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The Real Effects of Credit Ratings: The Sovereign Ceiling Channel

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ABSTRACT

We show that sovereign debt impairments can have a significant effect 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 in corporate ratings due to rating agencies' sovereign ceiling policies, which require that firms' ratings remain at or below the sovereign rating of their country of domicile.

SOVEREIGN DEBT IMPAIRMENTS have become a significant problem for developed countries in the aftermath of the 2007 to 2009 global financial crisis and the European sovereign debt crisis. France and the United States were downgraded from an 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

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identification strategy exploits the variation in corporate ratings that is due to rating agencies' sovereign ceiling policies. These policies require that firms' ratings 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 (nonbound firms). One key advantage of our empirical strategy is that nonbound firms have similar but lower credit quality than bound firms. Thus, alternative explanations based on changes in fundamentals and credit risk are not likely 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 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 nonbound 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 nonbound firms 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 the yields of nonbound 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 forced bond repurchases.[2] Finally, ratings can impact customer and employee relationships as well as business operations, including a firm's ability to enter into or maintain

[1] *CFO Magazine* 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" (see "Corporate, sovereign debt ratings closely linked: S&P," *CFO Magazine*, April 29, 2013).

[2] For example, performance-sensitive debt may incorporate 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.

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 nonlinear function of ratings. Because of this nonlinearity, 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 interpreted 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 during periods of global financial turmoil, 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 first isolate firms at the sovereign bound (treated firms). Then, from the population of firms below the sovereign bound (non-treated firms), we look for control firms that best match treated firms along 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. First, treated firms' investment decreases from 26.6% to 17.7% of capital in the year of the downgrade, implying a 8.9 percentage point 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 significant. Second, treated firms' net debt issuance decreases from 7.5% to

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

[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 following the financial crisis of 2007 to 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.

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 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 the yields of control firms over the period of three months after a sovereign downgrade relative to the three months before. This differential effect is more pronounced as the postevent window widens. For example, the differential effect is 61 basis points six months after the downgrade.

We conduct several robustness tests and find that 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 precrisis 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, and 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 to reduce investment. This difference across treated and control firms arises only following the sovereign downgrade, as there is no evidence of significant preexisting 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 greater sensitivity to sovereign debt crises, even in the absence of downgrades.[6] To further validate our exclusion restriction, we conduct a series of placebo tests that include recessions, the 2007 to 2009 financial crisis, and currency crises that are not accompanied by sovereign downgrades. We do not find significant differences in investment between treatment and control groups in any of the placebo tests.

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

[6] For instance, our treatment group could 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 (2015) and Chodorow-Reich (2014) find that borrowers with precrisis relationships with less healthy lenders were more affected by the 2007–2009 financial crisis compared to borrowers of healthier lenders.

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 investigate this possibility in several ways. First, we examine short-term effects of the sovereign downgrade on after-tax profitability of treated and control firms. Second, we conduct 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 a 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 driven in part by the government exposure channel, since this channel may matter only in the aftermath of a sovereign downgrade.

Our paper makes three contributions. First, we provide evidence of a link between sovereign debt impairments and the real economy. Sovereign debt impairments can lead to sovereign downgrades 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 on the effects of credit ratings on firm outcomes. This literature shows that credit ratings matter for capital structure decisions (Kisgen (2006)) and cost of capital (Kisgen and Strahan (2010), Baghai, Servaes, and Tamayo (2014)), as well as for firms' real decisions (Sufi (2009), Tang (2009), Lemmon and Roberts (2010), Chernenko and Sunderam (2012), and Harford and Uysal (2014)).[7] However, these studies are subject to omitted variables concerns because changes in ratings are correlated with changes in firm fundamentals. Our results, which support the argument that ratings affect firm investment and financial policy, appear 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 induced by sovereign downgrades can have real effects even for firms with the highest credit quality due to the ceiling rule.

Our study is subject to the standard limitations of quasi-natural experiments. First, we can only observe the consequences of sovereign debt impairments 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

[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 et al. (2014), and Bedendo and Colla (2015)).

periods of less turmoil. Second, our effects should 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] Sovereign downgrades can also have other effects on economic activity that we do not measure. For instance, Adelino and Ferreira (2016) find that sovereign downgrades reduce the supply of bank lending, and Becker and Ivashina (2014b) find that sovereign debt crises can affect firms through financial repression. Our findings can also apply to a country as a whole: a sovereign downgrade can lead to 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 can in turn affect real economic activity.

I. Methodology and Data

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

A. Sovereign Downgrades and Ceilings: Institutional Background

Credit rating agencies play a crucial role in providing information about the ability and 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 ratings depending on the maturity (short term or long term) and currency denomination of an issue (foreign currency or local currency). We focus on foreign currency long-term issuer ratings, which are most likely to be bound by the sovereign rating. We prefer the S&P rating history over those of the other agencies because S&P tends to be more active in making rating revisions and leads other agencies in rerating (Kaminsky and Schmukler (2002), Brooks et al. (2004)). Rating announcements by S&P also appear to have a larger own-country stock market impact and to not 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 1997, S&P first relaxed its sovereign ceiling rule in three dollarized economies: Argentina, Panama, and Uruguay.[9] Although rating agencies have moved away from 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 continue

[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 25% decrease in their investment implies a 4.5% reduction in aggregate investment in a country.

