The Real Effects of Credit Ratings:
The Sovereign Ceiling Channel*

Heitor Almeida

University of Illinois at Urbana Champaign

Igor Cunha

Nova School of Business and Economics

Miguel A. Ferreira

Nova School of Business and Economics

Felipe Restrepo

Ivey Business School - Western University

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Abstract

We show that sovereign debt impairments can have a significant impact on financial markets and real economies through a credit ratings channel. Specifically, we find that firms reduce their investment and reliance on credit markets due to a rising cost of debt capital following a sovereign rating downgrade. We identify these effects by exploiting exogenous variation on corporate ratings due to rating agencies' sovereign ceiling policies that require firms' ratings to remain at or below the sovereign rating of their country of domicile.

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1 Introduction

Sovereign debt impairments have become a significant problem for developed countries in the aftermath of the 2007-2009 global financial crisis and the European sovereign debt crisis. France and the United States were downgraded from a AAA credit rating for the first time in history, and other developed countries including Greece, Ireland, Italy, the Netherlands, Portugal, and Spain also experienced rating downgrades. How do sovereign debt impairments affect financial markets and real economic activity?

We examine this question by exploring the consequences of sovereign rating downgrades for firms' cost of capital, investment, and financing decisions. Our identification strategy exploits the variation on corporate ratings that is due to rating agencies' sovereign ceiling policies. These policies require firms' ratings to remain at or below the sovereign rating of their country of domicile. While rating agencies have been gradually moving away from a policy of never rating a private borrower above the sovereign, corporate ratings that "pierce" the sovereign ceiling are still not common (Standard & Poor's Rating Services (2012)).[1]

We show that the sovereign ceiling leads to an asymmetric change in corporate ratings following a sovereign downgrade. Firms with a rating equal to or above their sovereign prior to the downgrade (bound firms) are significantly more likely to be downgraded after a sovereign downgrade than firms rated below their sovereign (non-bound firms). One key advantage of our empirical strategy is that non-bound firms have similar but lower credit quality than bound firms. Thus, alternative explanations based on changes in fundamentals and credit risk are unlikely to explain the discontinuous change in ratings around the sovereign ceiling. The asymmetric effect of sovereign downgrades on firm ratings is thus likely to be due to the sovereign ceiling, and not to changes in fundamentals.

We trace down the financial and real consequences of this asymmetric effect of sovereign downgrades on bound firms. Specifically, we find that bound firms cut investment more than non-bound firms in the aftermath of a sovereign downgrade. We also find some evidence that bound firms reduce net debt issuance and increase equity issuance more than non-bound firms

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[1]In an article in CFO Magazine, Ryan (2013) summarizes the key implication of the sovereign ceiling as follows: "If a company is a better credit risk than its home country, it might still have trouble getting a credit rating agency to recognize that fact."

following a downgrade, although this evidence is not statistically as strong as the evidence for investment. Finally, we find that sovereign downgrades also affect corporate bond markets as the yields of bound firms increase more than yields of non-bound firms following a sovereign downgrade. The effect on the cost of debt capital is statistically and economically significant.

Credit ratings are a major concern for corporate managers' because of the frictions associated with ratings (Kisgen (2006, 2007)). First, ratings affect a firm's access to the bond and commercial paper markets, because rating levels determine whether institutional investors such as banks or pension funds are allowed to invest in a firm's securities. Second, ratings affect the capital requirements applied to banks and insurance companies when they invest in specific firms. Third, rating downgrades can trigger events such as bond covenant violations, increases in bond coupons or loan interest rates, and force bond repurchases.[2] Finally, ratings can impact customer and employee relationships and business operations including a firm's ability to enter or maintain long-term contracts. Because of these effects, firms appear to react to rating downgrades by reducing debt issuance and leverage (Kisgen (2009)).

We provide evidence on how rating downgrades matter in our context by focusing on ratings-based regulation. Basel II bank capital requirements are a non-linear function of ratings. Because of this non-linearity, some sovereign downgrades are more likely to cause changes in capital requirements applied to financial institutions. We find evidence that the financial and real consequences of sovereign downgrades are stronger for downgrades that matter most for capital requirements. While these results suggest that the regulation channel plays a role, they need to be taken with caution due to the small sample size and lack of statistical power.[3]

When financial markets operate normally, the consequences of sovereign downgrades may not spill over into firm decisions and real economic activity. For example, firms may be able to substitute equity for debt issuance. But periods of sovereign downgrades are far from normal. Local financial markets are likely to be in trouble, so it is difficult for firms to substitute equity for debt. Sovereign downgrades also tend to happen in periods of global financial turmoil,

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[2]For example, performance-sensitive debt may incorporate either explicit or implicit performance pricing provisions that depend on credit ratings (Manso, Strulovici, and Tchistyi (2010)). Manso (2013) shows that in this setting, rating downgrades can significantly amplify adverse shocks to firm fundamentals because of feedback effects between ratings and firm behavior.

[3]Our sample of bound (treated) firms includes 73 firms, so we have a limited ability to split the sample according to variables such as the likelihood of changes in capital requirements.

when even firms with access to global markets may find it difficult to raise alternative sources of finance. Thus, the impact of sovereign downgrades is often amplified by adverse market conditions.[4]

Our benchmark empirical specification employs the Abadie and Imbens (2011) bias-corrected matching estimator of the *Average Effect of the Treatment on the Treated* (ATT). We isolate firms at the sovereign bound (treated firms), and then, from the population of firms below the sovereign bound (non-treated firms), look for control firms that best match treated firms in multiple dimensions (country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending) before the treatment (sovereign downgrades).[5]

We find economically significant effects of sovereign rating downgrades. Treated firms investment goes from 26.6% to 17.7% of capital in the year of the downgrade, implying a 8.9 percentage points reduction. In contrast, control firms reduce investment by 2.6 percentage points, resulting in a difference-in-difference estimator of -6.4 percentage points and an ATT of -8.9 percentage points. The differential effects on investment are statistically and economically significant. Treated firms net debt issuance goes from 7.5% to 2.4% of assets, implying a 5.1 percentage point reduction. For control firms, net debt issuance falls only 2.3 percentage points. While the difference-in-difference estimator is statistically insignificant, the ATT is -5.5 percentage points, which is again statistically and economically significant. There is also some evidence that treated firms increase equity issuance more than control firms in the years after the sovereign downgrade. Finally, bond yields of treated firms increase by approximately 34 basis points more than yields of control firms in a period of three months after a sovereign downgrade relative to three months before. This differential effect is more pronounced as the post-event window widens. For example, the differential effect is 61 basis points six months after the downgrade.

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[4]Gande and Parsley (2005) show that sovereign downgrades have spillover effects on the credit spreads of other countries. In our sample, most sovereign downgrades happened in the aftermath of the Asian and Russian crises and the burst of the Internet bubble (end of the 1990s and beginning of the 2000s), and then following the financial crisis of 2007-2009. Thus, it may also be costly for firms to issue debt in other countries.

[5]While we match perfectly on country-year, it is difficult to find industry matches in smaller countries. Thus, our benchmark results use a sample of control firms that is not matched on industry. We obtain similar estimates when we use a smaller sample for which we can find control firms that match treated firms according to the Fama-French 12-industry classification.

We conduct several robustness tests and find the differential effect of sovereign downgrades on investment (ATT) ranges from 7% to 14% of capital, which is consistent with the benchmark results. This effect represents about 25% to 50% of the pre-crisis average investment for treated firms. Other papers that relate ratings and regulatory frictions to investment find effects of similar magnitude. For example, Lemmon and Roberts (2010) find that junk-rated firms net investment falls by about 33% following the introduction of regulations restricting the flow of institutional capital to these firms. Tang (2009) finds that firms that are upgraded due to Moody's 1982 ratings refinement increase investment by about 40%.

Overall, we interpret our results as follows. Treated firms find it more expensive to raise debt in the aftermath of a sovereign downgrade, which leads them to replace debt with equity and reduce investment. This difference across treated and control firms arises only following the sovereign downgrade, as there is no evidence of significant pre-existing differential trends in outcome variables.

The key assumption of our identification strategy is that sovereign downgrades are not related to differences in investment across treatment and control groups, other than through changes in ratings. This assumption would be violated if treated firms had unobservable characteristics that predict a greater sensitivity to sovereign debt crisis, even in the absence of downgrades.[6] To validate our exclusion restriction further, we conduct a series of placebo tests, including recessions, the 2007-2009 financial crisis, and currency crises that are not accompanied by sovereign downgrades. In all placebo tests, we find no significant differences in investment between treatment and control groups.

An additional concern is that treated firms may have greater exposure to the government than control firms. While our baseline specification controls for government ownership and exposure to government spending, these controls may not be sufficient. For example, the group of treated firms may include "national champions" that are expected to receive support from the government. More broadly, treated firms may be more exposed to the government's health (even without being a national champion). We further investigate this possibility in several

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[6]Our treatment group could, for instance, have many bank-dependent firms. Chava and Purnanandam (2011) find that bank-dependent firms are more affected during banking crises than firms with access to public debt markets. Carvalho, Ferreira, and Matos (2014) and Chodorow-Reich (2014) find that borrowers with pre-crisis relationships with less healthy lenders were more affected by the 2007-2009 financial crisis compared to borrowers of healthier lenders.

ways. First, we examine short-term effects of the sovereign downgrade on after-tax profitability
of treated and control firms. Second, we consider robustness tests in which we exclude firms
with government ownership or utilities from the treatment group. Third, we conduct a placebo
test in which treated firms are those with rating one notch below the sovereign, since these firms
might also be expected to receive government support. Finally, we examine whether security
(stock and bond) prices of treated and control firms are differentially affected by changes in the
prices of government securities.

The results of these tests suggest that exposure to the government is similar across treated
and control firms. Thus, our results are likely to be due to the sovereign downgrade itself, and
not to differential exposure to government shocks. Nevertheless, we cannot completely rule out
the possibility that the results may be partially driven by the government exposure channel,
since this channel may matter only in the aftermath of a sovereign downgrade.

Our work makes three contributions. First, we provide a novel link between sovereign debt
impairments and the real economy. Sovereign debt impairments can lead to sovereign down-
grades that induce corporate rating downgrades because of the ceiling rule. These sovereign-
driven corporate downgrades affect credit markets and real economic activity. Second, we
contribute to the literature that studies the effects of credit ratings on firm outcomes. Credit
ratings appear to matter for capital structure decisions (Kisgen (2006)) and cost of capital
(Kisgen and Strahan (2010), Baghai, Servaes, and Tamayo (2014)). There is also evidence
that ratings affect firm real decisions (Sufi (2009), Tang (2009), Lemmon and Roberts (2010),
Chernenko and Sunderam (2012), and Harford and Uysal (2014)).[7] However, it is challenging
to deal with omitted variables concerns because changes in ratings are correlated with changes
in firm fundamentals. Our results support the argument that ratings affect firm investment and
financial policy. Our effects seem to be driven specifically by changes in ratings, and not by
changes in fundamentals and crowding-out effects (e.g., Graham, Leary, and Roberts (2014)).
Finally, we contribute to the recent literature that studies credit supply effects on large and
high credit quality firms (Adrian, Colla, and Shin (2013) and Becker and Ivashina (2014a)).
We show that a negative shock to credit supply engendered by sovereign downgrades can have

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[7]There is also a literature on the relation between sovereign and corporate credit risk (e.g., Durbin and
Ng (2005), Borensztein, Cowan, and Valenzuela (2013), Augustin, Boustanifar, Breckenfelder, and Schnitzler
(2014), and Bedendo and Colla (2015)).

real effects even in the highest credit quality firms due to the ceiling rule.

Our study is subject to the standard limitations of quasi-natural experiments. We can only measure the consequences of sovereign debt impairments that are due to rating changes on bound firms. The estimates do not tell us much about the importance of sovereign debt for firms of different characteristics, or during periods of less turmoil. Our effects should also not be interpreted as the average effect of sovereign downgrades on real economic activity. Since there are only a few bound firms for each country, the aggregate magnitude of our effect is smaller than the effects that we report in the paper.[8] Additionally, sovereign downgrades can have other effects on economic activity that we do not measure. Adelino and Ferreira (2014) find that sovereign downgrades reduce the supply of bank lending, and Becker and Ivashina (2014b) find that sovereign debt crises can affect firms because of financial repression.

In short, the economic message of our findings can also apply to the country as a whole: the sovereign downgrade can engender a reduction in the supply of capital for the country due to a ratings channel (i.e., over and above the deterioration in fundamentals). This reduction in capital supply to firms can in turn affect real economic activity.

2   Methodology and data

We first describe our experimental design and the matching estimator that we use. We then describe the data and present summary statistics.

2.1   Sovereign downgrades and ceilings: Institutional background

Credit rating agencies play a crucial role in providing information about the ability and the willingness of issuers, including governments and private firms, to meet their financial obligations. The three major agencies – Standard & Poor's (S&P), Moody's, and Fitch – assign different types of ratings depending on the maturity (short-term or long-term) and currency denomination of an issue (foreign currency or local currency). We focus on the foreign currency long-term issuer ratings, which are the most likely to be bound by the sovereign rating. We

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[8]Since bound firms are typically large firms, the reduction in aggregate investment can be significant. Bound firms are responsible for 18% of the aggregate investment in a country, on average. Thus, a reduction in their investment by 25% implies a reduction of 4.5% in aggregate investment in a country.

prefer the S&P rating history over other agencies because S&P tends to be more active in making rating revisions and leads other agencies in re-rating (Kaminsky and Schmukler (2002), Brooks, Faff, Hillier, and Hillier (2004)). Rating announcements by S&P also seem to convey a greater own-country stock market impact and seem not to be fully anticipated by the market (Reisen and von Maltzan (1999)).

Until 1997, rating agencies followed a strict policy of not granting a private company a foreign currency rating higher than the sovereign rating. In April of that year, S&P first relaxed its sovereign ceiling rule in three dollarized economies: Argentina, Panama, and Uruguay.[9] Although rating agencies have moved away from a strict enforcement of the sovereign ceiling over the last two decades, corporate ratings that "pierce" the ceiling are still not common. Borensztein, Cowan, and Valenzuela (2013) show that sovereign ratings still represent a strong upper bound and an important determinant of ratings assigned to firms.[10]

Why do rating agencies use sovereign rating as an upper bound when they rate corporate issuers? Agencies use two key factors in rating issuers: the issuer's inherent likelihood of making repayment; and, in the case of foreign currency ratings, the issuer profile after taking into account the risk that capital and exchange controls might be imposed that would hinder the ability of issuers to meet their financial obligations in foreign currency. In general, rating agencies grant an issuer a rating above the sovereign only if it is able to demonstrate strong resilience and low default dependence from the sovereign, as well as some insulation from the domestic economic and financial disruptions typically associated with sovereign distress. Firms with foreign assets, high export earnings, and foreign parents are more likely to be rated above their sovereign.

Interestingly, S&P recently updated its methodology to address some of the limitations of the previous approach. Standard & Poor's Rating Services (2013) methodology applies a sovereign foreign currency default stress scenario (stress test) with respect to the country or countries where the firm has economic exposures and when the potential rating exceeds the rating on the sovereign (in general, the reference sovereign rating is a weighted average of the sovereign ratings of countries where the company has material exposures). Firms that pass the stress test

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[9]Fitch and Moody's followed suit in 1998 and 2001.

[10]For example, Standard & Poor's Rating Services (2012) reports only 54 non-financial corporations worldwide with ratings that exceed the sovereign rating as of October 2012.

can be rated up to two or four notches above the sovereign rating, depending on whether S&P views their sector's sensitivity to country risk as "high" or "moderate" respectively. As a result of the application of this new methodology, Standard & Poor's Rating Services (2013) expects that some corporations will receive upgrades. This suggests that S&P granted conservative ratings to some firms due to the sovereign ceiling before the recent revision of the methodology.

2.2 Identification strategy

The main challenge in tracing the effect of sovereign downgrades on firm outcomes is the inherent endogeneity between a sovereign's credit quality and the creditworthiness of firms in that country. We explicitly address this concern in our empirical strategy by examining the differential effect stemming from sovereign rating changes on firms that are bound by the sovereign ceiling (bound firms) and other firms in the same country that are not bound by it (non-bound firms).

Figure 1 shows the distribution of corporate ratings across sovereign rating classes. The figure shows that only a few corporations are rated above the sovereign ceiling and only by a limited degree. In our sample, 79% of firms receive a rating lower than the sovereign, 15% receive the same rating, and just 6% receive a rating higher than the sovereign.

Figure 2 illustrates the key empirical regularity that we use to identify causal effects of ratings on firm outcomes. The figure shows that the probability a corporate issuer will obtain a rating downgrade within the month of a sovereign downgrade is discontinuous exactly at the sovereign bound (where the difference between a firm's rating and its sovereign is equal to zero). The middle panel in Figure 2 shows that, conditional on the event of a sovereign downgrade, bound firms have a 59% chance of obtaining a rating downgrade within the month, compared to 9% and 4% for firms that are, respectively, one and two notches below the sovereign rating. The left panel shows that this disparity in the response of corporate of ratings is not observed in the month before the sovereign downgrade. The right panel shows the frequency of corporate downgrades in the month after the sovereign downgrade. Firms with rating one notch above the sovereign rating have the highest frequency of downgrade in the month after the sovereign downgrade, which is consistent with the ceiling rule. We conclude that bound firms have a significantly higher probability of downgrade than non-bound firms following a

sovereign downgrade.

