

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

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September 15, 2014

Abstract

We study the real effects of credit rating downgrades by exploring the exogenous variation on ratings that is due to the rating agencies' sovereign ceiling policies. Sovereign downgrades have a disproportional effect on the rating of firms whose rating is equal to or above the sovereign (bound firms). This asymmetric effect leads to greater reductions in investment and net debt issuance of bound firms relative to otherwise similar firms that are below the sovereign. Consistent with a contraction in debt supply, bond yields of bound firms increase more than yields of firms below the bound following a sovereign downgrade.

JEL classification: G24, G28, G31, G32, H63

Keywords: Credit ratings, Sovereign bonds, Sovereign ceiling, Cost of capital, Investment, Capital structure

*We thank Viral Acharya, Marco Bonomo, Murillo Campello, Sergey Chernenko, Paolo Colla, Jose Faias, Clifford Holderness, Victoria Ivashina, Darren Kisgen, Spyridon Lagaras, Sebastien Michenaud, Dean Paxson, Mitchell Petersen, Jun Qian, Henri Servaes, Kelly Shue, Rui Silva, Phil Strahan, Jérôme Taillard, David Thesmar, Yuhai Xuan, and Mike Weisbach; participants at the Adam Smith Workshop for Corporate Finance, European Finance Association Meeting, NBER Summer Institute Workshop on Corporate Finance, Portuguese Finance Network, and Lubrafin; and seminar participants at the Bank of Portugal, Chicago Booth School of Business, Federal Reserve Bank of New York, Hong Kong University of Science and Technology, INSPER, London School of Economics, Manchester Business School, National University of Singapore, Rice University, University of Houston, and University of North Carolina for helpful comments.

1 Introduction

How do credit ratings affect firm outcomes? Identifying the causal impact of credit ratings on firm policies is challenging, because changes in ratings are correlated with changes in macroeconomic and firm fundamentals. We study the real effects of credit rating downgrades using an identification strategy that explores the exogenous variation on ratings due to the sovereign ceiling policies that rating agencies follow. Under ceiling policies, firms generally cannot have ratings above the sovereign rating of their country of domicile.¹ 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)).

We show that the sovereign ceiling causes an asymmetric effect 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 (control firms). While ratings decline nearly one-to-one for bound firms at the time of a sovereign downgrade, ratings for the control group decline significantly less. One key advantage of our empirical strategy is that control firms have similar but lower credit quality than bound firms. Thus, standard stories based on changes in fundamentals and credit risk have a hard time explaining the discontinuous change in ratings around the sovereign bound. Rather, this discontinuity seems to suggest that ratings agencies employ the sovereign rating as an upper bound for corporate ratings. We also consider and rule out alternative explanations for this discontinuity such as non-linearities in the probabilities of default, and discontinuities arising from stress tests applied by rating agencies to firms rated above the sovereign, in the event of a sovereign downgrade. The asymmetric effect of sovereign downgrades on firm ratings is thus likely to be due to the sovereign ceiling and not to firm fundamentals.

We exploit this asymmetric effect of sovereign downgrades on bound firms to identify the effects of ratings on firm investment and financial decisions. These effects are likely to be

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

attributed to changes in the supply of capital (i.e., demand for securities) rather than in the demand for capital. Our benchmark empirical specification employs the Abadie and Imbens (2011) bias-corrected matching estimator of the *Average Effect of the Treatment on the Treated* (ATT). We isolate firms at the sovereign bound (treated firms), and then, from the population of firms below the sovereign bound (non-treated firms), look for control firms that best match the treated firm in multiple dimensions (country, industry, size, investment, Tobin's Q, cash flow, cash, leverage, and foreign sales) before the treatment (sovereign downgrades). Using a difference-in-differences estimator, we find that treated firms cut investment and net debt issuance more than control firms in the aftermath of a sovereign downgrade. While the non-parametric matching approach is well-suited for our test strategy, we show that the results hold when we use linear regression and instrumental variable methods.