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

to represent a strong upper bound and an important determinant of ratings assigned to firms.[10]

Why do rating agencies use the 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's profile after taking into account the risk that capital and exchange controls might be imposed that would hinder the ability of the issuer to meet its 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 vis-a-vis the sovereign, as well as some degree of 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. The Standard & Poor's Rating Services (2013) methodology applies a sovereign foreign currency default stress scenario (stress test) with respect to the country or countries in which 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 the countries for which the company has material exposures). Firms that pass the stress test 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 this new methodology, Standard & Poor's Rating Services (2013) expects some corporations to receive upgrades. This suggests that S&P issued conservative ratings to some firms due to the sovereign ceiling before the recent revision of the methodology.

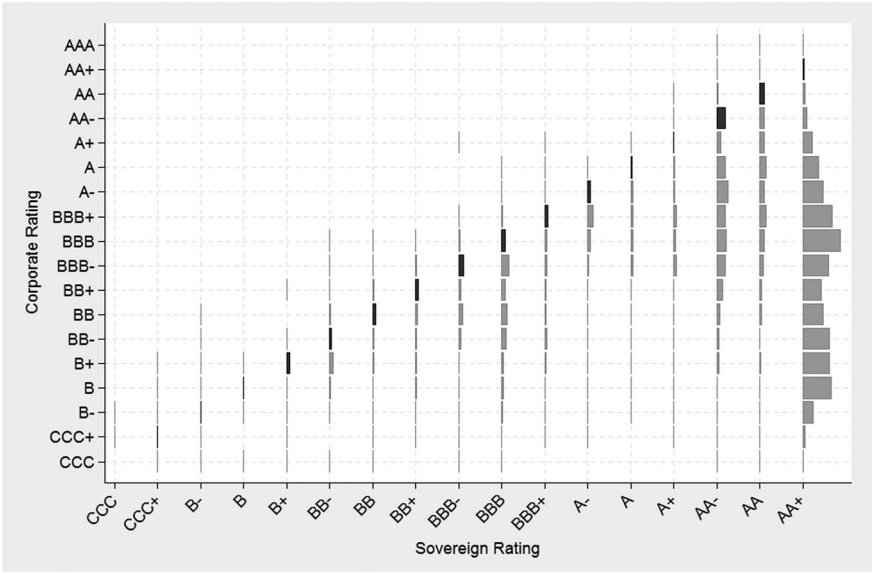
B. Identification Strategy

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 of sovereign rating changes on firms that are bound by the sovereign ceiling (bound firms) and on other firms in the same country that are not bound by the sovereign ceiling (nonbound firms).

Figure 1 presents 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 to a limited degree. In our sample, 88.2% of firms receive a rating lower than the sovereign, 8.4% receive the same rating, and just 3.4% receive a rating higher than the sovereign.

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

Panel A: Frequency of Corporate Ratings by Sovereign Rating



Panel B: Distribution of the Difference Between Corporate and Sovereign Rating

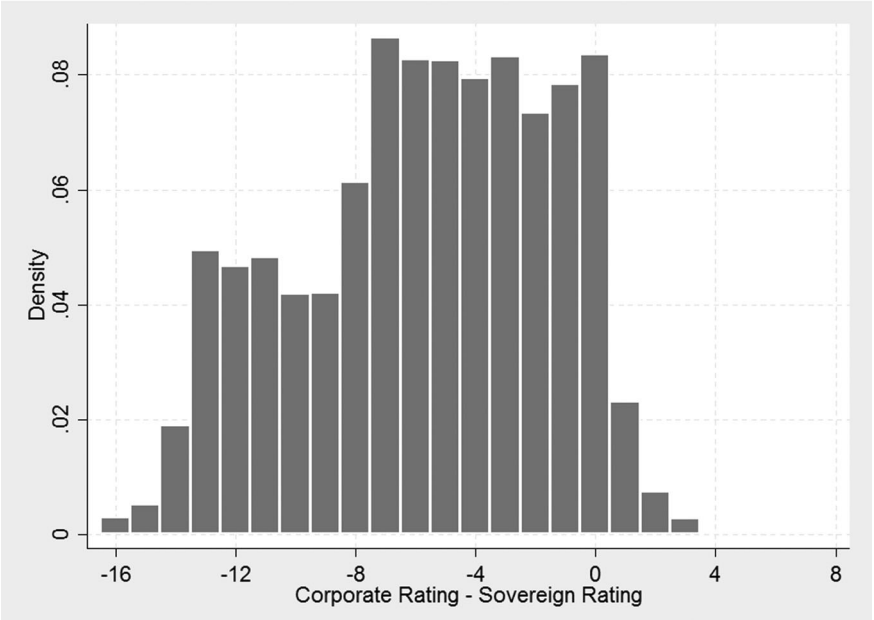


Figure 1. Sovereign ceiling rule. This figure shows the relation between sovereign and corporate credit ratings. The sample consists of WRDS-Factset Fundamentals Annual Fiscal (North America and International) nonfinancial firms over the 1990 to 2013 period. Panel A shows the frequency of S&P long-term 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.