The discontinuity in ratings downgrades across bound and non-bound firms is unlikely caused by factors other the sovereign ceiling rule. For example, a deterioration of macro-economic fundamentals could only generate this discontinuity if credit risk increases for bound firms, but stays constant for similar firms right below the bound. In fact, if there were any differential macro effects, better quality firms (our treatment group) should be less affected than poorer-quality firms (our control group).

Our evidence thus suggests that credit rating agencies continue to apply the sovereign ceiling rule in the event of a sovereign downgrade. Thus, the differential effect on firm outcomes across bound firms and non-bound firms in the event of a sovereign downgrade should stem from the change in ratings, and not from differences in fundamentals.

2.3   Matching approach

We test whether firms that are downgraded as a consequence of the sovereign ceiling change their investment and financial decisions. The treatment group includes bound firms (those with a rating equal to or above the sovereign rating of the firm's domicile country in the year prior to the sovereign downgrade). The non-treatment group includes non-bound firms (those with a pre-downgrade rating below the sovereign rating). Our analysis needs to account for the fact that treated and non-treated firms potentially have different observable characteristics.

One way to tackle this issue is to estimate differences between plausibly counterfactual outcomes and those that are observed in the data. The strategy we apply in our main tests is nonparametric, combining the sovereign downgrade episode with the use of matching estimators. The idea of this estimator is to first isolate treated firms and then, from the population of non-treated firms, find observations that best match the treated ones on multiple dimensions. In this framework, the set of counterfactuals is restricted to the matched controls; that is, in the absence of the treatment (in our application, sovereign downgrades), the treatment group would behave similarly to the control group.

We employ the Abadie and Imbens (2011) estimator, as implemented by Abadie, Drukker, Herr, and Imbens (2004). The Abadie-Imbens matching estimator minimizes the (Mahalanobis) distance between a vector of observed covariates across treated and non-treated firms to find

matched control firms. We select one matched control observation for each treated observation. The estimator allows control firms to serve as matches more than once, which (compared to matching without replacement) reduces the estimation bias but increases the variance. The Abadie-Imbens estimator produces exact matches on categorical variables, but less exact matches on continuous variables (though they should be close). The procedure corrects this issue by applying a bias-correction component to the estimates. The categorical variables include year, country, and whether a firm has a credit rating.[11] The non-categorical variables include firm size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending.

Inferences of the effect of sovereign downgrades are based on the Abadie-Imbens matching estimator of the *Average Effect of the Treatment on the Treated* (ATT). We perform difference-in-differences estimations by comparing changes in the outcome variables between treatment and control groups around the sovereign downgrade. Standard errors are clustered by country event (i.e., sovereign downgrade) to account for within-event residual correlation.

2.4   Sample and variable construction

The sample of firms is taken from the WRDS-Factset Fundamentals Annual Fiscal (North America and International) database. It includes firms from 80 countries for the 1990-2013 period. We exclude financial firms (SIC codes 6000-6999) because these firms tend to have significantly different investment and financial policies. We drop any observation with negative total assets. We obtain firm accounting and market variables from Factset and sovereign and corporate credit ratings (foreign currency long-term issuer ratings) from Bloomberg. We match firms in Factset to Bloomberg using ISIN, SEDOL, CUSIP, or company name. The initial sample includes 583,219 firm-year observations and 55,584 different firms. Only a small fraction of these firms have a rating (35,526 firm-year observations and 3,991 unique firms).

In our experiments, the outcome variables are the annual changes in firm investment, debt issuance, and equity issuance around a sovereign downgrade. *Investment* is defined as the ratio of annual capital expenditures (Factset item FF_CAPEX_FIX) to the lagged value of net

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[11]We also include industry (Fama-French 12 industry classification) as a covariate in an alternative control group.

property, plant, and equipment (Factset item FF_PPE_NET). *Net Debt Issuance* is computed from the statement of cash flows as the ratio of net debt issuance (Factset item FF_DEBT_CF) to the lagged value of total assets (Factset item FF_ASSETS). *Net Equity Issuance* is also computed from the statement of cash flows as the ratio of sale of common and preferred stock (Factset item FF_STK_SALE_CF) minus repurchase of common and preferred stock (Factset item FF_STK_PURCH_CF) to the lagged value of total assets. In some tests, we also consider other variables: return on assets (ROA), defined as the ratio of operating income (Factset item OPER_INC) minus income taxes (Factset item FF_INC_TAX) to the lagged value of total assets; *Long-Term Leverage*, defined as the ratio of long-term debt (Factset item FF_DEBT_LT) to total assets; *Leverage*, defined as the ratio of total debt (Factset item FF_DEBT) to total assets; and *Cash*, defined as the ratio of cash and short-term investments (Factset item FF_CASH_ST) to total assets.

Table 1 reports the number of treated firm-year observations by country and year. Table A.1 in the Internet Appendix presents the full list of treated firms as well as country of domicile, treatment year, and rating at the beginning and end of treatment year. There are 73 observations in the treatment group in 13 different countries that were downgraded a total of 24 times during the sample period. There have been more sovereign downgrades during our sample period (e.g., France), but we rely only on those for which we can identify treated firms in the downgraded country. The countries include both developed markets (Ireland, Italy, Japan, Portugal, Spain, and the United States) and emerging markets (Argentina, Brazil, Hungary, Indonesia, Mexico, Philippines, and Thailand). There are countries with multiple downgrades over the sample period, such as Italy with five downgrades, Argentina with four, Japan with three, and Portugal and Thailand with two. The median sovereign rating downgrade is one notch and the average is two notches. There are 14 downgrades during the post-2007 period corresponding to the global financial crisis and eurozone sovereign debt crises, but there are also a sizable number of downgrades in earlier periods.

The covariates are firm size, investment, Tobin's Q, cash flow, cash, leverage, and foreign sales. *Size* is defined as the logarithm of total assets. Tobin's Q is defined as the ratio of total assets plus market capitalization (Factset item FF_MKT_VAL) minus common equity (Factset item FF_COM_EQ) to total assets. *Cash Flow* is defined as the ratio of annual oper-

ating income (Factset item FF_OPER_INC) plus depreciation and amortization (Factset item FF_DEP_AMORT_EXP) to the lagged value of total assets. *Foreign Sales* is the ratio of foreign sales to total sales (Factset item FF_FOR_SALES_PCT). Covariates also include *Government Ownership*, defined as the total (direct and indirect) number of shares held by the government as a percentage of shares outstanding (using Factset ownership data); and *Government Exposure*, defined as the percentage of output purchased, directly or indirectly, by the government at the three-digit SIC level.[12] The matching estimator uses the pre-treatment (year prior to the sovereign downgrade) value of the covariates. To minimize the impact of outliers on these comparisons, we winsorize variables at the top and bottom 1% level.

We also match firms on year and their country of domicile. Thus, we impose that the control firm should match exactly the country and year of the treated firm so that we are effectively comparing outcomes within firms in the same country and year. We also require control firms to have a credit rating, as treated firms are necessarily rated.[13]

Our benchmark specification does not include industry as a covariate in the matching because the sample size is significantly reduced if we require an industry match in addition to country and year, especially in smaller countries. We also report estimates using an alternative group of control firms that matches the Fama-French 12 industry classification of treated firms. In this alternative specification, we can find a match within the same Fama-French 12 industry classification for 40 of the 73 treated observations. We drop the remaining 33 observations from this analysis.

2.5 Example

One of the firms in our treatment group comes from the energy business: EDP Energias de Portugal. S&P downgraded Portugal's sovereign rating on March 25, 2011, from A- to BBB

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[12]We thank Frederico Belo for providing us the government exposure variable used in Belo, Gala, and Li (2013).

[13]We implement the matching estimator using the Stata command nnmatch. The algorithm does not automatically force the match to be exact, but instead gives a weight of 1,000 (instead of 1) for the categorical variables for which we request an exact match. For example, the algorithm may find an observation in a different country-year that is closer to our treated observation based on the other covariates. This happens when the distance for the other covariates in the same country-year is so large that it cancels the effects of the large weight for country-year. In our application, we drop treated firms for which we are unable to find a match in the same country-year (15 observations out of 88 potential observations on treated firms). Thus, we end up with a sample of 73 treated firms.

and then on March 28, 2011 to BBB-. As a consequence, EDP was downgraded on March 28, 2011, from A- to BBB. The effect of the sovereign downgrade on the firm's rating was explained by Miguel Viana, Head of its Investor Relations Office, in the 2011 year-end results conference call:

> In terms of credit ratings, EDP recently suffered with downgrades by S&P and Moody's, penalized by the maximum notch differential allowed between EDP and Portugal Sovereign, so right now EDP is one notch above Portugal by S&P and two notches above Portugal by Moody's. Nevertheless, we consider that these by-the-book credit agencies methodologies are unable to reflect EDP's distinct credit profile, namely the geographical diversification, the high quality of our generation fleet, our resilient EBITDA, and the fact that our operations in Portugal have low sensitivity to the economic cycle.

The effect of the sovereign downgrade on EDP's investment and financial policy was explained by the chief executive officer, Antonio Mexia, in the 2011 and 2012 year-end results conference call:

> We are reducing CAPEX not only because of the evolution of the energy market but also to improve financials. The CAPEX fell 19% to less than 2.2 billion euros, especially because of the lower additions in the U.S. market. In the disposals program we reached 440 million euros in cash proceeds. I would also like to mention the fact that CAPEX were 2 billion euros, 7% lower on year-on-year basis, namely due to fewer expansion projects in wind power especially in the U.S. market, and by the fact that we went down the road once again in what concerns the deleveraging through disposals.

Although EDP signed a credit line of 2 billion euros in November 3, 2010, with a spread of 90 basis points over Euribor, the company saw the spread significantly increase as the facility terms included a credit rating grid (i.e., the spread to be paid at each level of rating). The managers' comments indicate that the link between the corporate ratings and sovereign ratings is due to ceiling policies and unrelated to firm fundamentals. EDP example shows how a rating downgrade can affect cost of capital, and investment and financial policy.

2.6 Summary statistics

Panel A of Table 2 compares means and medians of the covariates between the 73 treated firm-years and the remaining 21,618 non-treated firm-years (i.e., firms that are not assigned to the treatment group in the year prior to the sovereign downgrade). We restrict the group of non-treated firms to countries that have least one sovereign downgrade over the sample period. The treated firms are bigger and have higher investment rate, Tobin's Q, cash flow, and leverage values, and more government ownership than non-treated firms, on average. These differences are expected, given that we are relying on observational data. The goal of the matching estimator techniques is to control for these distributional differences, which could affect post-treatment outcomes.

Panel A of Table 2 also shows medians and means of the covariates for the matched control firms. The Abadie-Imbens matching estimator identifies a match for each firm in the treatment group. We have 73 firm-year observations in both groups, but because matching is done with replacement, we have 53 unique firm-year observations in the control group. The Pearson χ^2 statistic tests for differences in the medians of the covariates between the treatment and control groups.

After the matching procedure, there are no statistically significant differences in the pre-downgrade median values of the covariates across treatment and control groups, with the exception of cash flow and Q. The median cash flow and Q is higher for firms in the treatment versus the control group. The difference in cash flow cannot explain our findings, as we would expect firms with higher cash flow to be less affected by the sovereign downgrade than firms with lower cash flow. In contrast, the difference in Q can explain our findings, as firms with higher Q may be more sensitive to shocks than firms with lower Q.[14]

The last column in Table 2 compares the entire distributions of the matching covariates between the treatment and control groups using the Kolmogorov-Smirnov test. While treated firms differ significantly from non-treated firms, these differences disappear when we compare the group of treated firms to the group of matched control firms. Similarly to the median tests,

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[14]In subsection 4.5, we conduct a robustness test in which we use only Q and size (and categorical variables) as matching covariates. In this alternative sample, there is no difference in Q across treatment and control firms.

treated firms have higher average Q and cash flow than control firms. Table A.2 in the Internet Appendix shows the distribution support of the covariates across the three groups.

A concern is that treated firms could be more affected following a sovereign downgrade because of higher exposure to the government. Treated firms have average government ownership of 4% versus 3% for control firms, but the difference is statistically insignificant. The difference in exposure to government spending is also insignificant. The distribution of government ownership and exposure to government spending is also similar between treatment and control groups.[15]

Panel B of Table 2 shows medians and means of the covariates for the treated, non-treated, and matched control firms using the alternative matched sample with exact industry matching (Fama-French 12 industry classification). This alternative matching procedure generates similar groups to those in Panel A. There are no statistically significant differences in the pre-downgrade median and mean values of the covariates across treatment and control groups, with the exception of cash flow and Q.

3 Effect on corporate ratings

We examine whether sovereign downgrades have a differential effect on corporate ratings for bound firms (treatment group) and non-bound firms (control group). We expect treated firms to be more affected than otherwise similar firms at the time of a sovereign downgrade through the sovereign ceiling channel. Spillovers or common macro shocks associated with the sovereign downgrade, however, should affect treated and control firms equally or, if anything, they should affect control firms more than treated firms.

Table 3 presents the results of difference-in-differences matching estimators for corporate ratings. To perform this test we map the ratings into 22 numerical values (see Table A.3 in the Internet Appendix for details), where 22 corresponds to the highest rating (AAA) and one to the lowest (default). Panel A of Table 3 shows the average rating value for treated and control

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[15]We also check whether treated and control firms differ in terms of debt maturity structure or debt rollover risk (e.g., Almeida, Campello, Laranjeira, and Weisbenner (2012)). There are no significant differences in the distribution of the ratio of long-term debt to total assets (*Long-Term Leverage*) between treatment and control groups (see Table A.2 in the Internet Appendix).

firms in the year before the sovereign downgrade and in the year of the sovereign downgrade. Not surprisingly, we see that the pre-downgrade rating is significantly higher for treated firms than for control firms. The average treated firm has a rating value of 16 (i.e., A-), and the average control firm has a rating value of 13 (i.e., BBB-).

We find that sovereign downgrades have a much stronger effect on treated firm ratings with a reduction of 1.4 notches, while control firms ratings are reduced by only 0.7 notches. These estimates suggest that ratings decline 0.7 notches more for bound firms than for otherwise similar firms that are not bound by the sovereign ceiling. The effect of the sovereign downgrade on treated firm ratings is nearly one-to-one, while control firm ratings are not significantly affected by the sovereign downgrade. The median sovereign rating downgrade is one notch and the average is two notches.

Panel A of Table 3 also reports the differential change in ratings that is produced by the matching estimator of the ATT. The estimate is equal to -0.9 notches, indicating a significant asymmetry in the reaction of treatment and control group ratings to a sovereign downgrade. Panel B shows similar results using the matched sample with industry match. The ATT estimate is stronger at -1.4 notches.

Figure 3 plots the evolution of corporate ratings in the two years before and after the sovereign downgrade for the treatment and control groups. The ratings of the two groups follow parallel trends before the sovereign downgrade. Furthermore, the ratings fall significantly more for the treatment group in the year of the downgrade (between year -1 and year 0) than for the control group.

We perform other tests to study the relation between sovereign ratings and corporate ratings. We test whether bound firms have a more "pessimistic" rating than non-bound firms. Tables A.4 and A.5 in the Internet Appendix show that ratings are more pessimistic for bound firms than non-bound firms with the same actual ratings. This finding is consistent with the notion that the sovereign ceiling represents a meaningful friction and not just an unbiased and accurate assessment of a firm's creditworthiness.

4 Effect on investment and financial policy

We examine the investment and financial policy of the treated and matched control firms around sovereign downgrades.

4.1 Investment policy

Panel A of Table 4 presents the results of difference-in-differences matching estimator for investment rates around sovereign downgrades as measured by annual capital expenditures as a percentage of capital (*Investment*). The table shows the investment rates in the year before the sovereign downgrade and in the year of the sovereign downgrade. Firms in the treatment group (those with pre-downgrade rating equal to or above the sovereign rating) are compared with close counterfactuals (matched control firms). We find that treated firms cut investment significantly more than control firms at the time of a sovereign downgrade. For firms in the treatment group, average investment drops from 26.6% of capital to 17.7%, a fall of 8.9 percentage points. For control firms, investment falls only slightly from 19.2% of capital to 16.6% of capital, a fall of 2.6 percentage points. Therefore, investment is reduced by 6.4 percentage points more for treated firms than control firms, which is statistically and economically significant.

Panel A of Table 4 also reports the differential change in investment that is produced by the bias-corrected matching estimator of the ATT. The ATT is equal to -8.9 percentage points, which corresponds to 33% of the pre-downgrade investment level for treated firms.

The ATT estimate is significantly higher (in absolute terms) than the difference-in-differences estimate because it introduces a bias correction to take into account the differences in the distribution of covariates between the treatment and control groups. For example, control firms have lower average cash flow than treated firms. Since firms with lower cash flow are expected to have a larger reduction in investment, the difference-in-differences estimate is biased downwards (in absolute terms). If control firms were to have a cash flow distribution similar to that of treated firms, then the differential reduction in investment across treated and control firms would likely increase.

Panel B of Table 4 reports the estimates using the alternative matching procedure in which the control firms match the industries of the treated firms. The differential change in investment

produced by the matching estimator of the ATT is -6.7 percentage points. This effect is lower than that in Panel A but still statistically and economically significant; the ATT corresponds to about 25% of the pre-downgrade investment level for treated firms.