Credit ratings are a major concern for corporate managers' because of the frictions associated with credit ratings (Kisgen (2006, 2007)).² 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, ratings convey information to the market about a firm's credit quality. If investors pool firms by ratings, a rating change could result in changes in a firm's cost of debt. Fourth, rating downgrades can trigger events such as bond covenant violations, increases in bond coupons or loan interest rates, and force bond repurchases.³ Finally, ratings can impact customer and employee relationships and business operations including a firm's ability to enter or maintain long-term supply and financial contracts. Because of these effects, firms appear to react to rating downgrades by reducing debt issuance and leverage (Kisgen (2009)).

When financial markets operate normally, these financial policy changes may not spill over into real decisions and economic activity. 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

²Graham and Harvey (2001) find that credit ratings are a top concern for chief financial officers determining capital structure.

³For example, debt may incorporate either explicit or implicit performance pricing provisions (PSD obligations) that depend on credit ratings (Manso, Strulovici, and Tchisty (2014)). 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.

equity for debt issuance. Sovereign downgrades also tend to happen in periods of global financial turmoil, when even firms with access to global markets may find it difficult to raise alternative sources of finance.⁴ Thus, the impact of rating downgrades is amplified by adverse market conditions and can have real outcomes as well.⁵

Consistent with this amplification mechanism, we find important real effects of rating downgrades in our setting. We find that treated firms reduce investment in the year of the sovereign downgrade significantly more than control firms. Treated firms investment goes from 28.7% to 18.5% of capital, implying a 10.2 percentage point reduction. This reduction in investment is much greater than that observed for the control firms, which is only 2.8 percentage points and statistically insignificant. The Abadie and Imbens (2011) ATT is -16.8 percentage points, which is statistically and economically significant. We also show that this differential reduction in investment for the treatment group happens only in the year of the downgrade and that, prior to the downgrade, investment grows at about the same rate for both treatment and control groups.

We then show that treated firms reduce net debt issuance immediately after the sovereign downgrade significantly more than control firms. Treated firms net debt issuance goes from 8.2% to 2.4% of assets, implying a 5.8 percentage point reduction. For control firms, net debt issuance falls only 1.6 percentage points. The ATT is -7.0 percentage points, which is statistically and economically significant. Unlike debt issuances, there is no significant change in net equity issuances for treated firms right after the downgrade. Moreover, there is some evidence that treated firms increase equity issuance more than control firms in the years after the sovereign downgrade. Overall, the evidence suggests that treated firms experience a shock to the ability to raise debt following a downgrade, which leads them to replace debt with equity.

The changes in financial policy following a downgrade lead to a corresponding decline in leverage. We show that treated firms reduce long-term debt following the sovereign downgrade significantly more than control firms (the ATT is -3.8 percentage points, which is statistically

⁴Gande and Parsley (2005) show that sovereign downgrades have spillover effects on the credit spreads of other countries. Thus, it may also be costly for firms to issue debt in other countries.

⁵In our sample, for example, most sovereign downgrades happened in the aftermath of the Asian and Russian crises and the burst of the Internet bubble (end of the 1990s and beginning of the 2000s), and then following the financial crisis of 2007-2009. Additionally, bank rating downgrades can impact the supply of bank lending (Adelino and Ferreira (2014)).

and economically significant). The decline in total debt is lower than the decline in long-term debt, which indicates that treated firms replace long-term debt with short-term debt following a sovereign downgrade. We observe changes in leverage only in the year after the sovereign downgrade, which is consistent with the idea that leverage takes longer to adjust than investment and security issuance (Leary and Roberts (2005) and Lemmon, Roberts, and Zender (2008)). Additionally, there is an immediate reaction in corporate liquidity, as we find that treated firm cash holdings decline significantly more than control firms by 2.1 percentage points in the year of the sovereign downgrade.

Finally, we show that downgrades affect corporate bond yields. We find that bond yields of treated firms increase by approximately 34 basis points more than yields of control firms in a period of three months after a sovereign downgrade relative to three months before. This differential effect is more pronounced as the post-event window widens. For example, the differential effect is 80 basis points six months after the downgrade. Thus, treated firms find it more expensive to raise debt in the aftermath of a sovereign downgrade. This evidence suggests that the sovereign downgrade reduces debt supply more for treated firms than control firms.