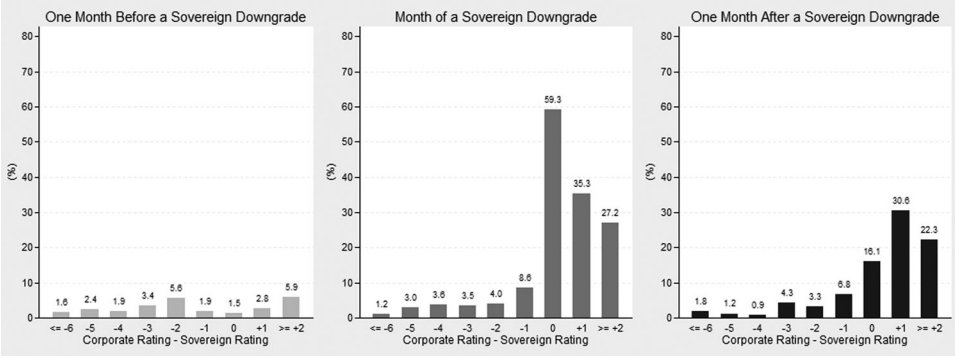


Figure 2. Frequency of corporate downgrades around a sovereign downgrade by distance from sovereign. This figure shows the fraction of firms in each group whose rating is downgraded in the month before, the month of, and the month after a sovereign downgrade. Observations are grouped according to the predowngrade difference between the corporate rating and sovereign rating. The sample consists of WRDS-Factset Fundamentals Annual Fiscal (North America and International) nonfinancial firms over the 1990 to 2013 period.

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 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 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 a rating one notch above the sovereign rating have the highest frequency of a 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 a downgrade than nonbound firms following a sovereign downgrade.

The discontinuity in ratings downgrades across bound and nonbound firms is not likely caused by factors other the sovereign ceiling rule. For example, a deterioration in macroeconomic 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 nonbound firms in

the event of a sovereign downgrade should stem from the change in ratings, and not from differences in fundamentals.

C. 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 country of domicile in the year prior to the sovereign downgrade). The nontreatment group includes nonbound firms (those with a predowngrade rating below the sovereign rating). Our analysis needs to account for the fact that treated and nontreated 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 nontreated firms, find observations that best match the treated ones along 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 context, sovereign downgrades), the treatment group would behave similarly to the control group.

We employ the Abadie and Imbens (2011) estimator, as implemented by Abadie et al. (2004). The Abadie–Imbens matching estimator minimizes the (Mahalanobis) distance between a vector of observed covariates across treated and nontreated 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 noncategorical variables include firm size, investment, Tobin's Q, cash flow, cash, leverage, foreign sales, government ownership, and exposure to government spending.

Inferences regarding the effect of sovereign downgrades are based on the Abadie–Imbens matching estimator of the 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.

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

D. 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 from 1990 to 2013. 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 for 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. Specifically, *Investment* is defined as the ratio of annual capital expenditures (Factset item FF_CAPEX_FIX) to lagged net 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 lagged total assets (Factset item FF_ASSETS); and *Net Equity Issuance* is also computed from the statement of cash flows as the ratio of sales of common and preferred stock (Factset item FF_STK_SALE_CF) minus repurchases of common and preferred stock (Factset item FF_STK_PURCH_CF) to lagged total assets. In some tests, we also consider *ROA* (return on assets), defined as the ratio of operating income (Factset item OPER_INC) minus income taxes (Factset item FF_INC_TAX) to lagged 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 investment (Factset item FF_CASH_ST) to total assets.

Table I reports the number of treated firm-year observations by country and year. Table IA.I in the Internet Appendix presents the full list of treated firms as well as their country of domicile, treatment year, and rating at the beginning and end of the treatment year.[12] The treatment group comprises 73 firms from a total of 13 different countries. The treated firms come from both developed markets (Ireland, Italy, Japan, Portugal, Spain, and the United States) and emerging markets (Argentina, Brazil, Hungary, Indonesia, Mexico, Philippines, and Thailand). Some of these countries had multiple downgrades over the sample period, such as Italy with five downgrades, Argentina with four, Japan with three, and Portugal and Thailand with two, and thus the treated sample spans 24 sovereign downgrades. The median sovereign 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

[12] The Internet Appendix is available in the online version of the article on the *Journal of Finance* website.

Table I
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
U.S.	2011	AAA	AA+	4
Total				73

sovereign debt crises, but there are also a sizable number of downgrades in earlier periods. There were additional 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 firm-level covariates include firm size, investment, Tobin's Q, cash flow, cash, leverage, and foreign sales, where *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 operating income (Factset item FF_OPER_INC) plus depreciation and amortization (Factset item FF_DEP_AMORT_EXP) to lagged total assets; and *Foreign Sales* is the ratio of foreign sales to total sales (Factset item FF_FOR_SALES_PCT). The 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.[13] The matching estimator uses the pretreatment (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. Accordingly, we impose the condition that the control firm should exactly match the country and year of the treated firm so that we compare outcomes among firms in the same country and year. We also require control firms to have a credit rating, as treated firms are necessarily rated.[14]

Our benchmark specification does not include industry as a covariate in the matching because matching on industry in addition to country and year would significantly reduce the sample size, 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 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.

E. Example

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

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

[14] 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 one) 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). We thus end up with a sample of 73 treated firms.