A concern about inferences from the treatment effects framework is whether the processes generating the treatment and control group outcomes would have followed parallel trends in the absence of the treatment. Differences in the post-treatment period can only be attributed to the treatment when this assumption holds. While this is not a direct test of the parallel trends assumption, it is standard in the literature to examine the evolution of the outcome variable (*Investment*) in the years leading to the treatment separately for the treatment and control groups. If trends are not parallel prior to the event, it is unlikely that post-event differences can be attributed to the treatment.

Figure 4 plots the evolution of investment rates in the two years before and after the sovereign downgrade. The investment processes of the two groups follow similar trends before the downgrade. Investment falls dramatically for the treatment group in the year of the downgrade and only slightly for the control group. In the two years following the downgrade, the investment processes again follow similar dynamics. Thus, we identify a unique effect on investment at the time of the sovereign downgrade.[16]

4.2   Placebo tests

A potential concern regarding our difference-in-differences approach is whether macro factors other than sovereign downgrades affecting both treatment and control groups can explain the differential behavior in the post-treatment period. For example, treated firms can have greater exposure to adverse economic conditions and credit supply shocks, which may happen at the same time as sovereign downgrades. One appealing feature of our identification strategy is that it is difficult to find a story in which higher-quality (treated) firms are more affected than lower-quality (control) firms.

In order to strengthen the interpretation of the results, we replicate exactly the same experi-

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[16]We further check the parallel trend assumption for investment rates by computing the difference between treatment and control groups between year -2 and year -1. The ATT estimate is -0.2 percentage points and statistically insignificant, which supports the notion that the investment policy of our treatment and control groups only diverge from each other after the downgrade.

ment that we run for sovereign downgrades but using placebo periods. That is, we use sovereign and corporate rating information to sort firms into treatment and non-treatment groups, and covariates to produce a matched control group of firms. We then compare treated versus control firm investment behavior during periods without sovereign downgrades. We consider three placebo periods: (1) recession periods; (2) the 2007-2009 financial crisis; and (3) currency crises. These falsification tests can help to rule out the possibility that treated firms are more sensitive to demand and credit supply shocks than control firms.

Panel A of Table 5 presents the results of the placebo test using recession periods without sovereign downgrades. We identify recession periods using the Organisation for Economic Co-operation and Development (OECD) recession indicators for each country drawn from the Federal Reserve Economic Data (FRED) database. For each country, we exclude recession years in which the country is downgraded.[17] There are 53 treated and control firms in this placebo test. Treated and control firms have virtually identical investment dynamics before recessions. More important, there is no difference in investment rate between the two groups of firms in the post-treatment period. The ATT estimate is 0.6 percentage points and statistically insignificant. Simply put, our treatment-control differences do not appear in recession periods that are not accompanied by sovereign downgrades.

Panel B of Table 5 presents the results of the placebo test using the 2007-2009 financial crisis. We exclude countries that experienced downgrades during the crisis. This crisis was characterized by a large shock to the supply of capital to firms. We find that the control group cuts investment by 1.4 percentage points more than the treatment group in the aftermath of the crisis, which is consistent with the idea that treated firms are *less* affected than control firms in periods of financial turmoil. The ATT estimate is 1.9 percentage points but statistically insignificant.

Panel C of Table 5 presents the results of the placebo test using currency crises that are not accompanied by sovereign downgrades. This placebo addresses the concern that currency crises affect treatment and control groups differently. For example, treated firms may be more affected by a currency depreciation because they use more foreign currency debt than control

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[17]The recession indicator is available for 38 countries with monthly frequency and we adopt the "From the Period following the Peak through the Trough" definition. We aggregate the monthly series into an annual series, and classify a country as being in a recession in a given year if it has more than six months of recession.

firms. If this is the case, we should find differential effects between treatment and control groups during currency crises. The currency crises indicators for each country are taken from Reinhart and Rogoff (2009).[18] We find no difference in the investment rates of the two groups at the time of currency crises. The ATT estimate is 0.5 percentage points and statistically insignificant.

Panels A-C of Figure A.1 in the Internet Appendix plot the evolution of investment rates in the two years before and after recessions, 2007-2009 financial crisis, and currency crises, respectively. The investment rates for treated firms are higher than those for control firms, but the investment processes follow similar dynamics around the placebo periods. There is no evidence that treated firms are not more affected than control firms around placebo periods.

An additional concern is that treated firms may have greater exposure to government fiscal crises than control firms. The group of treated firms may include some "national champions" that might be expected to receive support from the government and that the sovereign downgrade reduces the value of these explicit or implicit subsidies.[19] Additionally, treated firms might be subject to higher corporate taxes at the time of a sovereign downgrade associated with a sovereign debt crisis. Another alternative is that treated firms could sell more goods or services to the government than control firms. We believe that these alternative hypotheses are unlikely to explain our results, since the matched control group includes firms of similar but lower credit quality and in the same country as those in the treatment group. Control firms also have similar exposure to government spending (which is one of our matching variables). To further examine the alternative explanation that a differential exposure to a government factor drives our results, we perform several tests.

First, we repeat our investment tests after excluding firms with government ownership from the treatment group (13 observations). Panel A of Table 6 presents the results. We obtain slightly higher differential effects on investment (ATT is -13 percentage points). Thus, if anything, government ownership seems to protect firms against the adverse effects of a downgrade. We also repeat our tests after excluding utilities (SIC codes 4900-4999) from the treatment

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[18]The currency crises indicators are available up to 2010 on Carmen Reinhart's website at http://www.carmenreinhart.com/. We update the currency crises indicators for the 2011-2013 period.

[19]For example, Moody's announcements around Japan's downgrade mentioned bank and government support for the country's major firms, such as Toyota: "The ratings of these corporates incorporate one or two notches of uplift to their stand-alone credit profiles, reflecting our expectation for strong support from the major domestic banks and the government to many Japanese corporates, including these six issuers."

group, since these firms are arguably the most likely to have direct links to the government and receive support. The number of treated firms goes down to 41 firm-year observations, but the main results are robust. Panel B of Table 6 shows that the matching ATT is -13.8 percentage points when we exclude utilities. Table A.6 in the Internet Appendix shows that the estimates are qualitatively similar to those in Table 6 when we use the alternative matching procedure in which the control firms match the industries of the treated firms.

Second, Panel C of Table 6 presents the results of a placebo test that compares firms with rating one notch below the sovereign (treated firms) to matched control firms with rating more than one notch below the sovereign. There are 40 treated and control firms in this placebo test. There is no difference in investment rate between the two groups of firms around sovereign downgrades. The absence of differential effects shows that our effects do not simply capture highly rated firms, but firms that are bound by the sovereign ceiling.

Third, we study the implications for security prices. If treated firms are systematically more exposed to a government factor relative to control firms, then the sensitivity of treated firms' security prices to changes in the price of government securities should be higher. The advantage of exploring this implication is that it should hold even if there is some unobservable factor through which firms are exposed to the government.

We explore this possibility by examining the sensitivity of both corporate yields and stock returns to government yields for bound and non-bound firms. Panel A of Table 7 shows the estimates of regressions of corporate bond yields on a dummy variable that takes a value of one if a firm has a rating equal to or above the sovereign rating in year $t-1$ (*Bound*), the 10-year constant maturity sovereign bond yields (*Sovereign Yield*), and the interaction between the two variables. The sample consists of monthly data on local currency bond yields for the treated and matched control firms from 1990 through 2013 (31 treated firms and 11 control firms for which bond yields and their corresponding 10-year sovereign bond yields are available). We use the whole time series of yields for each bond issue and thus we do not restrict the sample to sovereign downgrades, as our purpose is precisely to explore a channel that potentially links government and corporate outcomes other than through the sovereign ceiling. The base model in column (1) includes time and country fixed effects, while columns (2) and (3) add firm fixed effects, corporate ratings fixed effects, and bond issue controls (coupon rate, issue amount in

U.S. dollars, and maturity).

As expected, there is a strong and positive association between corporate and government yields. The coefficient on *Sovereign Yield* is about 0.6-0.7. More importantly however, the coefficient on the interaction term *Sovereign Yield × Bound* is negative in all specifications and generally statistically insignificant, which does not support the hypothesis that treated firm yields are systematically more sensitive to changes in government yields. If anything, the negative coefficient would suggest that the market price of treated firms' debt securities is less sensitive to changes in government bond yields.

Panel B of Table 7 presents estimates of a similar analysis to test whether the stock returns of treatment and control firms have systematically different government betas. We run a regression of a firm's monthly stock return on its local stock market return (*Market Return*), the monthly change in 10-year constant maturity sovereign bond yields ($\Delta Sovereign\ Yield$), and the interactions of each of these two variables with *Bound*. The sample consists of monthly observations on stock returns for the treated and matched control firms from 1990 through 2013 (55 treated firms and 25 control firms for which stock returns are available). As in Panel A, we use the whole time series of stock returns for each firm. The base regression in column (1) shows that, if anything, bound firms have a statistically lower stock beta relative to control firms: 0.67 for the treatment group versus 0.83 for the control group. More importantly for our purpose, the magnitude of the "government beta" does not appear to differ across the two groups, as shown by the statistically insignificant coefficient on the interaction term $\Delta Sovereign\ Yield \times Bound$ in columns (2) and (4). We also explore the sensitivity to the government using the industry-level measure of exposure to government spending in the regressions in columns (3) and (4). The interaction term *Gov. Exposure × Bound* coefficient is statistically insignificant, which is consistent with results using sovereign bond yields. We conclude that treated firms do not appear to be systematically more exposed to a government factor than control firms.

Finally, we check whether there is a differential effect on the after-tax profitability of treated firms versus control firms. If there is differential government support to treated and control firms, we should observe short-term effects on the profitability of these firms. We examine the differential effect on return on assets (ROA) after taxes. Table A.7 in the Internet Appendix shows that there is no differential effect of sovereign downgrades on the profitability of treated

firms in the year of the downgrade.

4.3   Financial policy

We examine whether sovereign downgrades affect the financial policy of treated and matched control firms differently. We expect treated firms to reduce debt issuance, as they face a contraction in debt supply and an increase in the cost of debt, and expect control firms to be less affected.

Table 8 examines the effect of a sovereign downgrade on net debt issuance as a percentage of assets (*Net Debt Issuance*) in Panel A, and net equity issuance as a percentage of assets (*Net Equity Issuance*) in Panel B. Immediately following the downgrade, treated firms experience a sharp decrease in net debt issuance from 7.5% of assets to 2.4%, a fall of 5.1 percentage points. For control firms, the net debt issuance falls by 2.3 percentage points. The difference-in-difference estimator is -2.8 percentage points but statistically insignificant. The table also reports the differential change in net debt issuance that is produced by the bias-corrected matching estimator of the ATT, which is equal to -5.5 percentage points. The effect is statistically significant at the 5% level. Unlike debt issuance, there is no significant reduction in equity issuance after the downgrade for the treatment group. The control group experience a decrease in net equity issuance of 2.4 percentage points. The ATT of net equity issuance is equal to 2.6 percentage points, which is statistically significant at the 5% level. Table A.8 in the Internet Appendix reports the estimates using the alternative matching procedure in which the control firms match exactly the industries of the treated firms. The differential effects on net debt and equity issuances are qualitatively similar to those in the benchmark specification but more imprecisely estimated due to the smaller sample size.

Panels A and B of Figure 5 plot the evolution of net debt and equity issuance in the two years before and after the sovereign downgrade for treatment and control firms. The security issuance processes of firms in the two groups follow similar trends before the downgrade although there is a spike in debt issuance just before the sovereign downgrade. Panel A shows that net debt issuance falls dramatically for the treatment group in the year of the downgrade and only slightly for the control group. In the two years following the downgrade, the debt issuance

processes again follow similar dynamics.[20]

Panel B shows that net equity issuance has a different behavior as it falls significantly for the control group in the year of the downgrade and only slightly for the treatment group. Furthermore, equity issuance increases for the treatment group in the year after the sovereign downgrade, while it stays unchanged for the control group. Taken together, this evidence suggests that treated firms experience a shock to the ability to raise debt following a sovereign downgrade, and this shock leads firms to replace debt with equity.

We also examine the relative change in leverage and cash holdings for treatment and control groups. The predictions for leverage and cash are less clearcut. The negative shock to treated firms' ability to issue debt should cause them to have lower leverage. On the other hand, the sharp reduction in investment should decrease asset growth and push towards higher leverage. Cash holdings are also affected by multiple forces. On one hand, treated firms could use some of their cash to help withstand the negative financial shock associated with the downgrade. On the other hand, they may have incentives to save more cash to regain their pre-downgrade credit rating, or simply for precautionary reasons. Table A.9 in the Internet Appendix presents the results. We do not find significant differential effects in leverage and cash holdings.

Overall, the evidence suggests that rating downgrades generate a contraction in the supply of debt capital and an increase in its cost, which leads to lower investment rates and less use of debt.

4.4   Linear regression model

While the nonparametric matching approach is well-suited for our test strategy, we also implement reduced-form linear regressions to examine whether firms' investment rates drop for firms that are bound by the sovereign ceiling following a sovereign downgrade.

First, we run a pooled OLS regression using the sample of all firms in the 1990-2013 period. The dependent variable is the annual change in the investment rate ($\Delta Investment$) in year t. The main explanatory variables are a dummy variable that takes a value of one if a firm has a

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[20]We also find that the difference in net debt and equity issuance between treatment and control groups between year -2 and year -1. The ATT estimates of net debt and equity issuance are 2.98 and -0.14 percentage points respectively, and statistically insignificant, which supports the notion that the change in financial policy is not part of long-term trends before the downgrade.

rating equal to or above the sovereign rating in year $t-1$ (*Bound*), a dummy variable that takes a value of one if a firm's country rating is downgraded in year t (*Sovereign Downgrade*), and the interaction term *Bound × Sovereign Downgrade*. The interaction term coefficient captures the difference in the reaction of the investment rate between treated firms and non-treated firms following a sovereign downgrade.

Table 9 reports the estimates. Column (1) shows that treated firms cut their investment by 9.6 percentage points more than other firms as indicated by the interaction term coefficient. The group difference estimate is significant at the 5% level. In column (2), we estimate the investment regressions including the same covariates (coefficients not shown) as in Table 2. While these controls predict changes in investment in their own right, their inclusion does not materially alter the coefficient on the interaction term. The estimated group-mean difference increases slightly to 10.2 percentage points. Columns (3)-(5) present additional estimates using combinations of year, industry (two-digit SIC), country, and firm fixed effects. In particular, column (5) presents estimates using country-by-industry-by-year fixed effects so the effect is driven only by within country-industry-year variation.

Overall, the magnitude of the group difference estimates in Table 9 are similar at about 10 percentage points and statistically significant in all specifications. Furthermore, the difference between the two groups of firms outside the sovereign downgrade period becomes statistically insignificant when we include country fixed effects, as indicated by the *Bound* coefficient. The linear model regression estimates are consistent with those reported under the matching estimator approach in Table 4.

4.5 Robustness

We perform several robustness checks of our primary findings on the effect of rating downgrades on corporate investment. The results of these tests are reported in the Internet Appendix.

We first account for the presence of serial correlation in the data and consider a wider event window. Following Bertrand, Duflo, and Mullainathan (2004), we collapse the investment and debt issuance data into two periods before and after the downgrade: window (-2,-1) and window (0,+2). Tables A.10 and A.11 in the Internet Appendix report the results. The differential change in investment produced by the matching ATT is -6.0 percentage points and statistically

significant. The ATT of net debt issuance is also significant at -3.9 percentage points.

To check the sensitivity of our findings to outliers, we obtain estimates by deleting one firm at a time from our sample. In all cases we obtain similar estimates of the matching ATT of investment at about -9 percentage points. The treatment group includes 18 observations corresponding to Japanese firms. We obtain similar estimates of the ATT of investment at -14.5 percentage points and statistically significant when we exclude these observations from the sample.

The next robustness test excludes firms with ratings above the sovereign from the treatment group, as these firms may be systematically different from firms with rating equal to the sovereign. Table A.12 in the Internet Appendix reports the results of the difference-in-differences estimator of investment using this alternative treatment group. Not surprisingly, the effect is even stronger than in Table 4. The differential change in investment rate produced by the matching estimator of the ATT is -10.7 percentage points and is statistically significant.

We also compare the effects for firms that actually get downgraded following a sovereign downgrade, with those that do not; 36 treated firms out of 73 are actually downgraded in the year of the sovereign downgrade. We find that the reduction in investment is driven by the firms that are actually downgraded. The average change in investment rate for firms that are downgraded is -19.3 percentage points, while for firms that are not downgraded is 1.4 percentage points. This result provides additional evidence that the reduction in investment is in fact associated with rating downgrades.

We also address the concern that pre-treatment average Q is higher for firms in the treatment versus the control group. We construct a control group in which we use only Q and firm size (and categorical variables) as matching covariates. In this alternative, the differential effect in investment is similar at -11.1 percentage points and remains statistically significant.

We further check whether treatment and control groups differ in terms of their exposure to foreign currency debt and bank debt using Capital IQ data. Figure A.2 in the Internet Appendix shows the evolution of foreign currency debt (as a percentage of total debt) in the three quarters before and after the sovereign downgrade. We find that treatment and control group have similar exposure to foreign currency debt before the downgrade. Following the sovereign downgrade, firms seem to increase the exposure to foreign currency debt, but the

increase is more pronounced for the control group. We also examine the evolution of bank debt (as a percentage of total debt) before and after the sovereign downgrade. We find that the debt structure of treatment and control group contains similar levels of bank debt at 12% and 10% of assets, respectively. Thus, there is no indication that treated firms are more affected because they rely more on bank debt and lending relationships (and consequently less on public debt markets) than control firms.