The key assumption of our identification strategy is that sovereign downgrades are not related to differences in investment and debt issuance across treatment and control groups, other than through changes in ratings. This assumption would be violated if treated firms had unobservable characteristics that predict a greater sensitivity to sovereign crisis, even in the absence of downgrades. For example, treated firms can have greater exposure to adverse economic conditions and credit supply shocks.⁶

We examine this possibility by conducting a series of placebo tests. First, we examine the relative change in investment for treatment and control groups around recessions that are not accompanied by sovereign downgrades. Second, we examine the consequences of the 2007-2009 financial crisis, which corresponds to a large shock to the supply of capital that is not accompanied by sovereign downgrades. Finally, we examine the consequences of currency crises. This placebo can detect whether treated firms are more sensitive to currency crises because,

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

for example, they use more foreign currency debt. In all placebo tests, we find no significant differences in investment between treatment and control groups.

An additional concern is that treated firms may have greater exposure to government fiscal crises than control firms. The group of treated firms may include some “national champions” that might be expected to receive support from the government. A sovereign downgrade could reduce the value of such support by reducing subsidies or increasing taxes. We investigate this possibility in several ways. First, we examine short-term effects of the sovereign downgrade on after-tax profitability, since a reduction in government support may affect differentially short-term profits of treated firms. Second, we compare government ownership across treated and control firms. Third, we consider robustness checks in which we exclude firms with government ownership or utilities from the treatment group, since these firms are arguably most likely to receive government support. Fourth, we examine the relative change in investment for firms with rating one notch below the sovereign relative to matched control firms with rating more than one notch below the sovereign, since these firms might also be expected to receive government support. Finally, we compare changes in bond yields of treated and control firms following significant increases in sovereign bond yields that are not accompanied by sovereign downgrades. Significant increases in sovereign yields should be associated with deteriorations in local government fiscal position. The results of these tests do not support the hypothesis that treated firms have greater exposure to government fiscal crises.

In the context of a sovereign downgrade, another possible channel through which ratings may affect firms access to capital markets is through financial repression (Becker and Ivashina (2014b)). We investigate whether financial repression may affect our treated firms more than control firms by restricting the control group to firms within three notches, two notches or one notch of the sovereign rating. If our differential effect are explained by financial repression, then they should go away or at least be mitigated using this alternative control groups in which control firms debt is a closer substitute to government debt. We find that the results actually get stronger when we consider these alternative control groups.

Other authors have examined the effects of credit ratings on firm outcomes. Credit ratings matter for capital structure decisions (Kisgen (2006)) and cost of capital (Kisgen and Strahan (2010)), and firms appear to react to downgrades by reducing debt issuance and leverage (Kisgen

(2009)). Furthermore, Baghai, Servaes, and Tamayo (2013) find that rating agencies increased conservatism in assigning ratings to firms has affected leverage and credit spreads.

There is less conclusive evidence that ratings affect firm real decisions. Sufi (2009) finds that the introduction of loan ratings (as opposed to rating downgrades) by Moody's in 1995 preceded an increase in investment and debt for firms that seek ratings, particularly those with poorer credit quality and no rating prior to 1995.⁷ Tang (2009) finds that the Moody's credit rating refinement in 1982 led to an increase in debt and investment in upgraded firms versus downgraded firms. However, it is hard to rule out the possibility that upgrades and downgrades after refinement could be correlated with shocks to firm fundamentals. Lemmon and Roberts (2010) find that, after the junk bond crisis of 1989, junk-rated firms reduced investment and net debt more than unrated firms. Chernenko and Sunderam (2012) show that the investment rates of firms with ratings right below investment-grade are more sensitive to flows into high-yield mutual funds, compared to a matched sample of firms with ratings right above the cutoff. These papers, however, do not show that rating downgrades cause reductions in investment. In fact, Chernenko and Sunderam (2012) find no difference in the average investment of firms that are right above and below the investment grade cutoff.⁸

