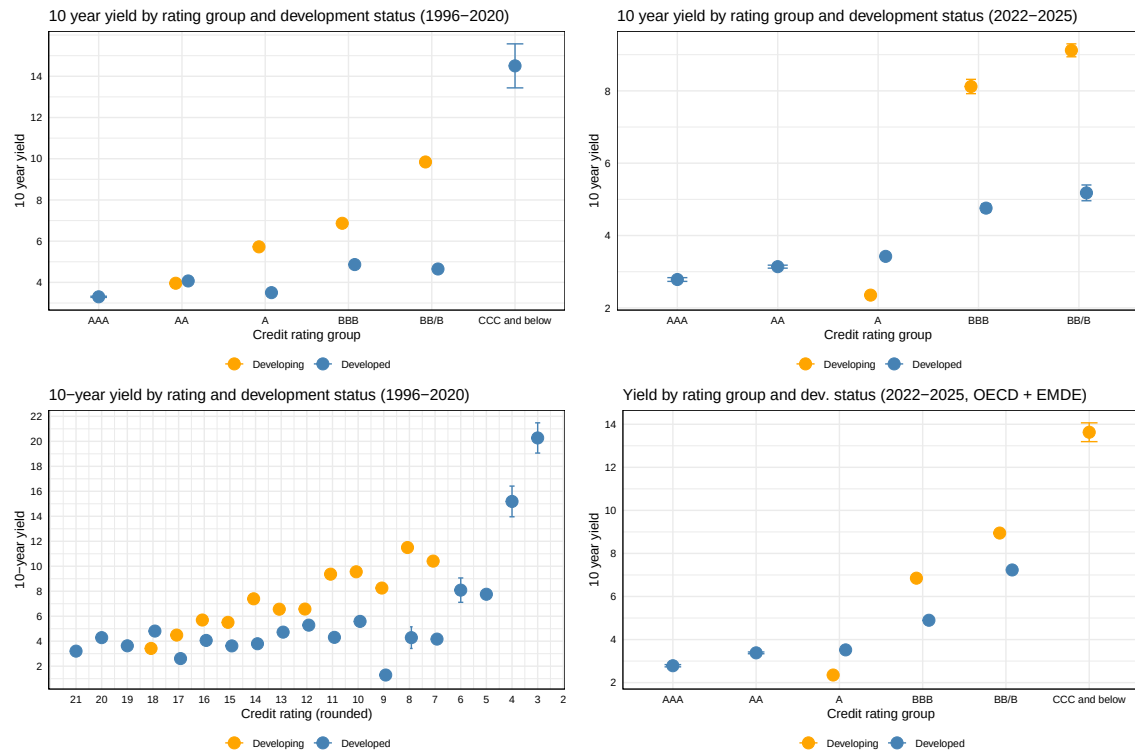
A.5 IR by rating



Note: Effective interest rate computed as the interest payments divided by the debt stock, averaged over countries in the same rating group and with the same development status by year on the conditionally balanced panel. Left: 1996–2020. Right: 2015–2020. Including China (AA rating in 7 years and very low effective interest rate).

Figure A4. Effective interest rate by rating group and development status.

A.6 Yields by Rating



Note: Yield by rating group for monthly data. 1996–2020, OECD (top-left), 2022–2025, OECD (top-right), 1996–2020 by rating OECD (bottom-left), 2022–2025, including OECD and EMDE data (bottom-right).

Figure A5. Yield by rating group for monthly data.

A.7 Panel IR on ratings and fundamentals

	<i>Dependent variable:</i>			
	Interest rate			
	(1)	(2)	(3)	(4)
Average rating	−0.291*** (0.027)	−0.286*** (0.027)	−0.160*** (0.030)	−0.170*** (0.031)
Log GDP per capita	0.570*** (0.087)	0.519*** (0.088)	0.078 (0.260)	0.077 (0.260)
GDP growth 10y avg	0.004 (0.016)	0.017 (0.016)	0.055*** (0.016)	0.053*** (0.016)
CA / GDP	−1.518*** (0.514)	−1.034* (0.528)	0.978* (0.563)	0.958* (0.563)
External debt / GDP	−2.343*** (0.289)	−3.032*** (0.341)	−1.095*** (0.299)	−0.928*** (0.344)
Debt / GDP		0.819*** (0.216)		−0.301 (0.306)
Default history	−1.678*** (0.346)	−1.544*** (0.347)	−0.747*** (0.287)	−0.754*** (0.287)
Government effectiveness	0.831*** (0.236)	0.681*** (0.239)	0.302 (0.231)	0.324 (0.232)
Rule of law	−0.336 (0.205)	−0.239 (0.206)	0.713*** (0.251)	0.715*** (0.251)
Year FE	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes
Observations	2,442	2,442	2,442	2,442
R ²	0.227	0.231	0.714	0.714

*p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses.

Table A11. OLS Estimates: interest rate on average rating and fundamentals, including debt share and country FE.

A.8 Panel Yield on ratings and fundamentals

	<i>Dependent variable:</i>			
	10 year yield			
	(1)	(2)	(3)	(4)
Average rating	−0.427*** (0.029)	−0.461*** (0.029)	−0.438*** (0.032)	−0.509*** (0.035)
Log GDP per capita	−0.724*** (0.141)	−0.447*** (0.146)	−0.289 (0.304)	−0.556* (0.305)
GDP growth 10y avg	0.049*** (0.018)	0.005 (0.020)	0.046** (0.019)	0.035* (0.019)
CA / GDP	0.733* (0.440)	−0.289 (0.466)	−0.094 (0.723)	−0.104 (0.714)
External debt / GDP	−1.300*** (0.228)	−0.772*** (0.241)	−0.909*** (0.265)	−0.297 (0.291)
Debt / GDP		−1.035*** (0.175)		−1.568*** (0.324)
Default history	7.117*** (0.725)	6.519*** (0.719)	6.076*** (0.584)	5.285*** (0.599)
Government effectiveness	0.989*** (0.294)	1.110*** (0.290)	0.380 (0.263)	0.579** (0.263)
Rule of law	−0.198 (0.259)	−0.427* (0.257)	0.541 (0.390)	0.715* (0.387)
Year FE	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes
Observations	955	955	955	955
R ²	0.724	0.734	0.881	0.884

*p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses.

Table A12. OLS Estimates: 10 year yield (OECD data) on average rating and fundamentals, including debt share and country FE.

A.9 First differences

Methodology. To study the effect of a change in rating on a change in the borrowing cost in more detail, I follow the approach in [Bussière & Ristiniemi \(2012\)](#) who suggest that spreads follow an AR(1) process. I use the monthly dataset of 10 year yields (only OECD data), ratings, the VIX and the FFR described in the data section.