A final issue is that the relative drop in the supply of capital to treated firms may be caused by a financial repression story. Becker and Ivashina (2014b) show that during the recent Eurozone sovereign debt crisis, governments use the domestic financial sector (e.g., banks, pension funds, insurance companies) to absorb government debt, which monopolizes investor demand for highly rated corporate securities. Such financial repression may affect our treated firms more than control firms, because government debt is a closer substitute to debt securities issued by firms with high ratings. In order to examine whether financial repression may explain our results, we limit the control group to firms within three notches of the sovereign rating. If our differential effects are due to financial repression, then they should disappear or at least be mitigated in these alternative control groups in which corporate debt is a closer substitute to government debt. We find that the results are similar when we consider this alternative control group. The matching ATT in the investment tests is about -10.3 percentage points and statistically significant. These results do not support the financial repression explanation for our results.

5 Effect on cost of debt

The evidence indicates that bound firm ratings are more affected by sovereign downgrades than non-bound firm ratings. While rating changes resulting from the sovereign ceiling downgrade do not reveal any new information, the cost of debt may be affected due to rating-based regulatory frictions. The increase in the cost of debt would be consistent with a contraction in debt capital supply and a negative impact on firm investment and financial policy following a sovereign downgrade.

To evaluate the impact on the cost of debt we rely on corporate bond yields. We collect

data from Bloomberg on end-of-the-month yield to maturity of bond issues for the treated and matched control firms from 1990 through 2013. We use yields for local currency bond issues because they are available for the majority of firms in the treatment and control groups, while yields for U.S. dollar-denominated bonds are limited to a small fraction of our sample. We drop floating-rate notes, insured bonds, and bonds with option-like features (i.e., convertible, callable, and puttable bonds). We also require that bond issues have at least one observation in the pre-downgrade period and one in the post-downgrade period. The final sample of bond yields includes 20 treated firms (342 issues) and 11 control firms (134 issues).

We estimate regressions to examine whether bond yields increase for bound firms versus non-bound firms following a sovereign downgrade. The dependent variable is the change in yield around the sovereign downgrade, i.e., the yield on firm's i bond j measured t months after each sovereign downgrade minus its yield s months prior to the event ($\Delta Yield_{i,j,t-s}$). Because we perform these tests at the bond issue level, we focus on the change in yield around sovereign downgrades to control for issue-specific effects. We perform event studies with different values of t around the time of the sovereign downgrade to capture the response of bond markets and take into account that rating changes can be anticipated.

The *Bound* coefficient captures the differential effect on the yield of bound firms relative to non-bound firms, as the dependent variable is the change in yield around the sovereign downgrade. We control for coupon rate, issue amount (in U.S. dollars), maturity, and ratio of issue amount to total amount issued (outstanding for each firm). The regressions also include country-event fixed effects, which corresponds to estimating the differential impact of the sovereign downgrade on the bond yield of bound firms versus non-bound firms for the same country-event. Standard errors are clustered by country-event.[21]

Table 10 reports the results for event windows starting three months prior to a sovereign rating change. When looking at the yield three months after the event, the average yield for bound firms increases by 34 basis points more than for non-bound firms. As the event window widens to six months after a sovereign downgrade, the differential effect increases to 61 basis points.

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[21]We include country-event fixed effects because the sample of yields is unbalanced with a different number of treated and control observations for each event. We are not able to include industry-event fixed effects due to the small sample size.

Figure 6 shows the monthly evolution of bond yields for bound and non-bound firms in the ten months before and after the sovereign downgrade. While the yields of non-bound firms stay fairly constant over time, the yields of bound firms increase steadily over time after the sovereign downgrade.[22]

We conduct a placebo test using periods of large increases in sovereign bond yields without sovereign downgrades. This test addresses the concern that treated firms may have greater exposure to a deterioration in government fiscal position as they are are more likely to receive government support. We identify the placebo events by taking the month with the maximum increase in sovereign bond yields in a given country and year. For each country, we exclude periods in which the country is downgraded in the six months before or after the month of the event. We estimate the same model as in Table 10. Table A.13 in the Internet Appendix reports the results. We find that the coefficients are statistically insignificant in this falsification test, which indicates that differences between bound and non-bound firms do not appear during periods of deterioration in government fiscal position without sovereign downgrades.

6   Mechanism: Why do rating downgrades matter?

In this final section, we provide evidence that rating-based regulatory frictions help to explain the effects of downgrades on investment and financial policy. Under Basel II, ratings affect the capital requirements applied to banks and insurance companies when they have claims on specific sovereigns or firms. The rating bins on sovereign claims and their corresponding risk weights are as follows: AAA to AA- (0%); A+ to A- (20%); BBB+ to BBB- (50%); BB+ to B- (100%); and below B- (150%). We split the sample in two subsamples: (1) when the sovereign downgrade implies a change in the rating bin; and (2) when the sovereign downgrade does not imply a change in the rating bin. Our prediction is that the sovereign downgrade will have stronger effects when a sovereign changes of rating bin as a result of the downgrade. In this case, the sovereign downgrade should have a particularly large effect on the supply of capital

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[22]It takes approximately two months after the sovereign downgrade for the bond yields of bound firms to increase. If the effect of ratings is indeed induced by ratings-based regulatory constraints, it takes time for investors to adjust their holdings of bond securities. Kisgen and Strahan (2010) find that the regulatory effect on the cost of debt is important, but that it takes a few months to be observed in a sample of U.S. firms.

to bound firms, if they are downgraded together with the sovereign.[23]

Table 11 reports the estimates. We re-run the analysis for investment in Table 4 separately for the two subsamples described above. Panel A of Table 11 reports the results when there is a change in rating bin, and Panel B reports the results when there is no change in rating bin. The results indicate that the differential reduction in investment of treated firms relative to control firms after a sovereign downgrade is driven mostly by those observations in which there is a change in rating bin. The differential reduction in investment is much smaller when there is no change in rating bin. Panel A shows that the difference-in-difference estimate is -10.6 percentage points, while in Panel B the estimate is -3.3 percentage points. The ATT estimates are -25.3 percentage points in Panel A and 2.0 percentage points in Panel B. The estimates in the subsample in which the downgrade implies a change in rating bin (Panel A) are economically important, but statistically insignificant likely because of the small size of the sample (23 treated firms). Figure A.3 in the Internet Appendix shows the evolution of investment in the two years before and after the sovereign downgrade for the two subsamples. The differential effects that we measure in Table 11 happen only in the year of the sovereign downgrade.

We also perform this test for net debt issuances. Table A.14 and Figure A.4 in the Internet Appendix report the results. We find that the differential reduction in net debt issuance of treated firms relative to control firms following a sovereign downgrade is driven by the subsample in which the downgrade implies a change in rating bin. The estimates are not statistically significant, as in Table 11.

This evidence suggests that changes in capital requirements are one of the mechanisms through which sovereign downgrades affect corporate debt markets and firm investment and financial policy. This evidence is subject to two important limitations. First, we split the sample according to the initial sovereign rating to identify the regulation channel. Given that our original sample is small, tests based on sample partitions generate large standard errors and limit our ability to precisely identify the magnitude of the effects that are due to ratings. Second, there may be other mechanisms through which ratings may affect the supply of capital to bound

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[23]Consistent with our previous analysis, we use sovereign downgrades and sovereign rating bins in this test. We obtain similar estimates of the ATT of investment at -20.4 percentage points and statistically significant when we use actual corporate downgrades and rating bins.

firms. A likely channel is the effect of ratings on contracts such as debt and supply contracts. We attempt to analyze instances of debt covenant violations around sovereign downgrades by collecting and reading firms' annual reports (including SEC's 10-K forms for U.S. companies and 20-F forms for international firms cross-listed on U.S. exchanges). While we find evidence that debt covenants do in fact depend on ratings, we are unable to find direct evidence that violations (as far as disclosed by firms) are due to ratings triggers. As a result, it is difficult to measure the contract channel empirically.

7   Conclusion

We show that sovereign debt impairments can have important effects on financial markets and real economic activity through a credit ratings channel. We find that firms with ratings at the sovereign bound reduce investment and reliance on credit markets more than firms with ratings below the bound following a sovereign downgrade. The bond yields of bound firms also increase significantly more than yields of firms whose rating is below the bound. This is consistent with an increase in firms' costs of borrowing and reduction in the supply of debt capital that is caused by the effect of sovereign downgrades on corporate ratings, rather than a reduction in the demand for debt capital.

We develop a new strategy to identify the effects of sovereign debt impairments and rating downgrades on firm investment and financial policy. Our results show that sovereign downgrades have effects on firm policies that are unlikely to be related to variation in unobservable firm characteristics, or macroeconomic conditions. Our results also uncover unintended consequences for real economic activity of the sovereign ceiling policies that the rating agencies typically follow. While rating agencies have been gradually moving away from a policy of never rating a private borrower above the sovereign, our results suggest that sovereign ceiling policies still apply. The ceiling rule pushes down ratings, and may be responsible for significant effects on firm investment and financial policy in the aftermath of a sovereign downgrade.

The results also have implications for public debt management. They show that sovereign downgrades matter for real economic activity, over and above the deterioration in macroeconomic fundamentals. Governments should be aware of the potential adverse effects of sovereign

downgrades on the corporate sector, and should factor these negative externalities into public debt management decisions.

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Table 1: Sample of Sovereign Rating Downgrades

This table presents the sample of sovereign credit rating downgrades, and the number of treated observations (i.e., firm-year observations with credit rating equal to or above the sovereign rating in the year before a sovereign downgrade) using S&P long-term foreign currency issuer ratings.

Country	Downgrade Year	Sovereign Rating		Number of Observations
		Before Downgrade	After Downgrade	
Argentina	2001	BB-	SD	4
	2008	B+	B-	3
	2012	B	B-	1
	2013	B-	CCC+	2
Brazil	2002	BB-	B+	5
Hungary	2012	BB+	BB	1
Indonesia	1998	BB+	CCC+	4
Ireland	2011	A	BBB+	4
Italy	2004	AA	AA-	1
	2006	AA-	A+	2
	2011	A+	A	2
	2012	A	BBB+	2
	2013	BBB+	BBB	7
Japan	2001	AAA	AA	1
	2002	AA	AA-	4
	2011	AA	AA-	13
Mexico	2009	BBB+	BBB	4
Philippines	2005	BB	BB-	2
Portugal	2010	A+	A-	1
	2011	A-	BBB-	1
Spain	2012	AA-	BBB-	2
Thailand	1997	A	BBB	1
	1998	BBB	BBB-	2
United States	2011	AAA	AA+	4
Total				73

Table 2: Summary Statistics: Median and Mean Tests

This table presents the pre-treatment median and mean of non-treated, treated and control groups. The sample consists of WRDS-Factset Fundamentals Annual Fiscal (North America and International) non-financial firms in the 1990-2013 period. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Non-treated firms are all other firms in the sample. The group of non-treated firms is restricted to countries that have least one sovereign downgrade over the sample period. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). In Panel B, the covariates also include industry (Fama-French 12 industry classification). The sample consists of 73 treated and control observations in Panel A, and 40 treated and control observations in Panel B. The Pearson's χ^2 statistic tests the difference in medians between treated and control firms. The Kolmogorov-Smirnov statistic tests the difference in distribution of treated and control firms. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

| | Median | | | | Mean | | | Kolmogorov-Smirnov |
	Non-Treated	Treated	Control	Pearson χ^2 p-value	Non-Treated	Treated	Control	p-value
Panel A: Matched Sample								
Size	5.25	9.58	9.64	1.00	5.20	9.01	8.87	0.50
					(0.01)	(0.15)	(0.16)	
Investment	11.91	15.95	11.71	0.32	27.92	26.62	20.01	0.25
					(0.42)	(5.01)	(2.81)	
Q	1.02	1.19	1.01	0.02**	2.87	1.42	1.13	0.00***
					(0.07)	(0.08)	(0.05)	
Cash Flow	5.04	9.66	7.75	0.10*	-8.99	11.02	7.48	0.04**
					(0.54)	(0.89)	(0.78)	
Cash	9.81	8.46	7.19	0.18	15.75	11.30	8.61	0.14
					(0.11)	(1.21)	(0.86)	
Leverage	23.07	33.39	36.96	0.74	30.07	33.32	36.62	0.64
					(0.24)	(2.15)	(2.03)	
Foreign Sales	0.00	0.00	23.19	0.19	11.72	21.46	27.34	0.28
					(0.14)	(3.15)	(3.35)	
Gov. Ownership	0.00	0.00	0.00	0.47	0.55	4.39	3.12	1.00
					(0.03)	(1.37)	(1.12)	
Gov. Exposure	12.12	11.80	11.80	0.62	14.69	15.02	13.44	0.77
					(0.07)	(1.18)	(0.78)	
Panel B: Matched Sample with Industry Match (Fama-French 12 industry classification)								
Size	5.25	9.79	9.75	0.91	5.20	9.26	9.08	0.90
					(0.01)	(0.19)	(0.21)	
Investment	11.91	15.07	16.45	0.43	27.92	23.49	21.02	0.38
					(0.42)	(7.74)	(3.38)	
Q	1.02	1.26	1.06	0.02**	2.87	1.36	1.17	0.00***
					(0.07)	(0.07)	(0.06)	
Cash Flow	5.04	9.24	6.11	0.14	-8.99	11.18	6.32	0.00***
					(0.54)	(1.24)	(0.96)	
Cash	9.81	10.37	7.46	0.31	15.75	11.89	10.59	0.26
					(0.11)	(1.50)	(1.48)	
Leverage	23.07	31.99	33.36	0.74	30.07	30.86	33.43	0.45
					(0.24)	(2.97)	(2.00)	
Foreign Sales	0.00	16.64	29.31	0.74	11.72	23.70	26.87	0.93
					(0.14)	(4.15)	(4.19)	
Gov. Ownership	0.00	0.00	0.00	0.96	0.55	5.81	4.67	1.00
					(0.03)	(2.32)	(2.10)	
Gov. Exposure	12.12	11.80	11.80	0.15	14.69	14.26	11.96	0.41
					(0.07)	(1.81)	(0.92)	

Table 3: Difference-in-Differences of Corporate Ratings around a Sovereign Downgrade

This table presents results of credit rating difference-in-differences matching estimator around a sovereign downgrade. Corporate ratings are converted to a numerical scale with 22 corresponding to the highest rating (AAA) and one to the lowest (default). Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). In Panel B, the covariates also include industry (Fama-French 12 industry classification). The sample consists of 73 treated and control observations in Panel A, and 40 treated and control observations in Panel B. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

	Year Before Downgrade	Year of Downgrade	Difference
Panel A: Matched Sample			
Treated Firms	16.11***	14.75***	-1.36***
	(1.09)	(1.18)	(0.41)
Control Firms	12.60***	11.94***	-0.65
	(1.01)	(1.21)	(0.47)
Difference	3.51***	2.81***	
	(0.38)	(0.51)	
Differences in Differences			-0.71*
			(0.38)
Matching Estimator			-0.88**
			(0.35)
Panel B: Matched Sample with Industry Match (Fama-French 12 industry classification)			
Treated Firms	16.95***	16.13***	-0.83
	(1.08)	(1.18)	(2.24)
Control Firms	12.83***	12.75***	-0.08
	(1.08)	(1.10)	(2.04)
Difference	4.13***	3.38***	
	(0.33)	(0.47)	
Differences in Differences			-0.75*
			(0.35)
Matching Estimator			-1.42**
			(0.56)

Table 4: Difference-in-Differences of Investment around a Sovereign Downgrade

This table presents results of investment rate difference-in-differences matching estimator around a sovereign downgrade. Investment rate is the ratio of annual capital expenditure to lag net property, plant and equipment. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). In Panel B, the covariates also include industry (Fama-French 12 industry classification). The sample consists of 73 treated and control observations in Panel A, and 40 treated and control observations in Panel B. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

	Year Before Downgrade	Year of Downgrade	Difference
Panel A: Matched Sample			
Treated Firms	26.62***	17.70***	-8.92
	(7.28)	(1.83)	(6.34)
Control Firms	19.15***	16.57***	-2.58
	(5.06)	(3.23)	(3.95)
Difference	7.48**	1.13	
	(3.56)	(2.70)	
Differences in Differences			-6.35*
			(3.71)
Matching Estimator			-8.90**
			(4.32)
Panel B: Matched Sample with Industry Match (Fama-French 12 industry classification)			
Treated Firms	23.49**	16.15***	-7.33
	(8.83)	(2.27)	(9.12)
Control Firms	21.02***	18.65***	-2.37
	(4.46)	(3.33)	(5.57)
Difference	2.47	-2.49	
	(6.57)	(1.83)	
Differences in Differences			-4.96
			(6.82)
Matching Estimator			-6.67**
			(3.10)

Table 5: Placebo Tests: Difference-in-Differences of Investment

This table presents results of investment rate difference-in-differences matching estimator. Investment rate is the ratio of annual capital expenditure to lag net property, plant and equipment. Panel A presents the estimates around the first year of a recession not accompanied by a sovereign downgrade. Panel B presents the estimates around the 2007-2009 financial crisis. Countries downgraded during the crisis are excluded. Panel C presents the estimates around a currency crisis not accompanied by a sovereign downgrade. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 53 treated and control observations in Panel A, 56 treated and control observations in Panel B, and 53 treated and observations in Panel C. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