> 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 Antonio Mexia, Chief Executive Officer, 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 increase significantly as the facility terms included a credit rating grid (i.e., the spread to be paid at each rating level). The managers' comments indicate that the link between the corporate rating and sovereign rating is due to ceiling policies that are unrelated to firm fundamentals. The EDP example shows how a rating downgrade can affect a firm's cost of capital, investment, and financial policy.

F. Summary Statistics

Panel A of Table II compares means and medians of the covariates between the 73 treated firm-years and the remaining 21,618 nontreated 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 nontreated 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, as well as more government ownership than nontreated 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 posttreatment outcomes.

Panel A of Table II 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 thus 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.

Table II

Summary Statistics: Median and Mean Tests

This table presents the pretreatment median and mean of nontreated, treated and control groups. The sample consists of WRDS-Factset Fundamentals Annual Fiscal (North America and International) nonfinancial firms over the 1990 to 2013 period. Treated firms have a credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Nontreated firms are all other firms in the sample. The group of nontreated 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 (pretreatment 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. Standard deviations of means are reported in parentheses. ***,**, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	Median			Pearson χ^2	Mean			Kolmogorov-Smirnov
	Nontreated	Treated	Control	p-value	Nontreated	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)	

(*Continued*)

Table II—*Continued*

	Median			Pearson χ^2	Mean			Kolmogorov-Smirnov
	Nontreated	Treated	Control	*p*-value	Nontreated	Treated	Control	*p*-value
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)	

After the matching procedure, there are no statistically significant differences in the predowngrade median values of the covariates across treatment and control groups, with the exception of cash flow and Q. The median cash flow and Q are 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 a 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.[15]

The last column in Table II 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 nontreated firms, these differences disappear when we compare the group of treated firms to the group of matched control firms. Similarly to the median tests, treated firms have higher average Q and cash flow than control firms. Table IA.II 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.[16]

Panel B of Table II shows medians and means of the covariates for the treated, nontreated, 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. And again, there are no statistically significant differences in the predowngrade median and mean values of the covariates across treatment and control groups, with the exception of cash flow and Q.

II. Effect on Corporate Ratings

We examine whether sovereign downgrades have a differential effect on corporate ratings for bound firms (treatment group) and nonbound 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,

[15] In Section I.E, 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.

[16] We also check whether treated and control firms differ in terms of debt maturity structure or debt rollover risk (e.g., Almeida et al. (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 IA.II in the Internet Appendix).

Table III
Difference-in-Differences in Corporate Ratings around a Sovereign Downgrade

This table presents difference-in-differences matching estimators for corporate ratings 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 a 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 (pretreatment 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. ***,**, and * indicate 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)	
Difference 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)	
Difference in Differences			−0.75*
			(0.35)
Matching Estimator			−1.42**
			(0.56)

however, should affect treated and control firms equally or, if differently, they should affect control firms more than treated firms.

Table III presents difference-in-differences matching estimators for corporate ratings. To perform this test we map the ratings into 22 numerical values (see Table IA.III in the Internet Appendix for details), where 22 corresponds to the highest rating (AAA) and one to the lowest (default). Panel A of Table III reports the average rating for treated and control firms in the year before the sovereign downgrade and in the year of the sovereign downgrade. Not surprisingly, we see that the predowngrade 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, than on control firms ratings, which 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 III 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 presents 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 over 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 (which occurs between year −1 and year 0) than for the control group.

We perform other tests to study the relation between sovereign and corporate ratings. In particular, we test whether bound firms have a more "pessimistic" rating than nonbound firms. Tables IA.IV and IA.V in the Internet Appendix show that ratings are more pessimistic for bound firms than nonbound 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.

III. Effect on Investment and Financial Policy

In this section, we examine the investment and financial policy of treated and matched control firms around sovereign downgrades.

A. Investment Policy

Panel A of Table IV presents difference-in-differences matching estimators for investment rates around sovereign downgrades as measured by annual capital expenditures as a percentage of capital (*Investment*). The table presents 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 reduce investment significantly more than control firms at the time of a sovereign downgrade. For firms in the treatment group, average investment drops from