In the baseline estimation I regress the change between the spread of a countries yield over US yields between this month and last month on the lagged change in yields ($\Delta SP_{i,t-1}$), the change in the rating ($\Delta R_{i,t}$), as well as the change in the VIX (ΔVIX_t) and the FFR (ΔFFR_t). Using first differences controls for unobserved country heterogeneity and the high persistence in spreads, it allows to focus on what drives changes.

$$\Delta SP_{i,t} = \beta_1 \Delta SP_{i,t-1} + \beta_2 \Delta R_{i,t} + \beta_3 \Delta VIX_t + \beta_4 \Delta FFR_t + \Delta \epsilon_{i,t}$$

As [Bussière & Ristiniemi \(2012\)](#) note, the lagged differenced regressor $\Delta \ln(sp)_{i,t-1}$ is endogenous because it contains $\ln(sp)_{i,t-1}$, which is correlated with $\epsilon_{i,t-1}$ in the differenced error. I then follow them and also estimate the regression instrumenting for $\Delta SP_{i,t-1}$ with $SP_{i,t-2}$ and alternatively with $\Delta SP_{i,t-2}$. [Arellano & Bond \(1991\)](#) suggest that instrumenting with the lagged variable in levels is the stronger instrument, while instrumenting with the difference might suffer from weak instrument bias.

Results. The first difference estimation yields a negative and significant coefficient for a change in ratings. However, when instrumenting for the lagged spread change with the spread level the period before the rating no longer negatively affects the spread but now positive which is puzzling. When instrumenting with the lagged difference of the period before the rating coefficient stays negative and significant.

	OLS	IV (level)	IV (diff)
Δ spread (lagged)	0.124*** (0.008)		
Δ spread (lagged, IV)		1.059*** (0.110)	-0.413*** (0.081)
Δ Average rating	-0.129*** (0.023)	0.111*** (0.042)	-0.267*** (0.033)
Δ VIX	0.011*** (0.001)	0.015*** (0.001)	0.009*** (0.001)
Δ FFR	-0.048*** (0.015)	0.117*** (0.028)	-0.145*** (0.022)
Constant	-0.008*** (0.003)	0.001 (0.004)	-0.013*** (0.003)
Num. Obs.	15 404	15 404	15 338
R ²	0.040	0.036	0.027

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Note: First-difference regression of spread change on rating change, lagged spread change, VIX, and FFR change. IV (level) instruments the lagged spread change with the lagged spread level $sp - t - 2$; IV (diff) instruments with the lagged spread difference Δsp_{t-2} .

Table A13. First-difference regression estimates.

A.10 Basel Regulation

Credit Assessment	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Risk Weight	0%	20%	50%	100%	150%	100%

Table A14. Risk weights for sovereign bonds under the standardized approach in Basel II and III.

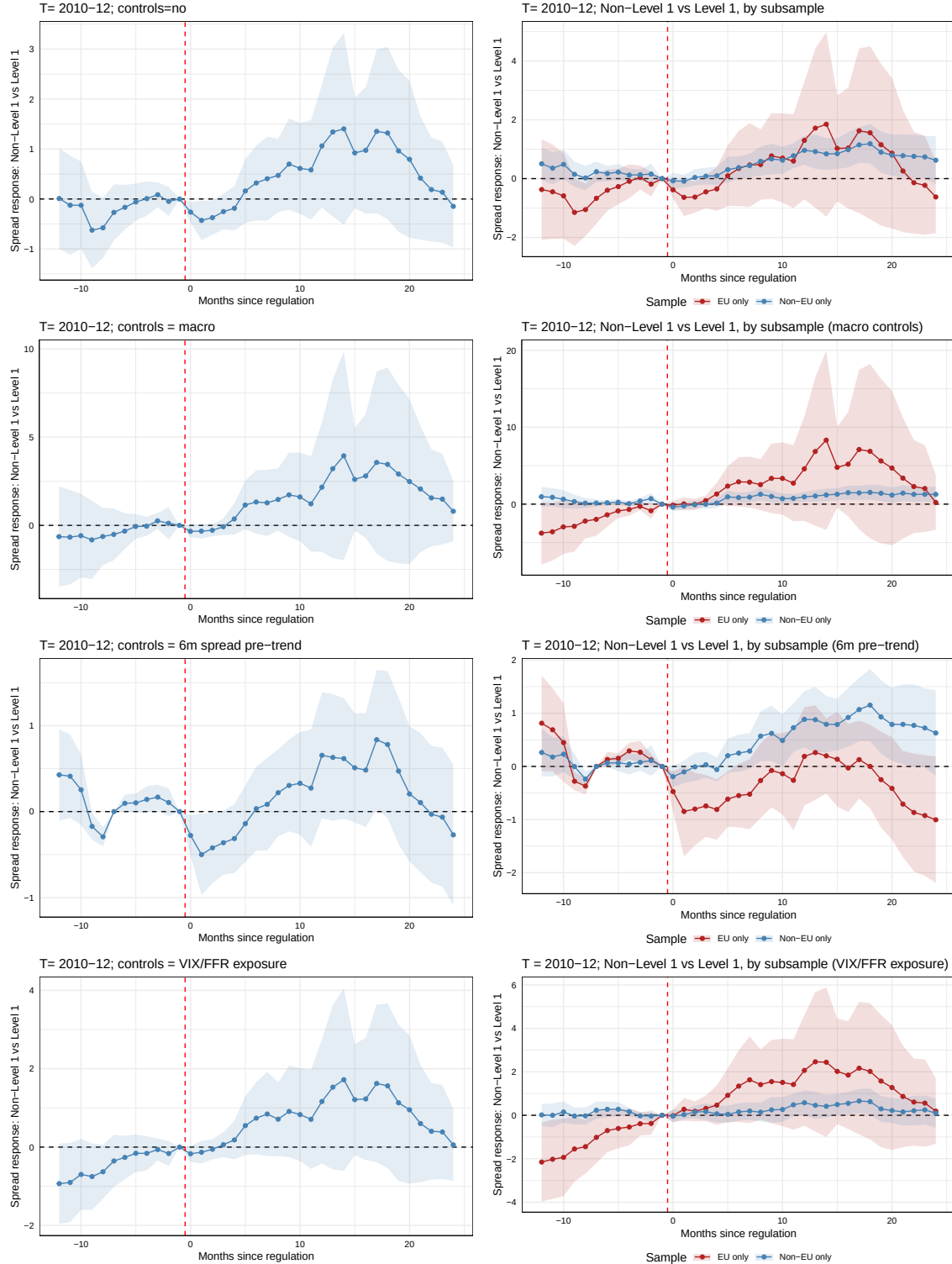
Implementation All of the countries in my dataset are either members of the BCBS since at least 2009 (which makes the announcement in 2010 effective for them and they also implemented the LCR in January 2015, exceptions marked below).⁹ The non members are all countries that have largely followed the Basel standards, which makes it likely that the announcements were similarly effective for them. They implemented the LCR in January 2015, with the exception of New Zealand that already had a similar measure in place and Colombia that implemented it already in 2015 ([Financial Stability Institute 2015](#)). Anyways, what counts most is that the LCR announcements in 2009, 2010 and 2013 were effective in the major jurisdictions of banks holding foreign government bonds, which is the case.