Panel A: Recession without a Sovereign Downgrade

	Year Before Recession	Year of Recession	Difference
Treated Firms	20.65***	21.43***	0.78
	(1.91)	(2.05)	(2.46)
Control Firms	17.09***	18.98***	1.89
	(2.68)	(3.71)	(5.41)
Difference	3.56	2.45	
	(2.16)	(3.31)	
Differences in Differences			-1.11
			(2.03)
Matching Estimator			0.56
			(1.835)

Panel B: 2007-2009 Financial Crisis

	2008	2009	Difference
Treated Firms	20.79***	16.57***	-4.21
	(3.14)	(2.15)	(3.75)
Control Firms	20.11***	14.51***	-5.61**
	(2.50)	(1.00)	(2.66)
Difference	0.68	2.07	
	(3.62)	(1.78)	
Differences in Differences			1.39
			(2.39)
Matching Estimator			1.94
			(3.05)

Panel C: Currency Crisis without a Sovereign Downgrade

	Year Before Currency Crisis	Year of Currency Crisis	Difference
Treated Firms	23.15***	23.78***	0.63
	(2.72)	(2.42)	(3.72)
Control Firms	20.91***	21.95***	1.03
	(3.54)	(2.47)	(4.26)
Difference	2.23	1.83	
	(2.31)	(3.93)	
Differences in Differences			-0.40
			(3.63)
Matching Estimator			0.54
			(0.38)

Table 6: Government Support Tests: Difference-in-Differences of Investment around a Sovereign Downgrade

This table presents results of investment rate difference-in-differences matching estimator around a sovereign downgrade. Investment rate is the ratio of annual capital expenditure to lag net property, plant and equipment. Panel A presents the results for a sub-sample that excludes firms with government ownership. Panel B presents the results for a sub-sample that excludes firms with government ownership and utilities (SIC codes 4900-4999). Panel C presents the results for a placebo test in which treated firms have credit rating one notch below the sovereign and control firms have credit rating more than one notch below the sovereign. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 60 treated and control observations in Panel A, 41 treated and control observations in Panel B, and 40 treated and control observations in Panel C. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

Panel A: Excluding Firms with Government Ownership

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	29.78***	19.49***	-10.30
	(8.82)	(2.19)	(9.60)
Control Firms	19.96***	18.02***	-1.94
	(4.72)	(3.88)	(6.16)
Difference	9.83*	1.47	
	(5.06)	(3.14)	
Differences in Differences			-8.36
			(6.39)
Matching Estimator			-12.96**
			(5.13)

Panel B: Excluding Utilities

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	33.22***	22.81***	-10.41
	(10.48)	(1.90)	(11.09)
Control Firms	25.21***	20.88***	-4.33
	(8.19)	(5.08)	(10.01)
Difference	8.00**	1.93	
	(3.65)	(4.07)	
Differences in Differences			-6.07
			(5.10)
Matching Estimator			-13.76**
			(6.94)

Panel C: Treated Firms with Rating One Notch Below Sovereign

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	13.80***	12.01***	-1.79
	(0.86)	(0.88)	(1.16)
Control Firms	15.09***	13.92***	-1.17
	(1.81)	(1.35)	(2.92)
Difference	-1.29	-1.92	
	(1.85)	(1.28)	
Differences in Differences			-0.62
			(1.51)
Matching Estimator			-0.30
			(0.99)

Table 7: Government Exposure Tests: Corporate Yields and Stock Returns

This table presents estimates of linear regressions of corporate bond yields (Panel A) and stock returns (Panel B) at the monthly frequency. *Bound* is a dummy variable that takes the value of one if a firm has a credit rating equal to or above the sovereign rating in year $t-1$. *Sovereign Yield* is the 10-year constant maturity sovereign yield. *Market Return* is the local stock market return. *Government Exposure* is the industry-level measure of exposure to government spending. Bond issue controls (coefficients not shown) in Panel A are coupon rate, issue amount (in U.S. dollars), and maturity. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of treated and control firms for which yields on local currency bond issues (Panel A) and stock returns (Panel B) are available in the 1990-2013 period. Robust standard errors clustered by firm are reported in parentheses.

Panel A: Corporate Yield

	(1)	(2)	(3)
Bound	0.504	2.161	0.472
	(0.429)	(2.332)	(0.641)
Sovereign Yield	0.548***	0.666**	0.712***
	(0.187)	(0.265)	(0.083)
Bound × Sovereign Yield	-0.240*	-0.412	-0.036
	(0.140)	(0.391)	(0.098)
Bond Issue Controls	No	No	Yes
Time FE	Yes	Yes	Yes
Country FE	Yes	No	No
Firm FE	No	Yes	Yes
Corporate Ratings FE	No	No	Yes
Observations	54,202	54,202	53,109
R^2	0.500	0.555	0.876

Panel B: Stock Return

	(1)	(2)	(3)	(4)
Bound	0.002	0.000	0.004	0.005*
	(0.001)	(0.001)	(0.003)	(0.003)
Market Return	0.825***			0.825***
	(0.071)			(0.072)
Market Return × Bound	-0.157**			-0.159**
	(0.065)			(0.066)
ΔSovereign Yield		-0.332*		-0.073
		(0.171)		(0.144)
ΔSovereign Yield × Bound		0.098		-0.096
		(0.233)		(0.176)
Gov. Exposure			0.024	0.022
			(0.018)	(0.018)
Gov. Exposure × Bound			-0.022	-0.022
			(0.019)	(0.019)
Time FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations	14,097	14,097	14,097	14,097
R^2	0.339	0.228	0.228	0.339

Table 8: Difference-in-Differences of Debt and Equity Issuance around a Sovereign Downgrade

This table presents results of net debt and net equity issuance difference-in-differences matching estimator around a sovereign downgrade. Net debt issuance is the ratio of net issuance of debt to the lag of total assets. Net equity issuance is the ratio of sale of common and preferred stock minus repurchase of common and preferred stock to the lag of total assets. Panel A presents net debt issuance estimates and Panel B presents net equity issuance estimates. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 73 treated and control observations. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

Panel A: Net Debt Issuance

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	7.52*	2.41**	-5.11
	(4.08)	(0.89)	(4.54)
Control Firms	3.35	1.07	-2.28
	(2.45)	(1.08)	(2.82)
Difference	4.18	1.34	
	(2.52)	(1.15)	
Differences in Differences			-2.83
			(3.19)
Matching Estimator			-5.47**
			(2.71)

Panel B: Net Equity Issuance

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	-0.20	-0.75	-0.55
	(0.65)	(0.44)	(0.56)
Control Firms	1.92	-0.49	-2.41*
	(1.40)	(0.49)	(1.37)
Difference	-2.12**	-0.26	
	(0.86)	(0.21)	
Differences in Differences			1.86**
			(0.87)
Matching Estimator			2.56**
			(1.15)

Table 9: Linear Regression of Investment

This table presents estimates of linear regressions of investment. The dependent variable is the annual change in investment rate ($\Delta Investment$) in year t. Investment rate is the ratio of annual capital expenditure to lag net property, plant and equipment. *Bound* is a dummy variable that takes the value of one if a firm has a credit rating equal to or above the sovereign rating in year $t-1$, and *Sovereign Downgrade* is a dummy variable that takes the value of one if a firm's country rating is downgraded in year t. The control variables (coefficients not shown) are firm size, Tobin's Q, cash flow, cash holdings, leverage, foreign sales, a dummy that takes the value of one if the firm has a credit rating, government ownership, and exposure to government spending. Regressions also include year, industry (two-digit SIC), country, and firm fixed effects. The sample consists of WRDS-Factset Fundamentals Annual Fiscal (North America and International) non-financial firms in the 1990-2013 period. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

	(1)	(2)	(3)	(4)	(5)
Bound × Sovereign Downgrade	-9.62**	-10.18**	-9.44*	-11.42***	-12.50**
	(4.42)	(5.58)	(5.42)	(3.72)	(6.43)
Bound	4.69***	1.85**	-0.76	-1.66	0.08
	(0.78)	(0.81)	(0.82)	(1.21)	(1.66)
Sovereign Downgrade	2.23	3.46*	1.50	0.44	
	(1.49)	(2.04)	(1.97)	(2.55)	
Controls	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	No
Industry FE	No	Yes	Yes	No	No
Country FE	No	No	Yes	No	No
Firm FE	No	No	No	Yes	No
Country × Industry × Year FE	No	No	No	No	Yes
Observations	424,903	348,593	348,593	348,593	348,593
R^2	0.000	0.016	0.017	0.135	0.090

Table 10: Difference-in-Differences of Corporate Bond Yields around a Sovereign Downgrade

This table presents estimates of linear regressions of corporate bond yield. The dependent variable is the corporate bond yield change around a sovereign downgrade for different event windows (in months). *Bound* is a dummy variable that takes a value of one if a firm has a credit rating equal to or above the sovereign rating before a sovereign downgrade. Bond issue controls (coefficients not shown) include coupon rate, issue amount (in U.S. dollars), maturity, and ratio of issue amount to total amount issued. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of treated and control firms for which yields on local currency bond issues are available. A bond issue is required to have at least one observation in the pre-downgrade period and one in the post-downgrade period. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

	(-3,+1)	(-3,+3)	(-3,+4)	(-3,+5)	(-3,+6)
Bound	-0.067	0.340**	0.385**	0.521***	0.608***
	(0.093)	(0.156)	(0.157)	(0.149)	(0.094)
Country-Event FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	533	520	523	515	445
R^2	0.714	0.527	0.537	0.550	0.544

Table 11: Difference-in-Differences of Investment around a Sovereign Downgrade: Rating-Based Regulation

This table presents results of investment rate difference-in-differences matching estimator around a sovereign downgrade. Investment rate is the ratio of annual capital expenditure to lag net property, plant and equipment. Panel A presents the results for a sub-sample of firms located in countries whose sovereign rating migrates to a new rating bin, defined by Basel II capital requirements rules, as a consequence of a downgrade. Panel B presents the results for a sub-sample of firms located in countries whose sovereign rating does not migrate to a new rating bin as a consequence of a downgrade. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 23 treated and control observations in Panel A, and 50 treated and control observations in Panel B. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

Panel A: Sovereign Downgrade to a New Rating Bin

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	33.35	19.29***	-14.06
	(19.54)	(4.11)	(20.48)
Control Firms	29.14*	25.66**	-3.47
	(15.01)	(9.78)	(18.96)
Difference	4.21	-6.37	
	(5.71)	(7.52)	
Differences in Differences			-10.58
			(8.80)
Matching Estimator			-25.29
			(21.22)

Panel B: Sovereign Downgrade within the Same Rating Bin

Treated Firms	22.38***	16.57***	-5.81
	(4.82)	(1.66)	(4.85)
Control Firms	15.67***	13.15***	-2.52
	(1.64)	(1.46)	(2.49)
Difference	6.72	3.42	
	(4.27)	(2.08)	
Differences in Differences			-3.29
			(3.30)
Matching Estimator			1.95
			(1.41)

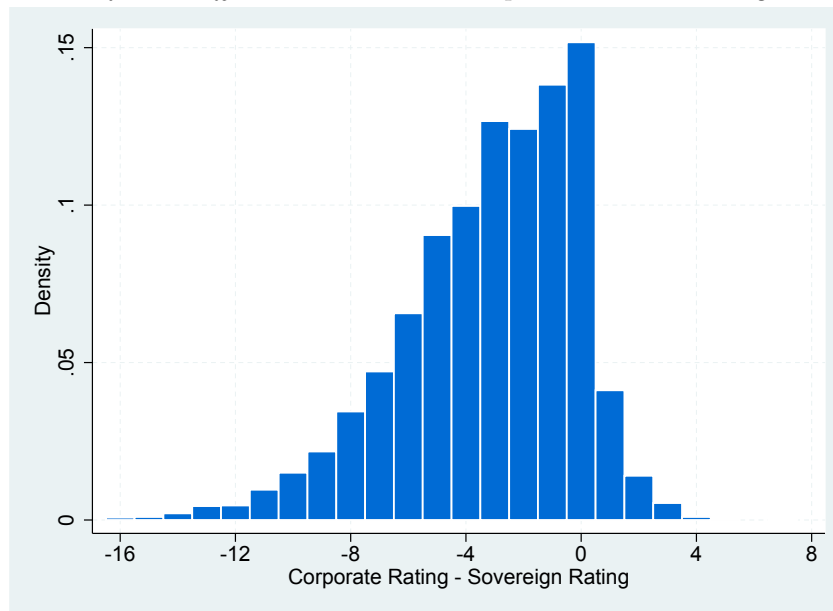# Figure 1: Sovereign Ceiling Rule

This figure shows the relation between sovereign and corporate credit ratings. The sample consists of WRDS-Factset Fundamentals Annual Fiscal (North America and International) non-financial firms in the 1990-2013 period. Panel A shows the frequency of S&P long-term foreign-currency corporate credit ratings by the sovereign rating of their country of domicile. Observations for countries with AAA ratings are excluded as, by definition, the sovereign ceiling policy does not represent a constraint for corporations when the sovereign has the maximum attainable rating. Panel B plots the distribution of the difference between corporate ratings and sovereign ratings.

Panel A: Frequency of Corporate Ratings by Sovereign Rating
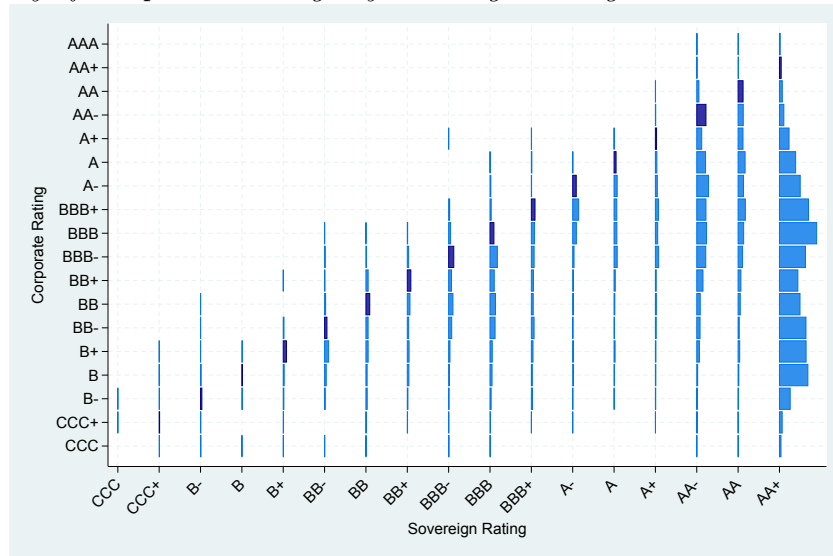
Panel B: Distribution of the Difference Between Corporate and Sovereign Rating

Figure 2: Frequency of Corporate Downgrades around a Sovereign Downgrade by Distance from Sovereign

This figure shows the fraction of firms in each group whose rating is downgraded in the month before, the month of, and the month after a sovereign downgrade. Observations are grouped according to the pre-downgrade difference between the corporate rating and sovereign rating. The sample consists of WRDS-Factset Fundamentals Annual Fiscal (North America and International) non-financial firms in the 1990-2013 period.
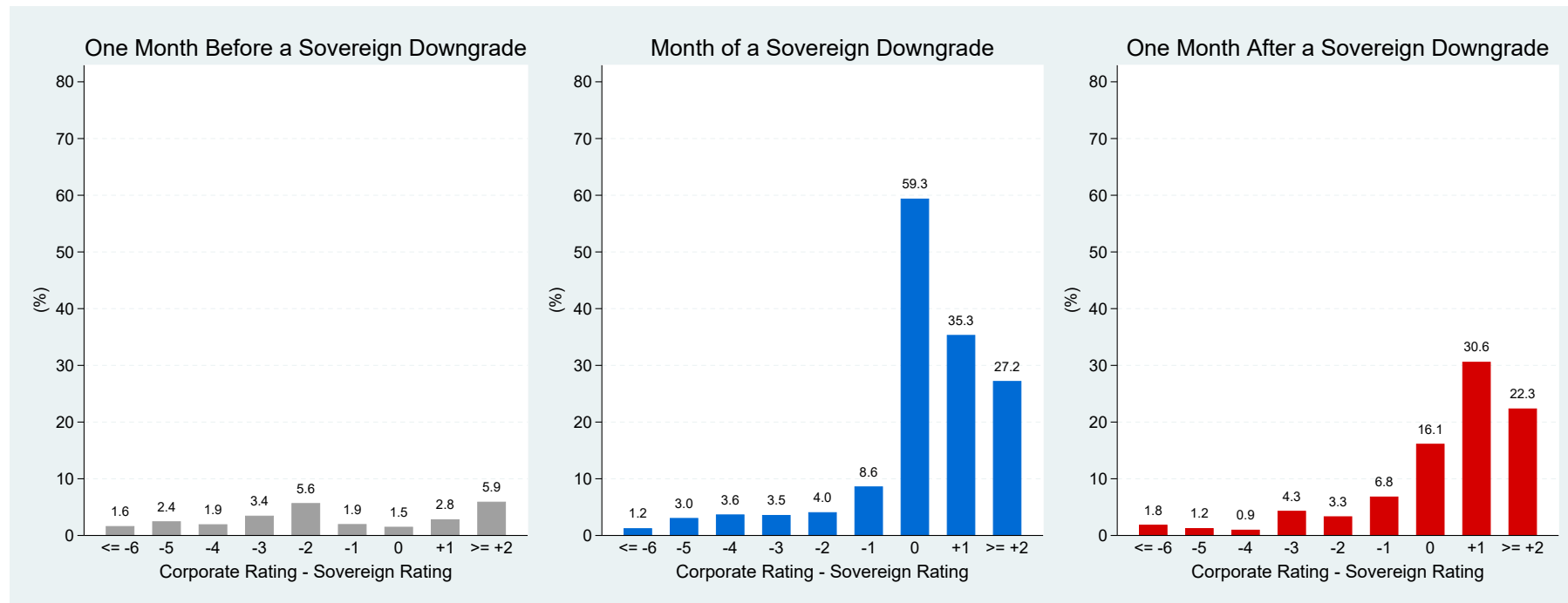
Figure 3: Corporate Ratings around a Sovereign Downgrade