Our work makes three contributions. First, it provides a causal estimate of the effect of credit ratings on firm investment and financial policy. Our effects seem to be driven specifically by changes in ratings, and not by changes in fundamentals and crowding-out effects (e.g., Graham, Leary, and Roberts (2014)). Second, we provide a novel link between sovereign downgrades and corporate finance. Sovereign downgrades cause corporate rating downgrades because of the sovereign ceiling rule and adverse market conditions associated with the sovereign downgrade amplify the impact of these downgrades. Finally, we contribute to the recent literature that studies credit supply effects on large and high credit quality firms. Becker and Ivashina (2014a) find that firms that have access to both bank loans and bond markets substitute away from bank loans into bonds at the time of tight lending standards and monetary policy. Adrian, Colla, and Shin (2013) find that rated firms substituted bond financing for bank loans during

⁷Harford and Uysal (2014) find that rated firms are more likely to make acquisitions than a matched sample of non-rated firms.

⁸Other authors study the relation between sovereign and corporate credit risk using ratings and bond yields (e.g., Durbin and Ng (2005), Bedendo and Colla (2013), and Borensztein, Cowan, and Valenzuela (2013)).

the 2007-2009 financial crisis. We show that a negative shock to credit supply engendered by sovereign downgrades has real effects even in the few (but important) high credit quality firms due to the rating agencies' sovereign ceiling policies.

These results have potential implications for public policy and credit rating agencies regulation. 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. While rating agencies have been gradually moving away from a policy of never rating a private borrower above the sovereign, our results show that the rule still applies following a sovereign downgrade. Our paper suggests that rating agencies still impose a sovereign ceiling on the ratings of firms irrespective of their fundamentals, which pushes down ratings and causes significant effects on firm investment and financial policy.

2 Methodology and data

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

2.1 Sovereign downgrades and ceilings: Institutional background

Credit rating agencies play a crucial role in providing information about the ability and the willingness of issuers, including governments and private firms, to meet their financial obligations. The three major agencies – Standard & Poor's (S&P), Moody's, and Fitch – assign different types of ratings depending on the maturity (short-term or long-term) and currency denomination of an issue (foreign currency or local currency). We focus on the foreign currency long-term issuer ratings, which are the most likely to be bound by the sovereign rating.⁹ We prefer the S&P rating history over other agencies because S&P tends to be more active in making rating revisions and leads other agencies in re-rating (Kaminsky and Schmukler (2002), Brooks, Faff, Hillier, and Hillier (2004), Gande and Parsley (2005)). Rating announcements by S&P also seem to convey a greater own-country stock market impact and seem not to be fully anticipated by the market (Reisen and von Maltzan (1999)).

⁹We obtain similar estimates of the differential effects when we use domestic currency long-term issuer ratings.

Until 1997, rating agencies followed a strict policy of not granting a private company a foreign currency rating higher than the sovereign rating. In April of that year, S&P first relaxed its sovereign ceiling rule in three dollarized economies: Argentina, Panama, and Uruguay.¹⁰ Although rating agencies have moved away from a strict enforcement of the sovereign ceiling over the last two decades, corporate ratings that “pierce” the ceiling are still not common. Borensztein, Cowan, and Valenzuela (2013) show that sovereign ratings still represent a strong upper bound and an important determinant of ratings assigned to firms.¹¹

Why do rating agencies use sovereign rating as a strong upper bound when they rate corporate issuers? Agencies use two key factors in rating issuers: the issuer’s inherent likelihood of making repayment; and, in the case of foreign currency ratings, the issuer profile after taking into account the risk that government exchange controls might be imposed that would hinder the ability of issuers to meet their financial obligations in foreign currency. Thus, firms that “pierce” the ceiling are particularly strong corporations with little exposure to the risk of failure to meet their foreign currency obligations in the case of a sovereign default. Firms with foreign assets, high export earnings, and foreign parents are more likely to be rated above their sovereign.