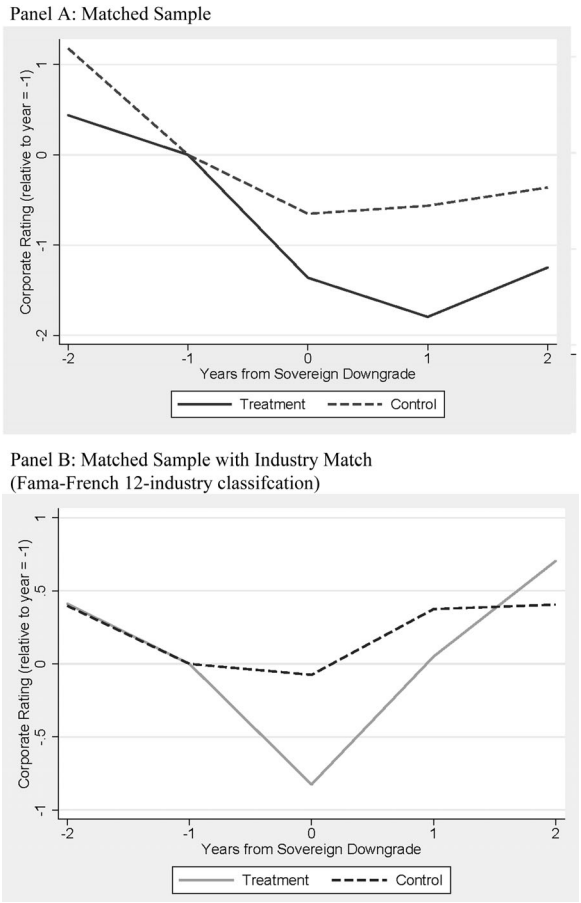


Figure 3. Corporate ratings around a sovereign downgrade. This figure shows the evolution of corporate ratings of treatment and control groups around a sovereign downgrade (which occurs between year −1 and year 0). Corporate ratings are converted to a numerical scale with 22 corresponding to the highest rating (AAA) and one to the lowest (default). Treated firms have a 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 (pretreatment values). In Panel B, the covariates also include industry (Fama-French 12-industry classification).

26.6% to 17.7% of capital, a reduction of 8.9 percentage points. For control firms, investment decreases only slightly from 19.2% to 16.6% of capital, a reduction of 2.6 percentage points. Investment is therefore reduced 6.4 percentage points more for treated firms than control firms, which is statistically and economically significant.

Panel A of Table IV also reports the differential change in investment that is produced by the bias-corrected matching estimator of the ATT. The

Table IV
Difference-in-Differences in Investment around a Sovereign Downgrade

This table presents difference-in-differences matching estimators for investment rate around a sovereign downgrade. Investment rate is the ratio of annual capital expenditures to lagged net property, plant, and equipment. Treated firms have a 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 (pretreatment 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. ***,**, and * indicate 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)	
Difference 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)	
Difference in Differences			−4.96
			(6.82)
Matching Estimator			−6.67**
			(3.10)

ATT is equal to −8.9 percentage points, which corresponds to 33% of the predowngrade 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 account for 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 IV reports the above 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 predowngrade investment level for treated firms.

A concern about inferences based on 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 posttreatment period can only be attributed to the treatment when this assumption holds. While 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 preceding the treatment separately for the treatment and control groups. If the trends are not parallel prior to the event, it is unlikely that postevent 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.[17]

B. 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 posttreatment period. For example, treated firms can face 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.

To strengthen the interpretation of the results, in this section we replicate the experiment that we run above for sovereign downgrades but using placebo periods. In particular, we use sovereign and corporate rating information to sort firms into treatment and nontreatment groups, and covariates to produce a matched control group of firms. We then compare treated versus control firm investment behavior during periods without a sovereign downgrade. We consider three placebo periods: (1) recession periods, (2) the 2007 to 2009 financial

[17] 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 policies of our treatment and control groups only diverge from each other after the downgrade.

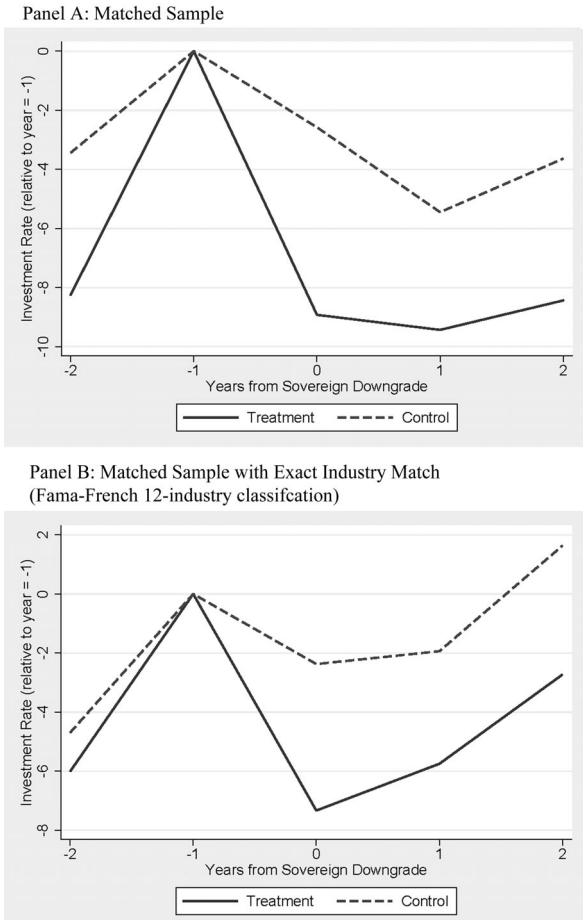


Figure 4. Investment around a sovereign downgrade. This figure shows the evolution of the investment rate of treatment and control groups around a sovereign downgrade (which occurs between year −1 and year 0). Investment rate is the ratio of annual capital expenditures to lagged net property, plant, and equipment. Treated firms have a 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 (pretreatment values).

crisis, and (3) currency crises. These falsification tests can help rule out the possibility that treated firms are more sensitive to demand and credit supply shocks than control firms.