BCBS members: Australia (final LCR legislation 2017, implemented in Jan. 2018), Austria, Belgium, Brazil (LCR implemented Jan. 2016), Bulgaria, Canada, Croatia, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, United Kingdom (LCR implemented Jan. 2016), United States.

Non Members: Chile (observer, LCR implementation 2015), Colombia (LCR equivalent implemented 2012), Iceland (follow EU), Israel (LCR implemented 2015), New Zealand (LCR equivalent already in place), Norway (follow EU).

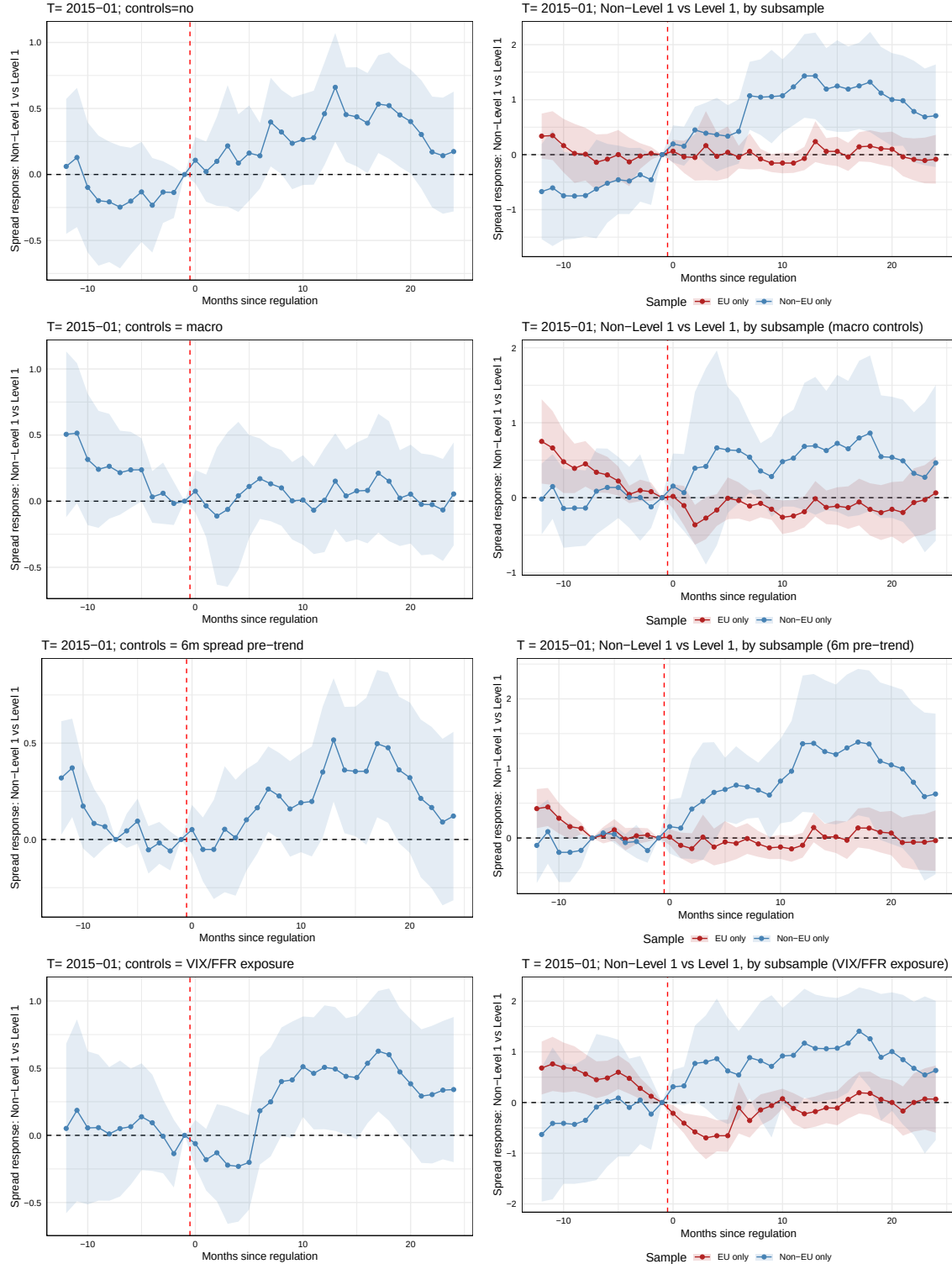
A.11 Local Projections

⁹RCAP Basel III Implementation Dashboard https://www.bis.org/bcbs/implementation/rcap_reports.htm