This figure shows the evolution of corporate ratings of treatment and control groups around a sovereign down-grade (between year -1 and year 0). Corporate ratings are converted to a numerical scale with 22 corresponding to the highest rating (AAA) and one to the lowest (default). Treated firms have credit rating equal to or above the sovereign rating in the year before a so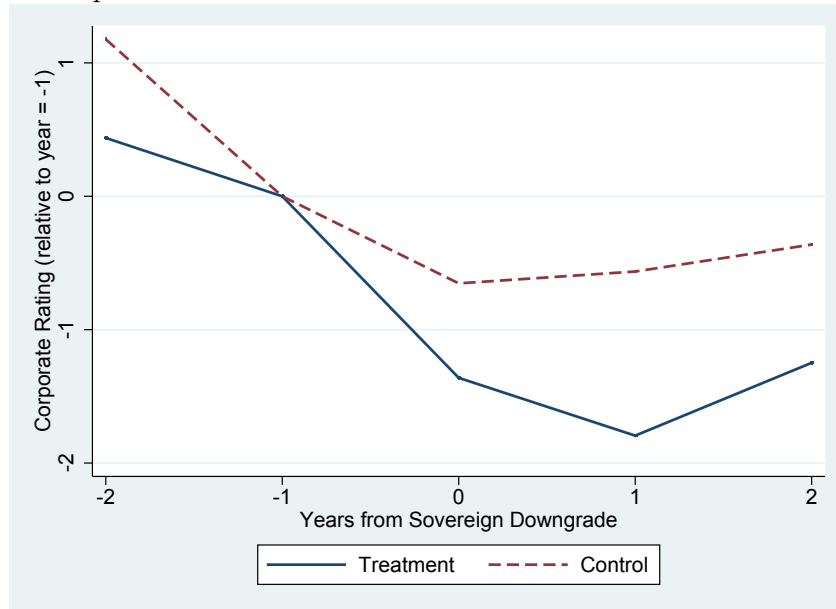vereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). In Panel B, the covariates also include industry (Fama-French 12 industry classification).

Panel A: Matched Sample

Panel B: Matched Sample with Industry Match (Fama-French 12 industry classification)
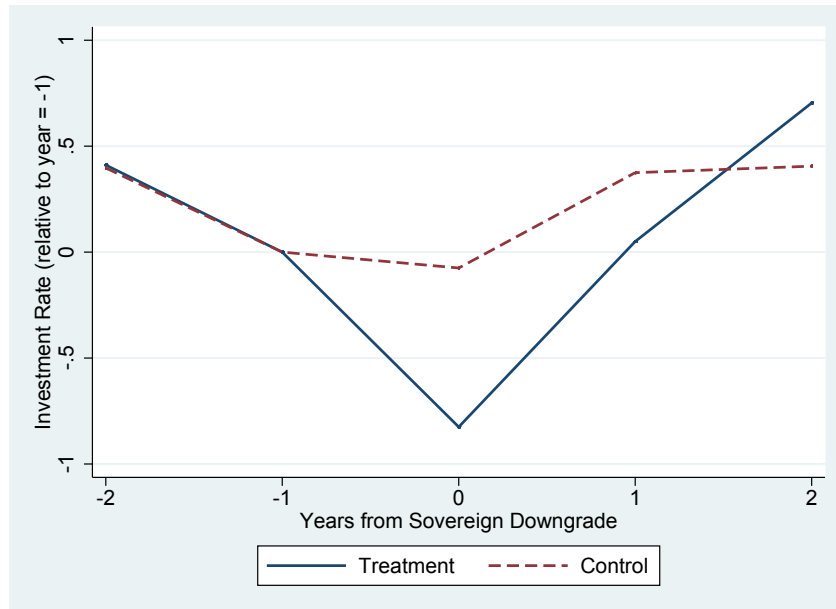
Figure 4: Investment around a Sovereign Downgrade

This figure shows the evolution of investment rate of treatment and control groups around a sovereign downgrade (between year -1 and year 0). Investment rate is the ratio of annual capital expenditure to lag net property, plant and equipment. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, industry (two-digit SIC in Panel A and Fama-French 12 industry classification in Panel B), size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values).

Panel A: Matched Sample
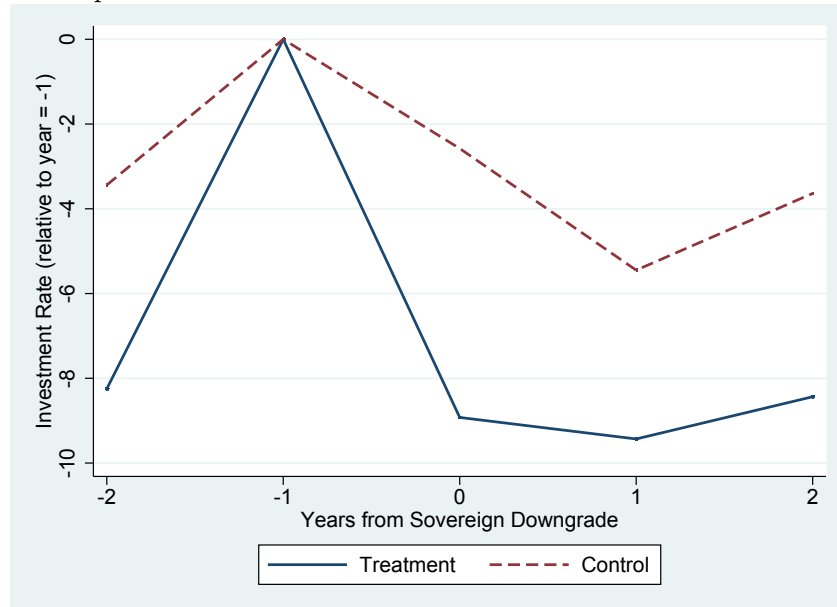
Panel B: Matched Sample with Exact Industry Match (Fama-French 12 industry classification)

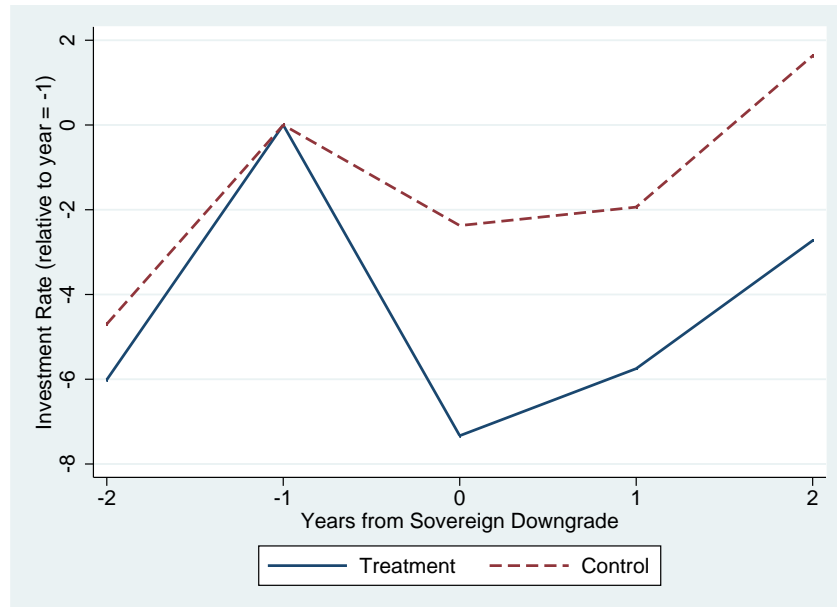# Figure 5: Debt and Equity Issuance around a Sovereign Downgrade

This figure shows the evolution of net debt and net equity issuance of treatment and control groups around a sovereign downgrade (between year -1 and year 0). Net debt issuance is the ratio of net issuance of debt to the lag of total assets. Net equity issuance is the ratio of sale of common and preferred stock minus repurchase of common and preferred stock to the lag of total assets. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, industry (two-digit SIC), size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values).

Panel A: Net Debt Issuance
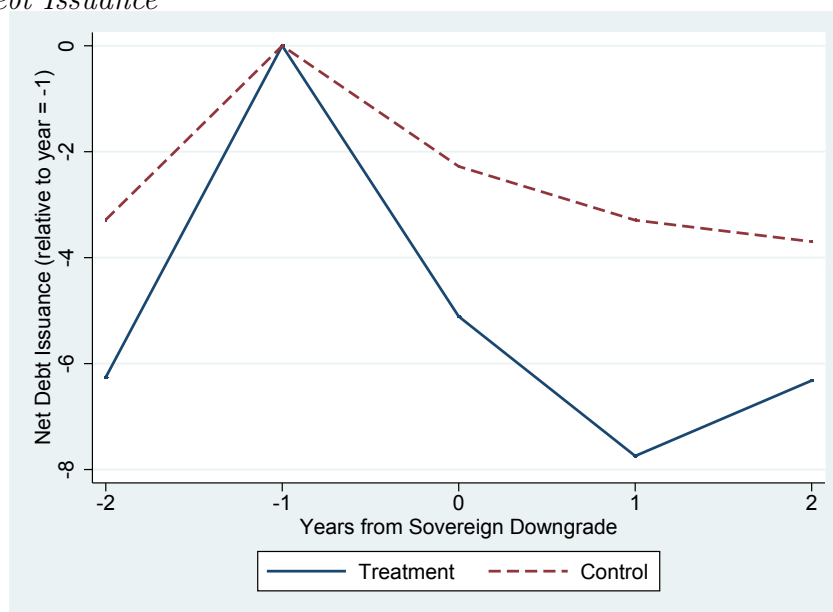
Panel B: Net Equity Issuance
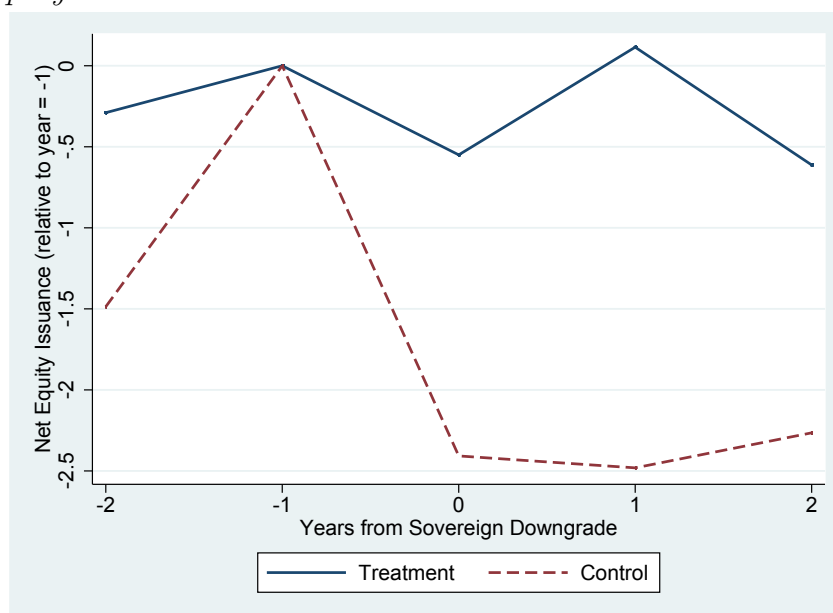
Figure 6: Corporate Bond Yields around a Sovereign Downgrades

This figure shows estimates of linear regressions of corporate bond yield of treatment and control groups around a sovereign downgrade (between month -1 and month 0). The dependent variable is the corporate bond yield. The explanatory variables are event-time dummies (month relative to the sovereign downgrade) for the treatment and control groups, and bond-event fixed effects (a dummy variable for each bond-sovereign downgrade pair). The coefficients can be interpreted as the change in bond yields around sovereign downgrades. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of treated and control firms for which yields on local currency bond issues are available. A bond issue is required to have at least one observation in the pre-downgrade period and one in the post-downgrade period.
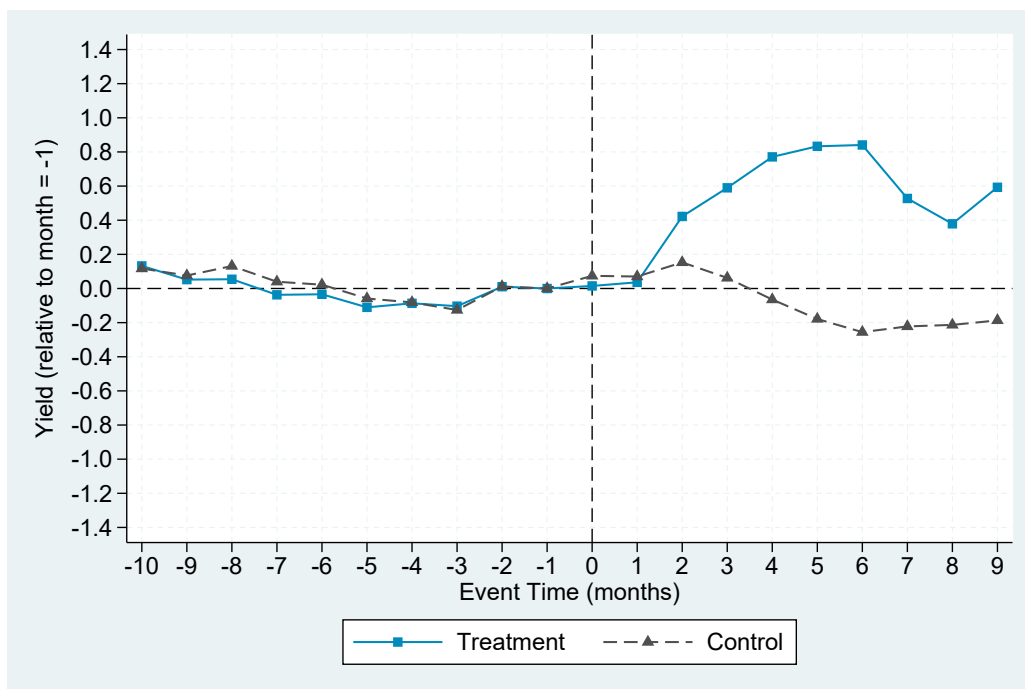
Internet Appendix for
"The Real Effects of Credit Ratings: The Sovereign Ceiling Channel"

Heitor Almeida
University of Illinois at Urbana Champaign

Igor Cunha
Nova School of Business and Economics

Miguel A. Ferreira
Nova School of Business and Economics

Felipe Restrepo
Ivey Business School - Western University

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A   Pessimistic ratings

We test whether bound firms have a more "pessimistic" rating than non-bound firms. If the sovereign ceiling represents a meaningful friction and not just an unbiased and accurate assessment of a firm's creditworthiness, ratings should be more pessimistic for bound firms than non-bound firms with the same actual ratings.

We explore whether bound firms are pessimistically rated using a two-step procedure. In the first step, we use as a benchmark annual financial data on rated firms in AAA countries (where the bound does not matter) to predict the ratings of firms in non-AAA countries, where the sovereign rating ceiling potentially represents a meaningful friction. The dependent variable is a firm's rating converted into numerical values (see Table A.3). The explanatory variables are return on assets (ROA), *Size, Leverage*, as in Kisgen (2006). We estimate the regression:

$$
\begin{aligned}
Rating_{i,t} = \ & \beta_1 ROA_{i,t} + \beta_2 Size_{i,t} + \beta_3 Leverage_{i,t} \\
& + \beta_4 ROA_{i,t}^2 + \beta_5 Size_{i,t}^2 + \beta_6 Leverage_{i,t}^2 + \alpha_t + \alpha_d + \epsilon_{i,t}
\end{aligned}
\tag{1}
$$

where $Rating_{i,t}$ is the rating (numerical value) for firm i in year t. The regression includes year fixed effects to control for time-specific shocks (α_t) and industry fixed effects (α_d). We estimate the regression using the sample of firms in AAA countries, and then use the estimated coefficients to calculate the predicted ratings for firms in non-AAA countries (which we denote as $\widehat{Rating}$). Table A.4 in the Internet Appendix shows the estimated coefficients.