Panel A of Table V presents results of the placebo test using recession periods without a sovereign downgrade. We identify recession periods using the Organisation for Economic Co-operation and Development (OECD) recession indicators for each country, which come from the Federal Reserve Economic

Table V

Placebo Tests: Difference-in-Differences in Investment

This table presents difference-in-differences matching estimators for investment rate. Investment rate is the ratio of annual capital expenditures to lagged 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 to 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 a 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 (pretreatment 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. ***,**, and * indicate 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)	
Difference in Differences			−1.11
			(2.03)
Matching Estimator			0.56
			(1.84)

Panel B: 2007 to 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)	
Difference 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)	
Difference in Differences			−0.40
			(3.63)
Matching Estimator			0.54
			(0.38)

Data (FRED) database. For each country, we exclude recession years in which the country is downgraded.[18] 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 posttreatment 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 a sovereign downgrade.

Panel B of Table V presents results of the placebo test using the 2007 to 2009 financial crisis. We exclude countries that experienced a downgrade 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 V presents results of the placebo test using currency crises not accompanied by a sovereign downgrade. 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 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 come from Reinhart and Rogoff (2009). [19] 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 to C of Figure IA.1 in the Internet Appendix plot the evolution of investment rates in the two years before and after recessions, the 2007 to 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 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 "national champions" that might be expected to receive support from the government and for which a sovereign downgrade reduces the value of these

[18] The recession indicator is available for 38 countries at a 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.

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

explicit or implicit subsidies.[20] 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 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). However, to further examine the possibility that 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 VI 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 group, since these firms are arguably the most likely to have direct links to the government and to receive support. The number of treated firms falls to 41 firm-year observations, but the main results hold. Panel B of Table VI shows that the matching ATT is −13.8 percentage points when we exclude utilities. Table IA.VI in the Internet Appendix shows that the estimates are qualitatively similar to those in Table VI when we use the alternative matching procedure in which the control firms match the industries of the treated firms.

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

[20] 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."

Table VI

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

This table presents difference-in-differences matching estimators for investment rate around a sovereign downgrade. Investment rate is the ratio of annual capital expenditures to lagged net property, plant, and equipment. Panel A presents results for a subsample that excludes firms with government ownership. Panel B presents results for a subsample that excludes firms with government ownership and utilities (SIC codes 4900-4999). Panel C presents results for a placebo test in which treated firms have a credit rating one notch below the sovereign and control firms have a credit rating more than one notch below the sovereign. Treated firms have a 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 (pretreatment 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. ***,**, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	Year before Downgrade	Year of Downgrade	Difference
Panel A: Excluding Firms with Government Ownership			
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)	
Difference in Differences			−8.36
			(6.39)
Matching Estimator			−12.96**
			(5.13)
Panel B: Excluding Utilities			
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)	
Difference in Differences			−6.07
			(5.10)
Matching Estimator			−13.76**
			(6.94)
Panel C: Treated Firms with Rating One Notch Below Sovereign			
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)	
Difference in Differences			−0.62
			(1.51)
Matching Estimator			−0.30
			(0.99)

Table VII

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 a 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 (pretreatment 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 to 2013 period. Robust standard errors clustered by firm are reported in parentheses. ***,**, and * indicate significance at the 1%, 5%, and 10% level, respectively.

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)
Δ*Sovereign Yield*		−0.332*		−0.073
		(0.171)		(0.144)
Δ*Sovereign 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

to or above the sovereign rating in year $t-1$ (*Bound*), the 10-year constant-maturity sovereign bond yield (*Sovereign Yield*), and the interaction between these two variables. The sample consists of monthly data on local currency bond yields for the treated and matched control firms from 1990 to 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 to explore a channel other than the sovereign ceiling that potentially links government and corporate outcomes. 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 to 0.7. More importantly, however, the coefficient on the interaction term *Sovereign Yield* $\times$ *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 VII 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 (Δ*Sovereign Yield*), and the interaction of these two variables with *Bound*. The sample consists of monthly observations on stock returns for the treated and matched control firms from 1990 to 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 Δ*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 coefficient on the interaction term *Gov. Exposure* $\times$ *Bound* 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 *ROA* after taxes. Table IA.VII 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.

C. Financial Policy

We next 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 VIII examines the effect of a sovereign downgrade on net debt issuance as a percentage of assets (*Net Debt Issuance*) in Panel A, and on 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 reduction of 5.1 percentage points. For control firms, 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 experiences 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 IA.VIII in the Internet Appendix reports the estimates using the alternative matching procedure in which the control firms match the industries of the treated firms exactly. The differential effects on net debt and equity issuance 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 patterns 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 patterns again follow similar dynamics.[21] Panel B shows that net equity issuance 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

[21] We also estimate 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.

Table VIII

Difference-in-Differences in Debt and Equity Issuance around a Sovereign Downgrade

This table presents difference-in-differences matching estimators for net debt and net equity issuance around a sovereign downgrade. Net debt issuance is the ratio of debt issuance to lagged total assets. Net equity issuance is the ratio of sales of common and preferred stock minus repurchases of common and preferred stock to lagged total assets. Panel A presents net debt issuance estimates and Panel B presents net equity issuance estimates. Treated firms have a 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 (pretreatment values). The sample consists of 73 treated and control observations. Robust standard errors clustered by country-event are reported in parentheses. ***,**, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	Year before Downgrade	Year of Downgrade	Difference
Panel A: Net Debt Issuance			
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)	
Difference in Differences			−2.83
			(3.19)
Matching Estimator			−5.47**
			(2.71)
Panel B: Net Equity Issuance			
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)	
Difference in Differences			1.86**
			(0.87)
Matching Estimator			2.56**
			(1.15)

raise debt following a sovereign downgrade, and that 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 clear-cut. The negative shock to treated firms' ability to issue debt should cause them to have lower leverage. However, the sharp reduction in investment should decrease asset growth and push toward higher leverage. Cash holdings are also affected by multiple forces. On the one hand, treated firms could use some of their cash to help weather the negative financial shock associated with the