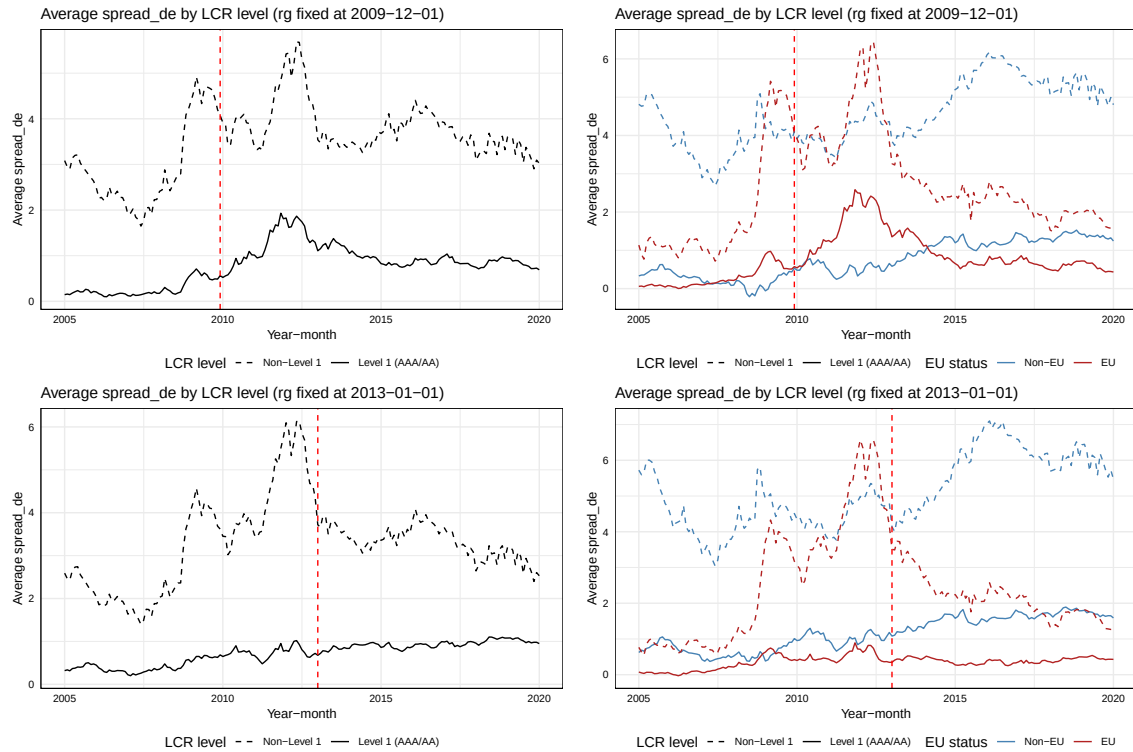
Note: Local projection difference in difference estimates for the effect of the December 2010 Basel III announcement on yield spreads of non-Level 1 (below AA-) relative to Level 1 rated countries (AAA to AA-). Positive coefficients mean an increased spread of between low and high-rated countries, relative to the spread in (T-1). Left: full sample, right: separately for EU (red) and non-EU countries (blue). Different controls: no controls (top), macro fundamentals in T-1 (mid-top), spread pre-trend over 6 months (mid-bottom), VIX and FFR sensitivity (bottom).

Figure A6. LP-DiD 2010 Level 1, baseline and controls



Note: Local projection difference in difference estimates for the effect of the January 2015 Basel III implementation on yield spreads of non-Level 1 (below AA-) relative to Level 1 rated countries (AAA to AA-). Positive coefficients mean an increased spread of between low and high-rated countries, relative to the spread in (T-1). Left: full sample, right: separately for EU (red) and non-EU countries (blue). Different controls: no controls (top), macro fundamentals in T-1 (mid-top), spread pre-trend over 6 months (mid-bottom), VIX and FFR sensitivity (bottom).

Figure A7. LP-DiD 2015 Level 1, baseline and controls

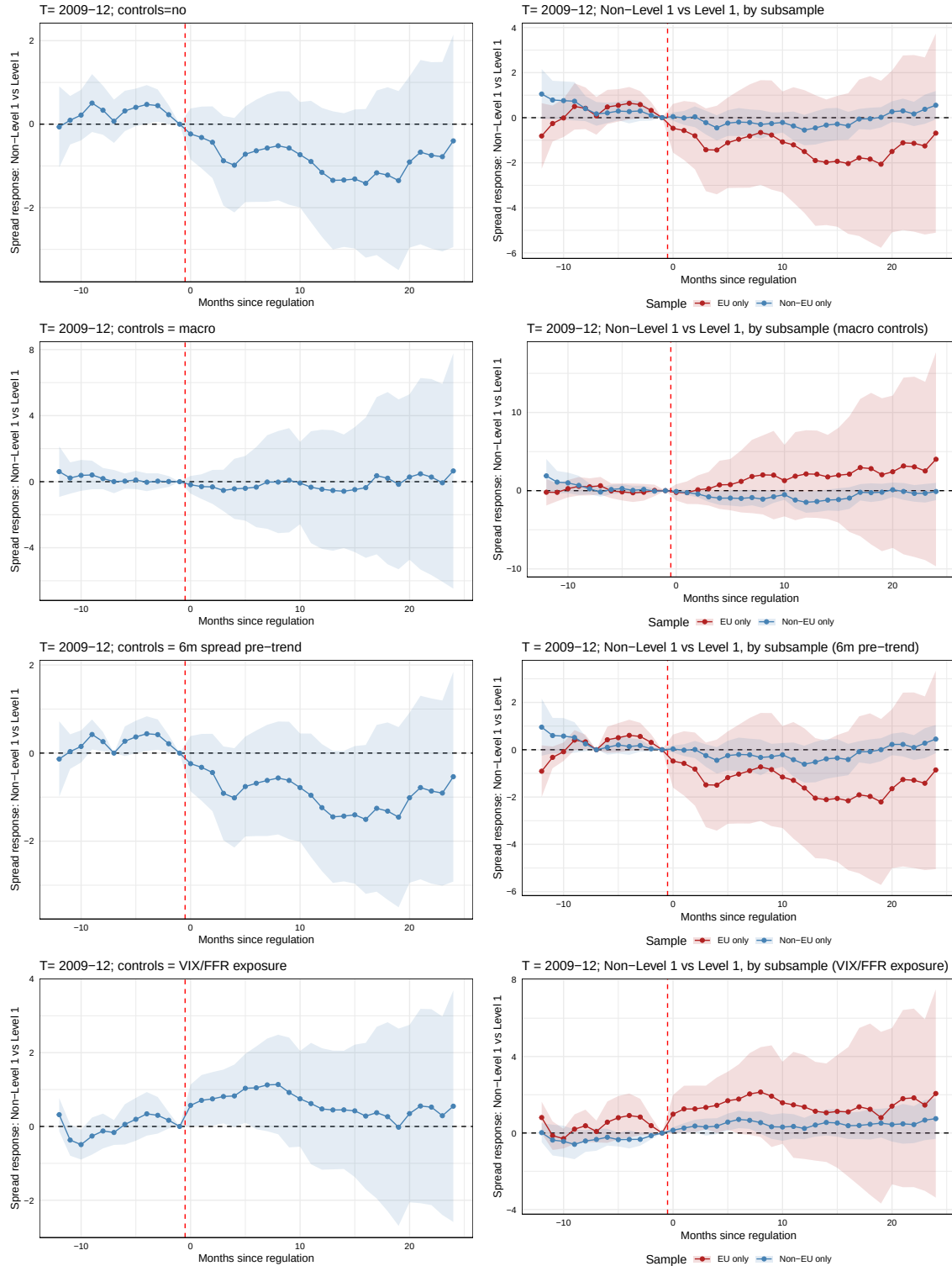


Note: Descriptive statistics of the evolution of average yield spreads over the benchmark German yield, countries with Level 1 rating (AAA to AA-) solid line, countries non-Level 1 (below AA-) dashed line. Left: full sample, right: EU countries in red and non-EU in blue. Level 1 status fixed in 2009 (top) and 2013 (bottom).