In the second step, we examine whether predicted rating are systematically higher for bound firms than for other firms that have the same actual rating but that are not bound by the sovereign ceiling. We estimate the regression:

$$
\begin{aligned}
\widehat{Rating}_{i,t} = \ & \beta_1 (RatingFE)_{i,t} + \beta_2 (RatingFE)_{i,t} \times Bound_{i,t} \\
& + \beta_3 (SovRatingFE)_{i,t} + \alpha_t + \epsilon_{i,t}
\end{aligned}
\tag{2}
$$

where $RatingFE$ is a set of dummies for each rating class; $Bound$ is a dummy variable that takes the value of one if a firm has a credit rating equal to or above the sovereign rating and zero otherwise; and $SovRatingFE$ is a set of dummies to control for differences across sovereign rating classes. The regressions include year fixed effects (α_t) to account for variations in corporate ratings through the business cycle. β_2 is a vector of coefficients that captures the differential effect, for each rating class, of the sovereign ceiling on a firm's predicted rating. If bound firms are rated fairly relative to non-bound firms, then predicted ratings should not systematically differ across the groups. If bound firms tend to be pessimistically rated, then their predicted ratings should be higher than the ratings of non-bound firms with the same actual rating.

Table A.5 compares predicted ratings for bound versus non-bound firms according to equation (2). We find that bound firms tend to have higher predicted ratings than comparable non-bound firms with the same rating. For example, a bound firm with a B+ rating has a predicted rating that is 1.7 notches higher than a firm that is also rated B+ but that is below the sovereign rating. The difference between the predicted ratings of bound versus non-bound firms is positive and statistically significant in 10 of the 15 rating levels. The sovereign ceiling rule represents a less meaningful restriction for the highest rating levels (A+ or above). These results suggest that the sovereign ceiling rule can have real consequences for firms even outside sovereign downgrade episodes, as bound firms receive lower ratings than they actually should.

Table A.1: List of Treated Firms

Company	Country	Year of Sovereign Downgrade	Corporate Rating Before Downgrade	After Downgrade
MetroGas SA	Argentina	2001	BBB-	CCC+
Telecom Argentina SA	Argentina	2001	BBB-	BBB-
Transportadora de Gas del Sur SA	Argentina	2001	BBB-	CCC+
YPF SA	Argentina	2001	BBB-	BB-
Telecom Argentina SA	Argentina	2008	B+	B
Transportadora de Gas del Sur SA	Argentina	2008	B+	B+
YPF SA	Argentina	2008	B+	BB
Transportadora de Gas del Sur SA	Argentina	2012	B	B-
Capex SA	Argentina	2013	B-	B-
Transportadora de Gas del Sur SA	Argentina	2013	B-	B-
Aracruz Celulose SA	Brazil	2002	BB-	BB-
Centrais Eletricas Brasileiras SA	Brazil	2002	BB-	B+
Cia Bebidas das Americas - AMBEV	Brazil	2002	BB-	BB-
Klabin SA	Brazil	2002	BB-	CCC+
Tele Norte Leste Participacoes SA	Brazil	2002	BB-	B+
MOL Hungarian Oil & Gas Plc	Hungary	2012	BB+	BB+
PT Asia Pacific Fibers Tbk	Indonesia	1998	BB+	NM
PT Barito Pacific Tbk	Indonesia	1998	BB+	CCC-
PT Citra Marga Nusaphala Persada Tbk	Indonesia	1998	BBB-	CC
PT Daya Guna Samudera	Indonesia	1998	BB+	CCC
Accenture Plc	Ireland	2011	A+	A+
Cooper Industries Plc	Ireland	2011	A	A
Covidien Plc	Ireland	2011	A	A
Eaton Corp. Plc	Ireland	2011	A	A
Eni SpA	Italy	2004	AA	AA
Eni SpA	Italy	2006	AA	AA
TERNA Rete Elettrica Nazionale SpA	Italy	2006	AA-	AA-
Eni SpA	Italy	2011	A+	A+
TERNA Rete Elettrica Nazionale SpA	Italy	2011	A+	A
Eni SpA	Italy	2012	A+	A
TERNA Rete Elettrica Nazionale SpA	Italy	2012	A	A-
Atlantia SpA	Italy	2013	BBB+	BBB+
Enel SpA	Italy	2013	BBB+	BBB
Eni SpA	Italy	2013	A	A
Hera SpA	Italy	2013	BBB+	BBB
Luxottica Group SpA	Italy	2013	BBB+	BBB+
SNAM SpA	Italy	2013	A-	BBB+
TERNA Rete Elettrica Nazionale SpA	Italy	2013	A-	BBB+
Toyota Motor Corp.	Japan	2001	AAA	AAA
DENSO Corp.	Japan	2002	AA+	AA+
FUJIFILM Holdings Corp.	Japan	2002	AA	AA
Ito-Yokado Co. Ltd.	Japan	2002	AA	AA
Toyota Motor Corp.	Japan	2002	AAA	AAA
Canon, Inc.	Japan	2011	AA	AA
Chubu Electric Power Co., Inc.	Japan	2011	AA	A+
DENSO Corp.	Japan	2011	AA	AA-
Electric Power Development Co., Ltd.	Japan	2011	AA	A+
NTT DoCoMo, Inc.	Japan	2011	AA	AA
Nippon Telegraph & Telephone Corp.	Japan	2011	AA	AA
Okinawa Electric Power Co., Inc.	Japan	2011	AA	AA-
Osaka Gas Co., Ltd.	Japan	2011	AA	AA-
Shikoku Electric Power Co., Inc.	Japan	2011	AA	A+
Takeda Pharmaceutical Co., Ltd.	Japan	2011	AA	AA-
Tokyo Electric Power Co., Inc.	Japan	2011	AA	B+
Tokyo Gas Co., Ltd.	Japan	2011	AA	AA-
Toyota Motor Corp.	Japan	2011	AA	AA-
Coca-Cola FEMSA SAB de CV	Mexico	2009	BBB+	BBB+
Grupo Bimbo SAB de CV	Mexico	2009	BBB+	BBB
Grupo Televisa SAB de CV	Mexico	2009	BBB+	BBB+
Kimberly-Clark de Mexico SAB de CV	Mexico	2009	BBB+	BBB+
Globe Telecom, Inc.	Philippines	2005	BB	BB
Universal Robina Corp.	Philippines	2005	BB	BB
Redes Energeticas Nacionais SA	Portugal	2010	A+	A-
EDP - Energias de Portugal SA	Portugal	2011	A-	BBB
Enagas SA	Spain	2012	AA-	BBB
Red Electrica Corp. SA	Spain	2012	AA-	BBB
PTT Exploration & Production Plc	Thailand	1997	A	BBB
Advanced Info Service Public Co., Ltd.	Thailand	1998	BBB	BBB-
PTT Exploration & Production Plc	Thailand	1998	BBB	BBB-
Automatic Data Processing, Inc.	United States	2011	AAA	AAA
Exxon Mobil Corp.	United States	2011	AAA	AAA
Johnson & Johnson	United States	2011	AAA	AAA
Microsoft Corp.	United States	2011	AAA	AAA

Table A.2: Summary Statistics: Distribution Support

This table presents the pre-treatment distribution of non-treated, treated and control groups. The sample consists of WRDS-Factset Fundamentals Annual Fiscal (North America and International) non-financial firms in the 1990-2013 period. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Non-treated firms are all other firms in the sample. The group of non-treated firms is restricted to countries that have least one sovereign downgrade over the sample period. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, industry (two-digit SIC in Panel A and Fama-French 12 industry classification in Panel B), size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 73 treated and control observations.

		5%	25%	50%	75%	95%
Panel A: Treated vs Non-Treated						
Size	Treated	6.60	8.03	9.58	10.10	10.10
	Non-Treated	1.47	3.99	5.25	6.59	8.87
Investment	Treated	4.15	11.38	15.95	23.29	82.32
	Non-Treated	0.43	4.73	11.91	25.15	90.68
Q	Treated	0.85	1.02	1.19	1.56	2.75
	Non-Treated	0.57	0.83	1.02	1.41	4.86
Cash Flow	Treated	2.80	6.77	9.66	13.31	23.17
	Non-Treated	-39.78	0.76	5.04	9.57	20.92
Cash	Treated	0.65	2.86	8.46	14.94	34.11
	Non-Treated	0.45	3.98	9.81	20.67	52.91
Leverage	Treated	0.72	20.04	33.39	46.98	62.41
	Non-Treated	0.00	6.13	23.05	40.45	72.91
Long-Term Leverage	Treated	0.59	13.81	25.84	36.63	56.48
	Non-Treated	0.00	0.17	7.56	20.31	46.50
Foreign Sales	Treated	0.00	0.00	0.00	45.68	73.70
	Non-Treated	0.00	0.00	0.00	10.19	72.00
Gov. Ownership	Treated	0.00	0.00	0.00	0.00	32.31
	Non-Treated	0.00	0.00	0.00	0.00	0.00
Gov. Exposure	Treated	2.63	11.08	11.80	17.36	28.46
	Non-Treated	1.16	7.98	12.12	20.56	28.46
Panel B: Treated vs Control						
Size	Treated	6.60	8.03	9.58	10.10	10.10
	Control	6.75	7.35	9.64	10.10	10.10
Investment	Treated	4.15	11.38	15.95	23.29	82.32
	Control	4.20	8.50	11.71	20.07	65.70
Q	Treated	0.85	1.02	1.19	1.56	2.75
	Control	0.80	0.90	1.01	1.24	1.88
Cash Flow	Treated	2.80	6.77	9.66	13.31	23.17
	Control	-1.36	3.16	7.75	10.88	18.64
Cash	Treated	0.65	2.86	8.46	14.94	34.11
	Control	1.47	2.87	7.19	10.77	20.88
Leverage	Treated	0.72	20.04	33.39	46.98	62.41
	Control	10.39	20.70	36.96	49.32	62.75
Long-Term Leverage	Treated	0.59	13.81	25.84	36.63	56.48
	Control	3.36	17.15	25.74	39.72	55.55
Foreign Sales	Treated	0.00	0.00	0.00	45.68	73.70
	Control	0.00	0.00	23.19	41.80	82.88
Gov. Ownership	Treated	0.00	0.00	0.00	0.00	32.31
	Control	0.00	0.00	0.00	0.00	25.52
Gov. Exposure	Treated	2.63	11.08	11.80	17.36	28.46
	Control	2.51	11.08	11.80	15.56	27.85

Table A.3: Credit Ratings Numerical Scale

This table presents the conversion of S&P credit rating notations to a numerical scale.

Numerical Rating	S&P Rating
22	AAA
21	AA+
20	AA
19	AA-
18	A+
17	A
16	A-
15	BBB+
14	BBB
13	BBB-
12	BB+
11	BB
10	BB-
9	B+
8	B
7	B-
6	CCC+
5	CCC
4	CCC-
3	CC
2	C
1	SD/D

Table A.4: Determinants of Corporate Ratings in AAA Countries

This table reports estimates of a regression of corporate ratings on firm characteristics using the sample of firms domiciled in AAA countries. The sample consists of WRDS-Factset Fundamentals Annual Fiscal (North America and International) non-financial firms in the 1990-2013 period. Robust standard errors clustered by firms are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

	(1)
ROA	9.000***
	(0.49)
Size	0.901***
	(0.30)
Leverage	-6.984***
	(0.33)
ROA^2	1.353***
	(0.17)
$Size^2$	0.027
	(0.02)
$Leverage^2$	2.111***
	(0.17)
Year FE	Yes
Industry FE	Yes
Observations	24,062
R^2	0.587

Table A.5: Predicted Rating by Sovereign Bound Status

This table reports the estimates of the effect of the sovereign ceiling on a firm's predicted rating using the following regression model:

$$\widehat{Rating}_{i,t} = \beta_1(RatingFE)_{i,t} + \beta_2(RatingFE)_{i,t} \times Bound_{i,t} + \beta_3(SovRatingFE)_{i,t} + \alpha_t + \epsilon_{i,t}$$

where β_2 is a vector of coefficients that captures the differential effect for each rating class. The sample consists of WRDS-Factset Fundamentals Annual Fiscal (North America and International) non-financial firms in the 1990-2013 period. Robust standard errors clustered by firm are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

	Bound	Non-Bound	Difference between Bound and Non-Bound Firms	
	(1)	(2)	(3) = (2) - (1)	p-value
AA	15.08	14.60	-0.48	0.216
AA-	14.42	14.03	-0.39	0.156
A+	14.28	14.40	0.12	0.837
A	14.06	14.71	0.65**	0.027
A-	13.74	14.09	0.35	0.237
BBB+	13.53	14.05	0.52*	0.063
BBB	13.22	14.21	0.98***	0.000
BBB-	13.10	13.85	0.75***	0.001
BB+	12.68	13.90	1.22***	0.003
BB	12.29	12.58	0.30	0.319
BB-	11.57	12.69	1.12***	0.004
B+	10.92	12.61	1.69***	0.003
B	9.98	11.02	1.05***	0.001
B-	9.75	10.94	1.19***	0.003
CCC+	9.57	11.89	2.32***	0.000
Observations	9,330			
R^2	0.604			

Table A.6: Government Support Tests - Matched Sample with Industry Match

This table presents results of investment rate difference-in-differences matching estimator around a sovereign downgrade. Investment rate is the ratio of annual capital expenditure to lag net property, plant and equipment. Panel A presents the results for a sub-sample that excludes firms with government ownership. Panel B presents the results for a sub-sample that excludes firms with government ownership and utilities (SIC codes 4900-4999). Panel C presents the results for a placebo test in which treated firms have credit rating one notch below the sovereign and control firms have credit rating more than one notch below the sovereign. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, industry (Fama-French 12 industry classification), size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 32 treated and control observations in Panel A, 22 treated and control observations in Panel B, and 25 treated and control observations in Panel C. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

Panel A: Excluding Firms with Government Ownership

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	27.00**	18.55***	-8.44
	(9.63)	(1.44)	(11.05)
Control Firms	23.07***	19.82***	-3.24
	(4.42)	(2.50)	(6.06)
Difference	3.93	-1.27	
	(9.77)	(2.18)	
Differences in Differences			-5.20
			(9.59)
Matching Estimator			-7.39*
			(3.89)

Panel B: Excluding Utilities

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	33.71**	21.72***	-11.99
	(14.51)	(1.63)	(16.05)
Control Firms	27.60***	22.66***	-4.93
	(5.89)	(3.09)	(7.03)
Difference	6.12	-0.94	
	(14.19)	(2.94)	
Differences in Differences			-7.06
			(14.07)
Matching Estimator			-7.99
			(5.27)

Panel C: Treated Firms with Rating One Notch Below Sovereign

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	14.00***	13.29***	-0.71
	(1.55)	(0.81)	(1.75)
Control Firms	14.31***	11.71***	-2.60
	(2.63)	(2.73)	(3.79)
Difference	-0.31	1.58	
	(2.68)	(2.06)	
Differences in Differences			1.89
			(3.38)
Matching Estimator			1.18
			(1.56)

Table A.7: Difference-in-Differences of Returns on Assets around a Sovereign Downgrade

This table presents the results of returns on assets (ROA) differences-in-differences matching estimator around a sovereign downgrade. ROA is the ratio of operating income minus income taxes to the lag of total assets. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 73 treated and control observations. Robust standard errors clustered by country event are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	7.86***	7.18***	-0.68
	(1.13)	(1.21)	(2.03)
Control Firms	5.61***	4.72***	-0.89
	(1.00)	(1.15)	(1.81)
Difference	2.25**	2.46*	
	(0.89)	(1.33)	
Differences in Differences			0.21
			(1.02)
Matching Estimator			-0.03
			(0.80)

Table A.8: Difference-in-Differences of Debt and Equity Issuance around a Sovereign Downgrade - Matched Sample with Industry Match

This table presents results of net debt and net equity issuance difference-in-differences matching estimator around a sovereign downgrade. Net debt issuance is the ratio of net issuance of debt to the lag of total assets. Net equity issuance is the ratio of sale of common and preferred stock minus repurchase of common and preferred stock to the lag of total assets. Panel A presents net debt issuance estimates and Panel B presents net equity issuance estimates. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, industry (Fama-French 12 industry classification), size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 40 treated and control observations. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

Panel A: Net Debt Issuance

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	6.83*	3.40**	-3.43
	(3.60)	(1.51)	(4.78)
Control Firms	2.77*	0.78	-1.99
	(1.40)	(2.01)	(2.77)
Difference	4.06	2.62	
	(2.82)	(1.90)	
Differences in Differences			-1.44
			(3.76)
Matching Estimator			-2.02
			(3.15)

Panel B: Net Equity Issuance

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	-1.01**	-1.22**	-0.21
	(0.47)	(0.50)	(0.74)
Control Firms	2.79	-0.58	-3.37
	(1.95)	(0.38)	(2.47)
Difference	-3.80*	-0.64***	
	(1.93)	(0.21)	
Differences in Differences			3.16
			(2.50)
Matching Estimator			3.30
			(2.07)

Table A.9: Difference-in-Differences of Financial Policy around a Sovereign Downgrade

This table presents the results of financial policy difference-in-differences matching estimator around a sovereign downgrade. Panel A presents long-term leverage estimates, Panel B presents leverage estimates, and Panel C presents cash-to-assets ratio estimates. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 73 treated and control observations. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

Panel A: Long-Term Leverage

	Year Before Downgrade	Year After Downgrade	Difference
Treated Firms	23.39***	24.27***	0.87
	(1.81)	(2.27)	(2.90)
Control Firms	26.71***	29.52***	2.81
	(3.18)	(3.89)	(5.03)
Difference	-3.31	-5.25	
	(2.54)	(3.74)	
Differences in Differences			-1.94
			(4.52)
Matching Estimator			-0.40
			(1.76)