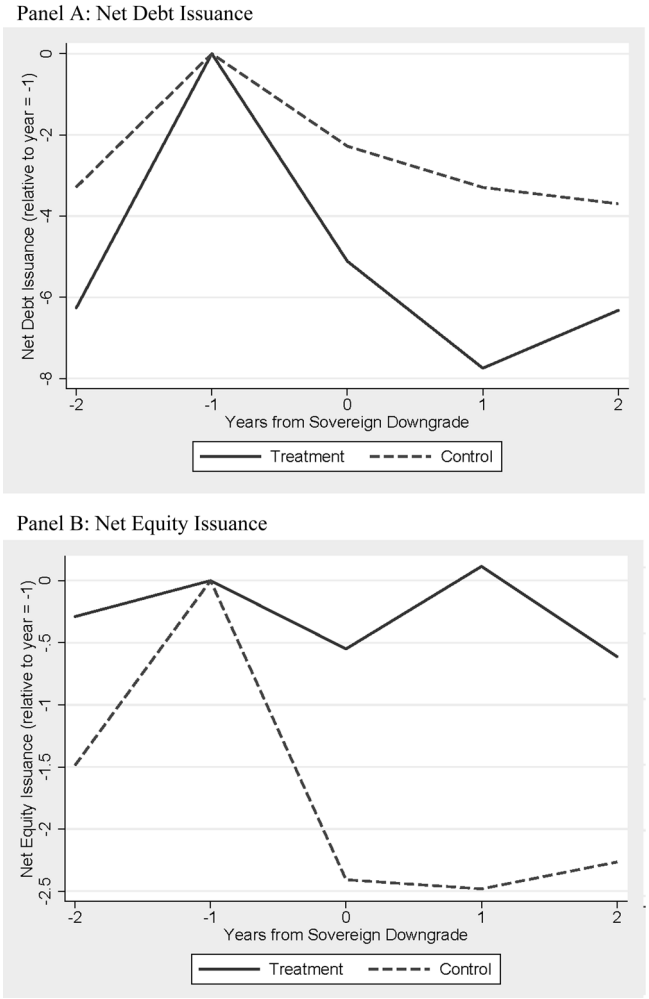


Figure 5. Debt and equity issuance around a sovereign downgrade. This figure shows the evolution of net debt and net equity issuance of treatment and control groups around a sovereign downgrade (which occurs between year −1 and year 0). Net debt issuance is the ratio of debt issuance to lagged total assets. Net equity issuance is the ratio of sales of common and preferred stock minus repurchases of common and preferred stock to lagged total assets. Treated firms have a 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 (pretreatment values).

downgrade. On the other hand, they may have incentives to save more cash to regain their predowngrade credit rating or for precautionary reasons. Table IA.IX 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 induce 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.

D. 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 to 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 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 coefficient on the interaction term captures the difference in the reaction of the investment rates of treated firms and nontreated firms following a sovereign downgrade.

Table IX reports the results. Column (1) shows that treated firms reduce their investment by 9.6 percentage points more than other firms as indicated by the interaction term's 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 II. 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) to (5) present additional results using combinations of year, industry (two-digit SIC), country, and firm fixed effects. In particular, column (5) presents estimates using country × industry × year fixed effects, so that the effect is driven only by variation within a given country-industry-year.

Overall, the magnitudes of the group difference estimates in Table IX 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 coefficient on *Bound*. The linear model regression estimates are consistent with those reported under the matching estimator approach in Table IV.

E. 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),

Table IX

Linear Regression: Difference-in-Differences in Investment around a Sovereign Downgrade

This table presents difference-in-differences linear regression estimators for investment rate around a sovereign downgrade. 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 lagged 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. The 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) nonfinancial firms in the 1990 to 2013 period. Robust standard errors clustered by country-event are reported in parentheses. ***,**, and * indicate 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

we collapse the investment and debt issuance data into periods before and after the downgrade: window (−2,−1) and window (0,+2). Tables IA.X and IA.XI 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 first obtain estimates by deleting from our sample one firm at a time. In all cases we obtain similar estimates of the matching ATT of investment, at about −9 percentage points. We next exclude from the treatment group 18 observations corresponding to Japanese firms. We again obtain similar estimates of the ATT of investment, at −14.5 percentage points and statistically significant.

We also exclude from the treatment group firms with a rating above the sovereign, as these firms may be systematically different from firms with a rating equal to the sovereign. Table IA.XII in the Internet Appendix reports difference-in-differences estimates for investment using this alternative

treatment group. Not surprisingly, the effect is even stronger than in Table IV. The differential change in investment rate produced by the matching estimator of the ATT is −10.7 percentage points and is statistically significant.

In our next robustness test 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 it 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 pretreatment 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. Under this alternative, the differential effect on investment is similar at −11.1 percentage points and is again 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 IA.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 the treatment and control groups have similar exposure to foreign currency debt before the downgrade. Following the sovereign downgrade, firms seem to increase their 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 the treatment and control groups 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.