Figure A8. Evolution of spreads by country group.

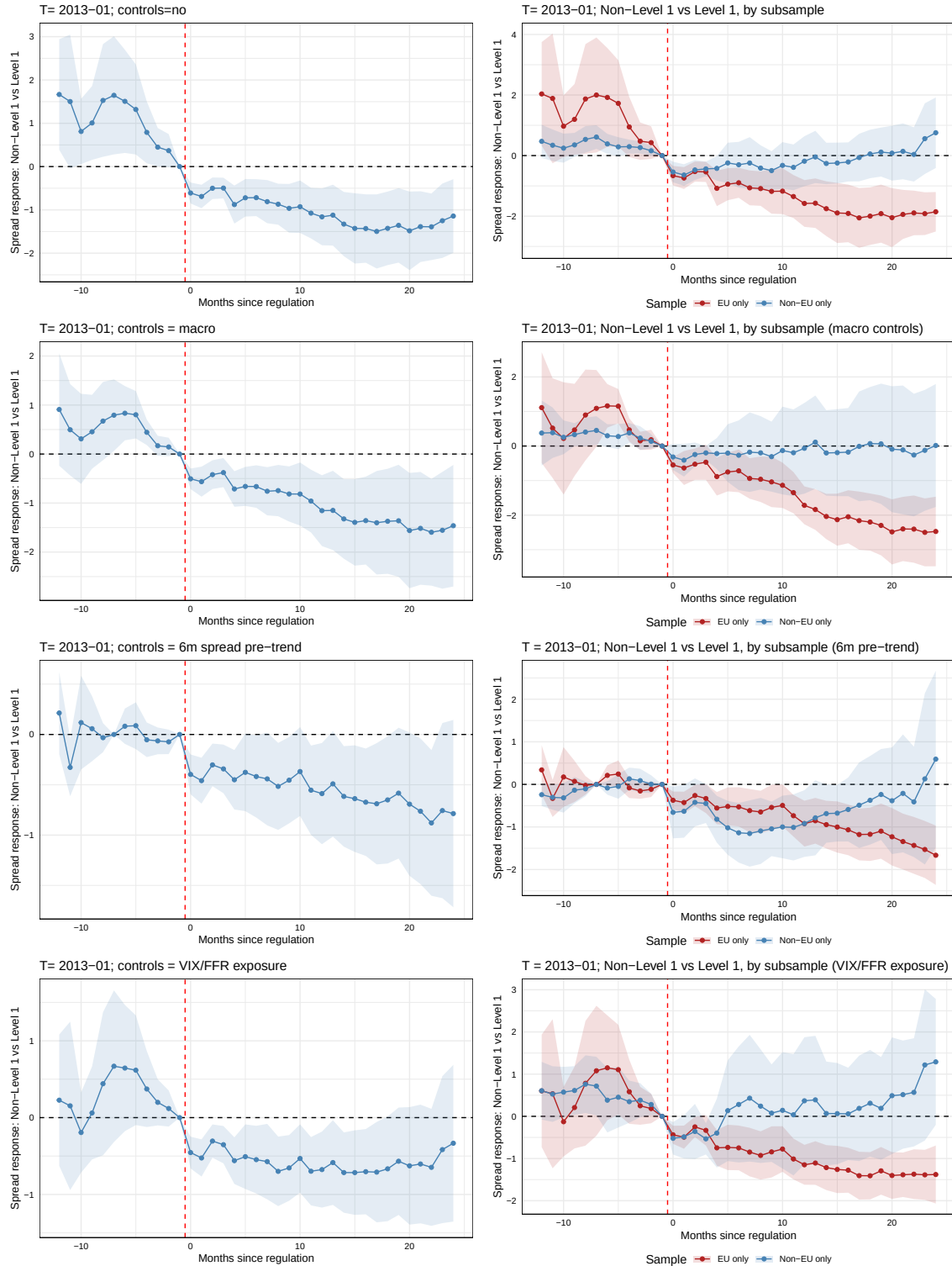
Group	2009-12	2010-12	2013-01	2015-01
Level 1, EU	Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovenia, Spain, Sweden, United Kingdom	Austria, Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Slovenia, Spain, Sweden, United Kingdom	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Luxembourg, Netherlands, Sweden, United Kingdom	Austria, Belgium, Denmark, Czechia, Finland, France, Germany, Luxembourg, Netherlands, Sweden, United Kingdom
Level 1, Non-EU	Australia, Canada, Japan, New Zealand, Norway, Switzerland, United States	Australia, Canada, Japan, New Zealand, Norway, Switzerland, United States	Australia, Canada, Chile, Japan, New Zealand, Norway, South Korea, Switzerland, United States	Australia, Canada, Chile, Japan, New Zealand, Norway, South Korea, Switzerland, United States
Non-Level 1, EU	Bulgaria, Croatia, Czechia, Greece, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia	Bulgaria, Croatia, Czechia, Greece, Hungary, Ireland, Latvia, Lithuania, Poland, Portugal, Romania, Slovakia	Bulgaria, Croatia, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Poland, Portugal, Romania, Slovakia, Slovenia, Spain	Bulgaria, Croatia, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Poland, Portugal, Romania, Slovakia, Slovenia, Spain
Non-Level 1, Non-EU	Brazil, Chile, Colombia, Iceland, Israel, Mexico, Russia, South Africa, South Korea	Brazil, Chile, Colombia, Iceland, Israel, Mexico, Russia, South Africa, South Korea	Brazil, Colombia, Iceland, Israel, Mexico, Russia, South Africa	Brazil, Colombia, Iceland, Israel, Mexico, Russia, South Africa

Table A15. Country classification by LCR Level 1 status and EU membership in December 2009, December 2010, January 2013 and January 2015.



Note: Local projection difference in difference estimates for the effect of the December 2009 Basel III preliminary announcement on yield spreads of non-Level 1 (below AA-) relative to Level 1 rated countries (AAA to AA-). Positive coefficients mean an increased spread of between low and high-rated countries, relative to the spread in (T-1). Left: full sample, right: separately for EU (red) and non-EU countries (blue). Different controls: no controls (top), macro fundamentals in T-1 (mid-top), spread pre-trend over 6 months (mid-bottom), VIX and FFR sensitivity (bottom).