Panel B: Leverage

	Year Before Downgrade	Year After Downgrade	Difference
Treated Firms	31.30***	33.69***	2.39
	(2.93)	(3.81)	(4.35)
Control Firms	35.61***	37.94***	2.33
	(3.48)	(4.91)	(5.34)
Difference	-4.31*	-4.25	
	(2.24)	(3.57)	
Differences in Differences			0.06
			(2.35)
Matching Estimator			2.30
			(2.02)

Panel C: Cash

	Year Before Downgrade	Year After Downgrade	Difference
Treated Firms	11.91***	11.57***	-0.34
	(1.39)	(1.21)	(2.11)
Control Firms	8.17***	8.21***	0.04
	(1.27)	(0.96)	(2.06)
Difference	3.73***	3.36**	
	(1.27)	(1.46)	
Differences in Differences			-0.38
			(1.33)
Matching Estimator			0.93
			(1.31)

Table A.10: Difference-in-Differences of Investment around a Sovereign Downgrade: Collapsed Observations

This table presents the results of the investment rate difference-in-differences matching estimator around a sovereign downgrade. Investment rate is the ratio of annual capital expenditure to lag net property, plant and equipment. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 73 treated and control observations. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

	Average Two Years Before Downgrade	Average Two Years After Downgrade	Difference
Treated Firms	22.34***	18.34***	-4.00
	(3.92)	(1.69)	(3.41)
Control Firms	17.37***	15.12***	-2.26
	(2.80)	(2.23)	(2.93)
Difference	4.97*	3.22	
	(2.37)	(2.41)	
Differences in Differences			-1.75
			(2.11)
Matching Estimator			-5.96***
			(1.94)

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Table A.11: Difference-in-Differences of Debt Issuance around a Sovereign Downgrade: Collapsed Observations

This table presents results of net debt issuance difference-in-differences matching estimator around a sovereign downgrade. Net debt issuance is the ratio of net issuance of debt to the lag of total assets. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 73 treated and control observations. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

	Average Two Years Before Downgrade	Average Two Years After Downgrade	Difference
Treated Firms	3.38*	1.28*	-2.10
	(1.92)	(0.71)	(2.32)
Control Firms	1.88	0.82	-1.07
	(1.87)	(0.85)	(2.02)
Difference	1.50	0.46	
	(1.26)	(0.86)	
Differences in Differences			-1.04
			(1.56)
Matching Estimator			-3.94**
			(1.90)

Table A.12: Difference-in-Differences of Investment around a Sovereign Downgrade: Firms with Rating Equal to the Sovereign

This table presents the results of the investment rate difference-in-differences matching estimator around a sovereign downgrade. Investment rate is the ratio of annual capital expenditure to lag net property, plant and equipment. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 60 treated and control observations. Robust standard errors clustered by country event are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	28.65***	17.87***	-10.78
	(8.58)	(2.07)	(7.17)
Control Firms	19.10***	17.67***	-1.42
	(4.36)	(3.53)	(3.74)
Difference	9.55*	0.20	
	(5.16)	(3.02)	
Differences in Differences			-9.35*
			(4.92)
Matching Estimator			-10.73**
			(5.13)

Table A.13: Placebo Tests: Difference-in-Differences of Corporate Bond Yield

This table presents estimates of linear regressions of corporate bond yield around placebo periods identified by taking the month with the maximum increase in sovereign bond yields in a given country and year not accompanied by a sovereign downgrade. The dependent variable is the corporate bond yield change around a sovereign downgrade for different event windows (in months). *Bound* is a dummy variable that takes a value of one if a firm has a rating equal to or above sovereign rating before a sovereign downgrade. Bond issue controls (coefficients not shown) include coupon rate, issue amount (in U.S. dollars), maturity, and ratio of issue amount to total amount issued. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of treated and control firms for which yields on local currency bond issues are available. A bond issue is required to have at least one observation in the pre-downgrade period and one in the post-downgrade period. Robust standard errors clustered by country event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

	(-3,+1)	(-3,+3)	(-3,+4)	(-3,+5)	(-3,+6)
Bound	0.006	0.012	0.011	0.036	0.028
	(0.012)	(0.012)	(0.018)	(0.033)	(0.032)
Country-Event FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	1,742	1,715	1,717	1,701	1,695
R^2	0.683	0.721	0.782	0.781	0.792

Table A.14: Difference-in-Differences of Debt Issuance around a Sovereign Downgrade: Rating-Based Regulation

This table presents the results of of net debt issuance difference-in-differences matching estimator around a sovereign downgrade. Net debt issuance is the ratio of net issuance of debt to the lag of total assets. Panel A presents the results for a sub-sample of firms located in countries whose sovereign rating migrates to a new rating bin, defined by Basel II capital requirements rules, as a consequence of a downgrade. Panel B presents the results for a sub-sample of firms located in countries whose sovereign rating does not migrate to a new rating bin as a consequence of a downgrade. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values). The sample consists of 23 treated and control observations in Panel A, and 50 treated and control observations in Panel B. Standard errors clustered by country-event are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

Panel A: Sovereign Downgrade to a New Rating Bin

	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	13.45	1.69	-11.76
	(10.23)	(1.07)	(10.50)
Control Firms	7.78	3.12	-4.66
	(7.64)	(1.76)	(8.09)
Difference	5.68	-1.43	
	(3.69)	(2.40)	
Differences in Differences			-7.10
			(5.21)
Matching Estimator			-15.37
			(11.10)

Panel B: Sovereign Downgrade within the Same Rating Bin

|	Year Before Downgrade	Year of Downgrade	Difference
Treated Firms	4.58	2.14*	-2.44
	(2.91)	(1.16)	(3.23)
Control Firms	2.41	0.24	-2.17
	(1.59)	(0.95)	(1.43)
Difference	2.16	1.90*	
	(2.68)	(1.02)	
Differences in Differences			-0.27
			(3.46)
Matching Estimator			1.00
			(1.69)

Figure A.1: Placebo Tests of Investment

This figure shows the evolution of investment rate of treatment and control groups. Investment rate is the ratio of annual capital expenditure to lag net property, plant and equipment. Panel A presents the estimates around the first year of a recession not accompanied by a sovereign downgrade. Panel B presents the estimates around the 2007-2009 financial crisis. Countries downgraded during the crisis are excluded. Panel C presents the estimates around a currency crisis not accompanied by a sovereign downgrade. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values).

Panel A: Recession without a Sovereign Downgrade
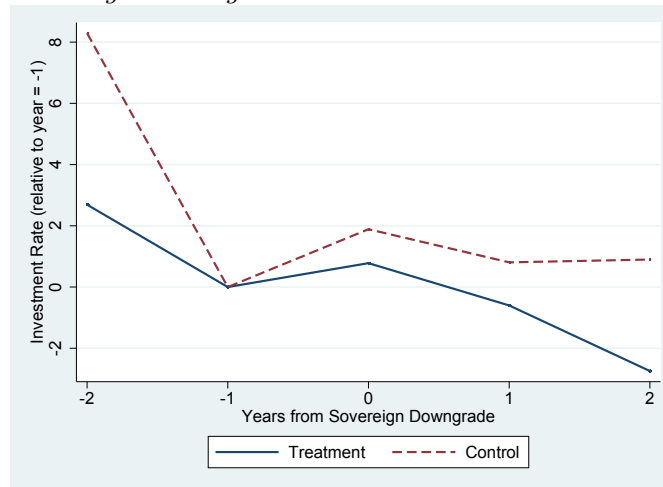

Panel B: 2007-2009 Financial Crisis
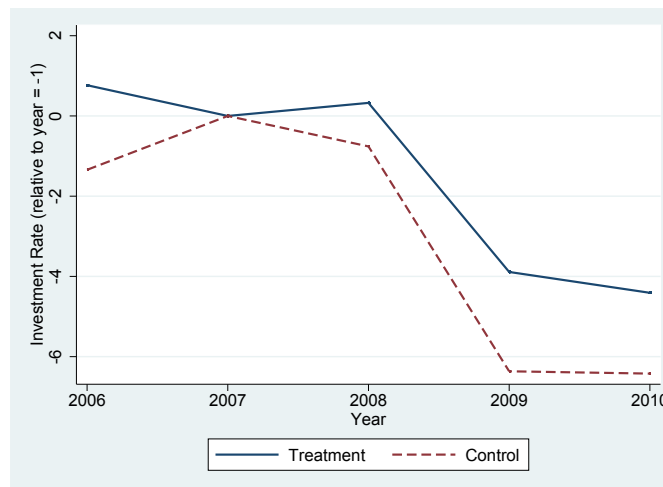
Panel C: Currency Crisis without a Sovereign Downgrade
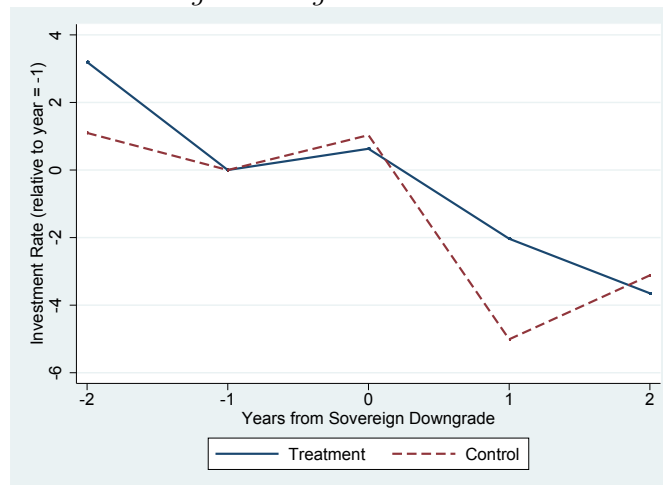
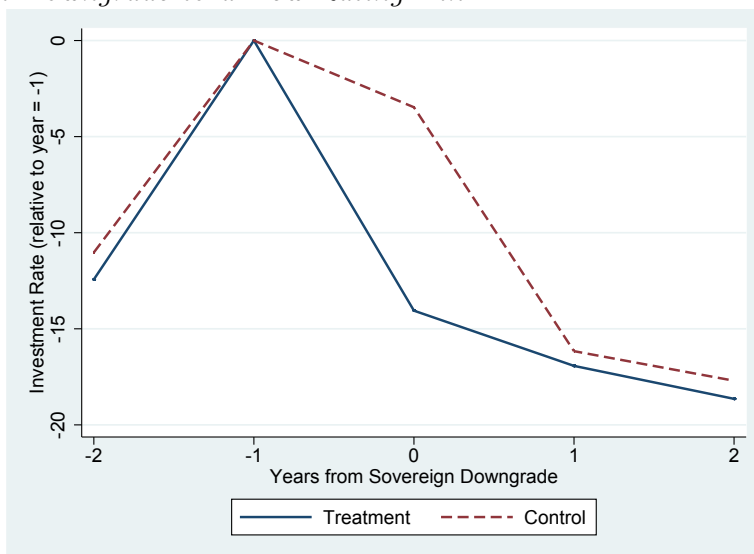# Figure A.2: Debt in Foreign Currency

This figure shows the evolution of debt in foreign currency (as a percentage of total debt) of treatment and control groups around a sovereign downgrade. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values).
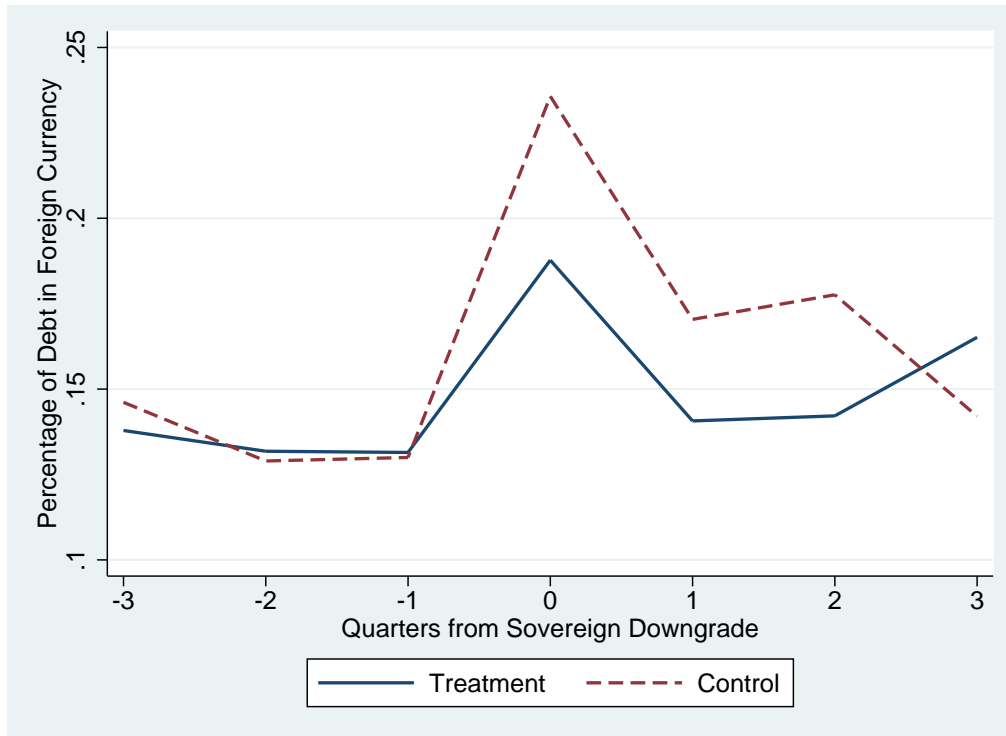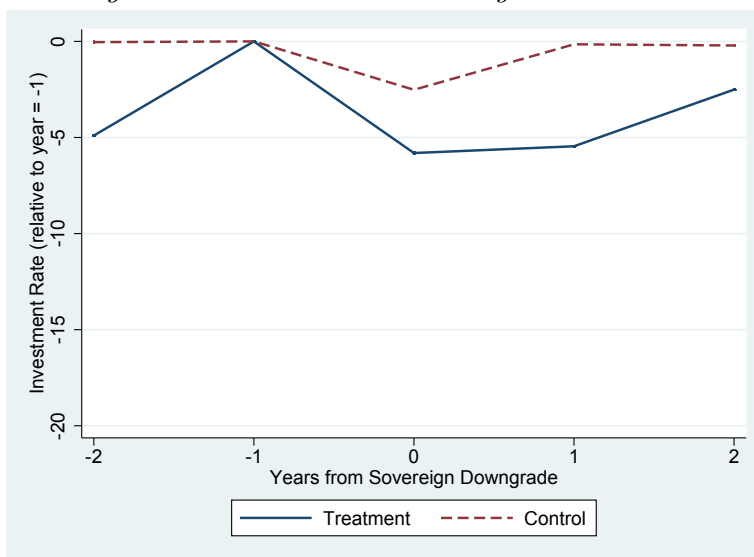
Figure A.3: Investment around a Sovereign Downgrade: Rating-Based Regulation

This figure shows the evolution of investment rate of treatment and control groups around a sovereign downgrade (between year -1 and year 0). Investment rate is the ratio of annual capital expenditure to lag net property, plant and equipment. Panel A presents the results for a sub-sample of firms located in countries whose sovereign rating migrates to a new rating bin, defined by Basel II capital requirements rules, as a consequence of a downgrade. Panel B presents the results for a sub-sample of firms located in countries whose sovereign rating does not migrate to a new rating bin as a consequence of a downgrade. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values).

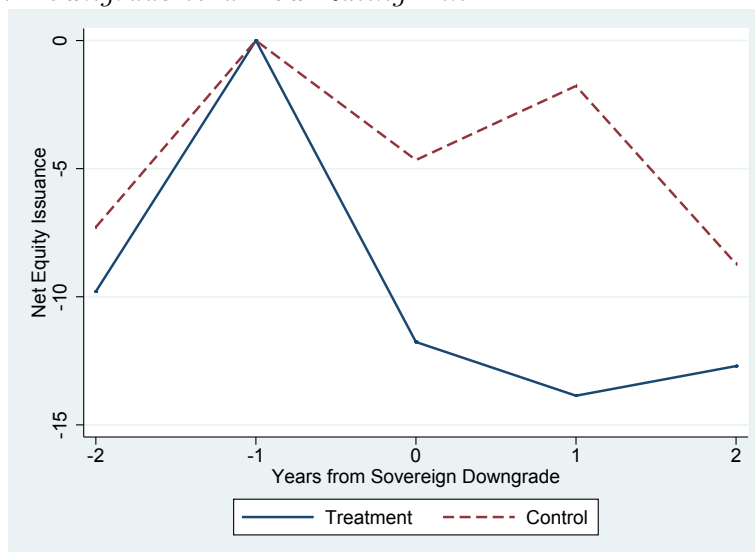*Panel A: Sovereign Downgrade to a New Rating Bin*

Panel B: Sovereign Downgrade within the Same Rating Bin

Figure A.4: Debt Issuance around a Sovereign Downgrade: Rating-Based Regulation

This figure shows the evolution of net debt issuance of treatment and control groups around a sovereign downgrade (between year -1 and year 0). Net debt issuance is the ratio of net issuance of debt to the lag of total assets. Panel A presents the results for a sub-sample of firms located in countries whose sovereign rating migrates to a new rating bin, defined by Basel II capital requirements rules, as a consequence of a downgrade. Panel B presents the results for a sub-sample of firms located in countries whose sovereign rating does not migrate to a new rating bin as a consequence of a downgrade. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. The covariates are country, year, size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending (pre-treatment values).

Panel A: Sovereign Downgrade to a New Rating Bin

Panel B: Sovereign Downgrade within the Same Rating Bin

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