Another concern that we address is that the relative decrease in the supply of capital to treated firms may be due to 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. 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 reduced 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. Thus, we do not find support for a financial repression explanation for our results.

IV. Effect on Cost of Debt

The evidence indicates that the ratings of bound firms are more affected by sovereign downgrades than the ratings of nonbound firms. 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. An 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 on end-of-month yield to maturity of bond issues for treated and matched control firms from 1990 to 2013 from Bloomberg. 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 predowngrade period and one in the postdowngrade 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 nonbound firms following a sovereign downgrade. The dependent variable is the change in yield around the sovereign downgrade, that is, the yield on firm i's bond j measured t months after each sovereign downgrade minus the yield on firm i's bond j measured 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 to account for the possibility that rating changes can be anticipated.

The coefficient on *Bound* captures the differential effect on the yield of bound firms relative to nonbound 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 correspond to estimating the differential impact of the sovereign downgrade on the bond yield of bound firms versus nonbound firms for the same country-event. Standard errors are clustered by country-event.[22]

Table X 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 nonbound firms. As the event window widens to six months after a sovereign downgrade, the differential effect increases to 61 basis points.

[22] 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.

Table X

Difference-in-Differences in Corporate Bond Yields around a Sovereign Downgrade

This table presents difference-in-differences matching estimators for corporate bond yield around a sovereign downgrade. The dependent variable is the change in corporate bond yield 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 a 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 (pretreatment 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 predowngrade period and one in the postdowngrade period. Robust standard errors clustered by country-event are reported in parentheses. ***,**, and * indicate 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

Figure 6 shows the monthly evolution of bond yields for bound and nonbound firms in the 10 months before and after the sovereign downgrade. While the yields of nonbound firms stay fairly constant over time, the yields of bound firms increase steadily over time after the sovereign downgrade.[23]

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 more likely to receive government support. We identify 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 X. Table IA.XIII 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 nonbound firms do not appear during periods of deterioration in government fiscal position without a sovereign downgrade.

[23] It takes approximately two months after a 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.

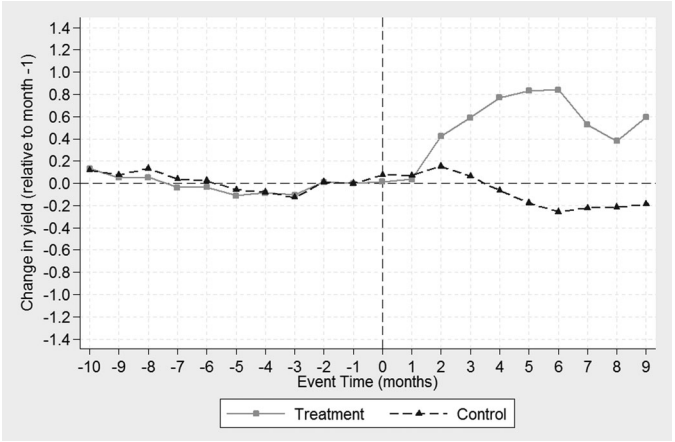


Figure 6. Corporate bond yields around a sovereign downgrade. This figure shows estimates of linear regressions of corporate bond yield of treatment and control groups around a sovereign downgrade (between month −1 and month 0). The dependent variable is the corporate bond yield. The explanatory variables 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 a 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 (pretreatment 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 predowngrade period and one in the postdowngrade period.

V. Mechanism: Why Do Rating Downgrades Matter?

In this section, we provide evidence that rating-based regulatory frictions help 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 into 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 a sovereign downgrade will have stronger effects when the sovereign changes 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 to bound firms, if they are downgraded together with the sovereign.[24]

[24] 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.

Table XI

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

This table presents difference-in-differences matching estimators for investment rate around a sovereign downgrade. Investment rate is the ratio of annual capital expenditures to lagged net property, plant, and equipment. Panel A presents results for a subsample of firms located in countries whose sovereign rating migrates to a new rating bin, defined by Basel II capital requirement rules, as a consequence of a downgrade. Panel B presents results for a subsample 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 a 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 (pretreatment 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. ***,**, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	Year before Downgrade	Year of Downgrade	Difference
Panel A: Sovereign Downgrade to a New Rating Bin			
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)	
Difference 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)	
Difference in Differences			−3.29
			(3.30)
Matching Estimator			1.95
			(1.41)

Table XI reports the estimates. We rerun the analysis for investment in Table IV separately for the two subsamples described above. Panel A of Table XI 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 IA.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 XI occur only in the year of the sovereign downgrade.

We also perform this test for net debt issuances. Table IA.XIV and Figure IA.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 XI.

This evidence suggests that changes in capital requirements are one of the mechanisms through which sovereign downgrades affect corporate debt markets and in turn 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 effects that are due to ratings. Second, there may be other mechanisms through which ratings may affect the supply of capital to bound 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 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.

VI. Conclusion

We show that sovereign debt impairments can affect financial markets and real economic activity through a credit ratings channel. In particular, 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 the yields of firms whose rating is below the bound. This is consistent with an increase in firms' costs of borrowing and a 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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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Appendix S1: Internet Appendix.