Figure A9. LP-DiD 2009 Level 1, baseline and controls.

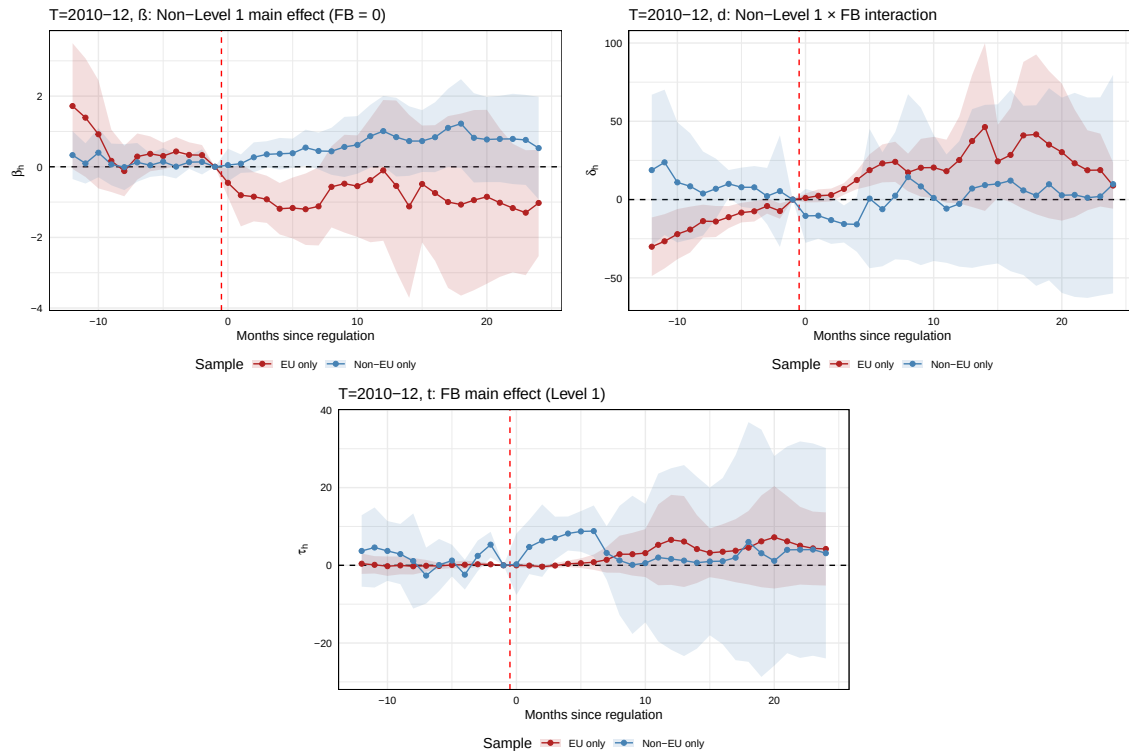


Note: Local projection difference in difference estimates for the effect of the January 2013 Basel III announcement weakening the LCR on yield spreads of non-Level 1 (below AA-) relative to Level 1 rated countries (AAA to AA-). Positive coefficients mean an increased spread of between low and high-rated countries, relative to the spread in (T-1). Left: full sample, right: separately for EU (red) and non-EU countries (blue). Different controls: no controls (top), macro fundamentals in T-1 (mid-top), spread pre-trend over 6 months (mid-bottom), VIX and FFR sensitivity (bottom).

Figure A10. LP-DiD 2013 Level 1, baseline and controls.

Level 1 interaction foreign bank share I suggested that the effect of the change in regulation on yield spreads mostly runs through the increase in bank demand for high-rated governments bonds and a decrease for others. As the LCR allows an exception for the domestic sovereign, I will focus on exposure to foreign banks. To study whether the effects are larger for countries that are more exposed to foreign banks i.e. have a higher share of their debt held by foreign banks, I interact the rating dummy with the share of countries debt held by foreign banks FB_i in the period before the treatment.

$$\Delta y_{i,h} = \alpha_h + \beta_h \text{NonLevel1}_i + \delta_h FB_i + \tau_h \cdot FB_i + \varepsilon_{i,h} \quad (\text{A3})$$



Note: Local projection difference in difference estimates for the December 2010 Basel III announcement interacting the rating variable with the share of government debt held by foreign banks. Plotting the response in the spread of non-Level 1 rated countries relative to Level 1 rated countries (top left) and for the interaction with foreign bank share (top right). Positive coefficients mean an increased spread for countries with higher exposure (foreign bank share) within the non-Level 1 group, relative to countries in that group with smaller exposure (foreign bank share), all relative to the spread in November 2010 (T-1). The bottom panel show the response relative to the foreign bank share for the spreads of Level 1 rated countries. All estimated separately for the sample of EU and the sample of non-EU countries.

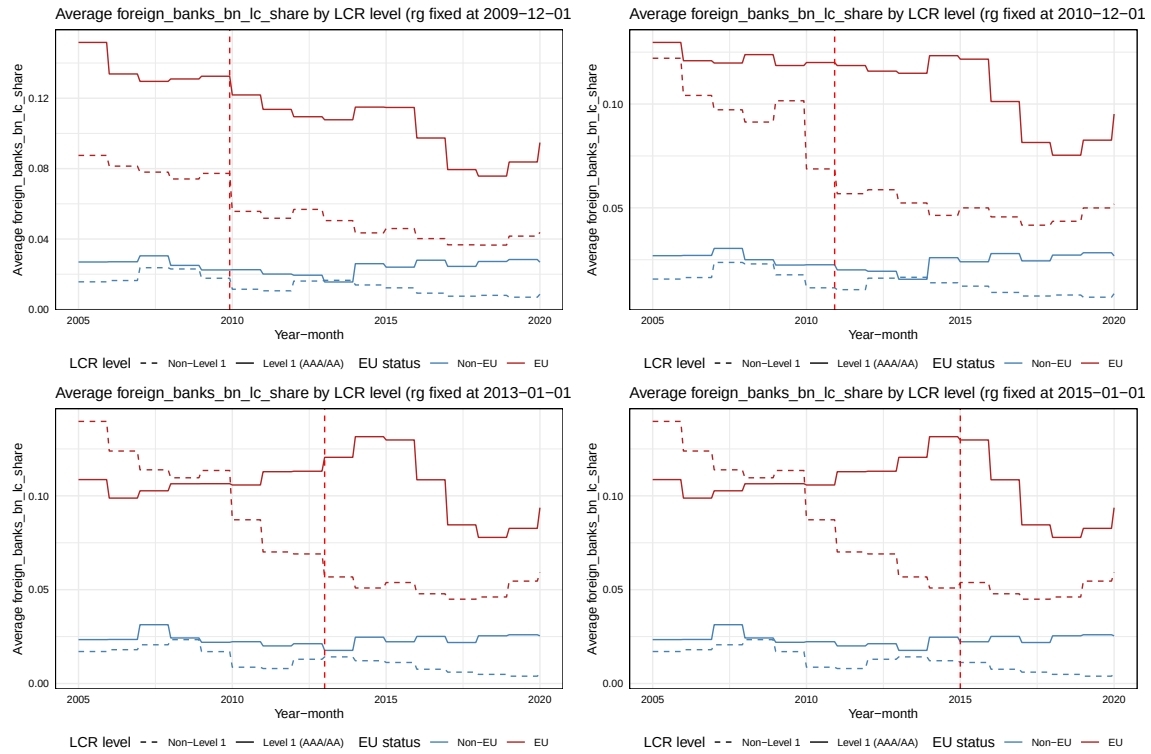
Figure A11. LP-DiD for December 2010 Basel III announcement by non-Level 1 dummy with foreign bank share interaction.

Level 1 foreign bank share Another option to assess the role of debt holding structure is to study how the changes in banking regulation affected the share of countries' debt held

by foreign banks depending on their rating. The only thing changed in this regression is the dependent variable. This no longer looks at the change in spreads but the change in foreign bank share, relative to the reference period before the event $\Delta FB_{i,h} = FB_{i,T+h} - FB_{i,T-1}$. The variables on the debt holding structure are only available yearly so I use the annual dataset for this analysis.

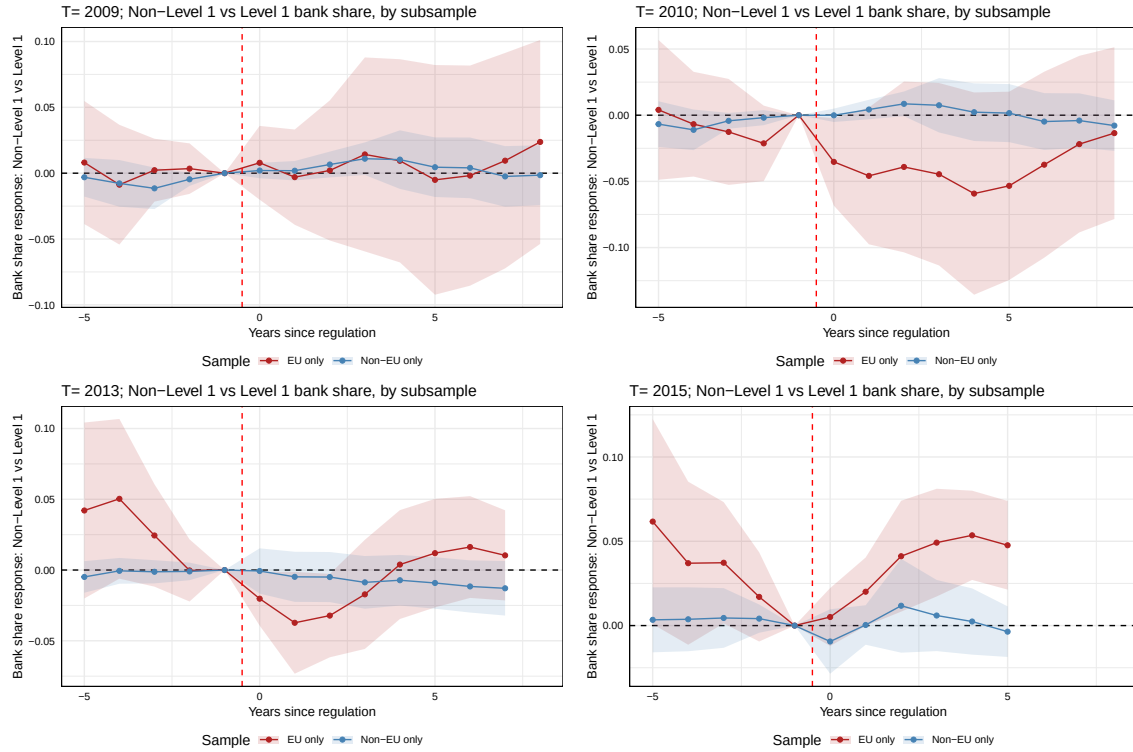
$$\Delta FB_{i,h} = \alpha_h + \beta_h \text{NonLevel1}_i + \varepsilon_{i,h} \quad (\text{A4})$$

Studying the effect of Basel III regulation on the share of government debt held by foreign banks we would expect an increase in the share of debt of high-rated countries held by foreign banks and a decrease or more moderate increase for lower-rated countries. In the estimations in figure A12 we do see a relative decrease in the share of debt held for AA and A rated countries but surprisingly an increase for lower-rated countries.



Note: Descriptive statistics of the evolution of share of government debt owned by foreign banks between 2005 and 2020, holding the rating variable constant at the respective event dates: 2009 (top left), 2010 (top right), 2013 (bottom left) and 2015 (bottom right). Separate for the sample of EU and of non-EU countries.

Figure A12. Share of government debt held by foreign banks.



Note: Local projection difference in difference estimates for the Basel III events on the share of government debt held by foreign banks. Plotting the response in the foreign bank share by non-Level 1 group relative to the response of the foreign bank share Level 1 rated countries. Positive coefficients mean that the share of a countries government bonds held by foreign banks of this rating group on average increased relative to that of Level 1 rated countries, normalizing T-1 to 0. By event date: 2009 (top left), 2010 (top right), 2013 (bottom left) and 2015 (bottom right).

Figure A13. LP-DiD effect of Basel III events on foreign bank share by Level 1 dummy.

Rating groups

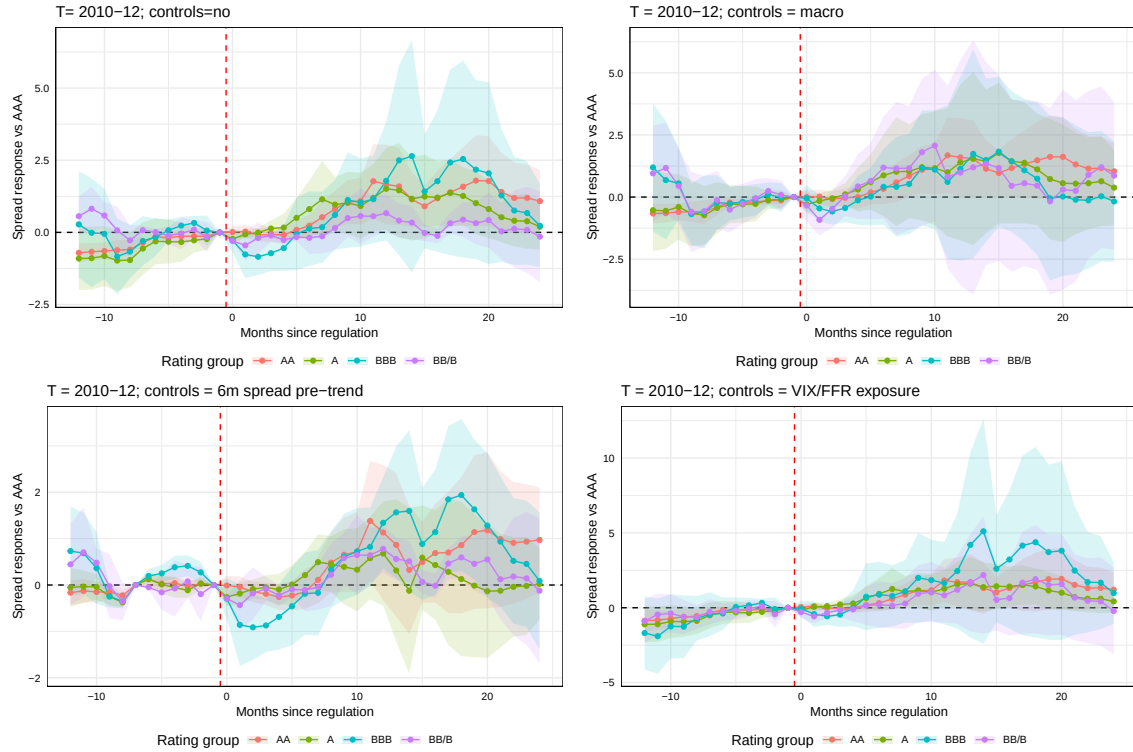
Rating group	2009-12	2010-12	2013-01	2015-01
AAA	Austria, Canada, Denmark, Finland, France, Germany, Luxembourg, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom, United States	Austria, Canada, Denmark, Finland, France, Germany, Luxembourg, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom, United States	Australia, Austria, Canada, Denmark, Finland, France, Germany, Luxembourg, Netherlands, Norway, Sweden, Switzerland, United Kingdom, United States	Australia, Austria, Canada, Denmark, Finland, Germany, Luxembourg, Netherlands, Norway, Sweden, Switzerland, United Kingdom, United States
AA	Australia, Belgium, Ireland, Italy, Japan, Portugal, Slovenia	Australia, Belgium, Ireland, Italy, Japan, Portugal, Slovenia	Belgium, New Zealand	Belgium, France, New Zealand
A	Chile, Czechia, Greece, Israel, Malta, Poland, Slovakia, South Korea	Chile, Czechia, Greece, Israel, Poland, Slovakia, South Africa, South Korea	Israel, Malta, Poland, Slovakia	Israel, Malta, Poland, Slovakia
BBB	Bulgaria, Hungary, Iceland, Lithuania, Mexico, Russia	Brazil, Bulgaria, Croatia, Hungary, Iceland, Lithuania, Mexico, Russia	Bulgaria, Iceland, Ireland, Italy, Latvia, Lithuania, Mexico, Romania, Russia, South Africa, Spain	Bulgaria, Iceland, Italy, Romania, Russia, Slovenia, South Africa, Spain
BB/B	Latvia, Romania	Colombia, Latvia, Romania	Cyprus, Hungary, Portugal	Cyprus, Greece, Hungary, Portugal
CCC and below			Greece	

Table A16. Country classification by sovereign rating group in December 2009, December 2010, January 2013 and January 2015.



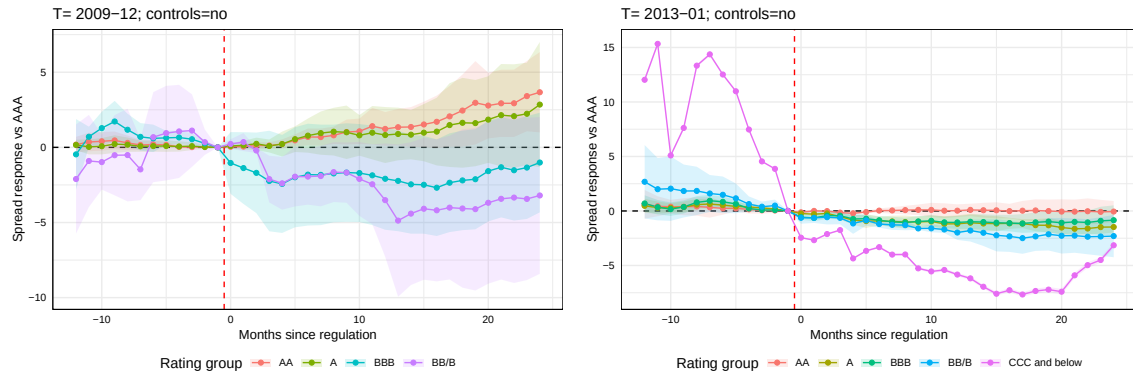
Note: Descriptive statistics of the evolution of yield spreads over the benchmark German yield. The panels show the average spread by rating group (fixed to 2009-12 ratings, top left, 2010-12, top right, 2013-01, bottom left, and 2015-01, bottom right) from 2005 to 2020.

Figure A14. Evolution of spreads as rating group average.



Note: Local projection difference in difference estimates with different specifications for the effect of the December 2010 Basel III announcement on yield spreads. Plotting the response in the spread by rating group relative to the response of AAA rated countries. Positive coefficients mean an increased spread of this rating group over the spread of AAA rated countries, relative to the spread in November 2010 (T-1). Baseline (top left), controlling for macroeconomic fundamentals (top right), for spread pre-trends over 6 months (bottom left) and for the spreads VIX and FFR sensitivity (bottom right).

Figure A15. LP-DiD for December 2010 Basel III announcement by rating group with different controls.



Note: Local projection difference in difference estimates with different specifications for the effect of the preliminary December 2009 Basel III announcement (left) and the January 2013 LCR refinement on yield spreads (right). Plotting the response in the spread by rating group relative to the response of AAA rated countries. Positive coefficients mean an increased spread of this rating group over the spread of AAA rated countries, relative to the spread in November 2009 (T-1). Baseline specification, no controls.

Figure A16. LP-DiD for December 2009 preliminary Basel III announcement by rating group.