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 with the sovereign, as well as some insulation from the domestic economic and financial disruptions typically associated with sovereign distress. Interestingly, S&P recently updated its methodology to address some of the limitations of the previous approach. Standard & Poor’s Rating Services (2013) methodology applies a sovereign foreign currency default stress scenario (stress test) with respect to the country or countries where the firm has a concentration of economic exposure and when the potential rating would exceed the foreign currency rating on the sovereign (in general, the reference sovereign rating is a weighted average of the sovereign ratings of countries where the company has material exposures). Firms that pass the stress test can be rated up to two or four notches above the sovereign foreign currency rating, depending on whether S&P views their sectors sensitivity to country risk as “high” or “moderate” respectively. As a result of the

¹⁰Fitch and Moody’s followed suit in 1998 and 2001.

¹¹For example, Standard & Poor’s Rating Services (2012) reports only 54 non-financial corporations worldwide with ratings that exceed the sovereign rating as of October 2012.

application of this new methodology, Standard & Poor’s Rating Services (2013) expects that some corporations will receive upgrades. This suggests that S&P granted conservative ratings to some firms due to the sovereign ceiling before the recent revision of the methodology.

2.2 Identification strategy

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

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

Figure 2 illustrates the key empirical regularity that we use to identify causal effects of ratings on firm outcomes. The figure shows that the probability a corporate issuer will obtain a rating downgrade within the month of a sovereign downgrade is discontinuous exactly at the sovereign bound (where the difference between a firm’s rating and its sovereign is equal to zero). More precisely, the middle panel in Figure 2 shows that, conditional on the event of a sovereign downgrade, firms that are at the bound have a 57.3% chance of obtaining a rating downgrade within the month, compared to 8.4% and 2.7% 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.¹² We conclude that bound firms have a significantly higher probability of downgrade than non-bound firms following a sovereign downgrade.

Our interpretation is that the discontinuity in ratings downgrades across bound and non-

¹²Firms with rating one notch above the sovereign rating have the highest frequency of downgrade in the month after the sovereign downgrade, which is consistent with the ceiling rule.

bound firms is caused by the sovereign ceiling rule. For example, a deterioration of 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). There are two other possible explanations for this discontinuity in ratings. First, the change in the probabilities of default can be non-linear in the event of an aggregate shock. Specifically, probabilities of default for highly rated firms can increase significantly more than those for firms with lower ratings. Thus, the discontinuity in downgrades may reflect a discontinuity in credit risk at the time of negative aggregate shocks. Second, if credit rating agencies apply stress tests only to firms rated above the sovereign in the event of a sovereign downgrade, this revaluation can explain the discontinuity in corporate downgrades (Standard & Poor's Rating Services (2013)).

We believe that these alternative explanations cannot explain the discontinuity in ratings at the sovereign bound. Table 1 shows that the sovereign rating ceiling before the downgrades varies from B to AAA in our sample of events. Thus, it is unlikely that a discontinuity in credit risk around a specific rating could explain the discontinuity in corporate ratings downgrades that we document. To confirm this conjecture, we provide two complementary pieces of evidence using the 2007-2009 financial crisis as a placebo aggregate shock. Figure 3 shows the fraction of corporate ratings downgrades from 2007 to 2009, for different initial rating classes. We find that the probability of a downgrade increases significantly in this period, while there is no evidence of a discontinuity in downgrades in any specific initial rating. In addition, the probability of a downgrade in 2008 and 2009 is significantly higher for firms with lower rating. This evidence is inconsistent with the idea that ratings fall more for high credit quality firms in the event of a negative aggregate shock. Figure 4 shows the changes in ratings for treated and control firms during the 2007-2009 financial crisis. There is no evidence that treated firms suffer stronger reductions in ratings in the presence of an aggregate shock that is not accompanied by a sovereign downgrade.

This evidence does not directly address the second alternative explanation of a discontinuity due to rating agencies' stress tests applied to firms with ratings above the sovereign. Following a sovereign downgrade, bound firms will be now rated above the sovereign and therefore could

be subject to a stress test and as a result be downgraded. This explanation implies that bound firms ratings are likely “too high” and the sovereign downgrade prompts a revaluation in ratings that corrects this distortion. However, we will provide evidence that ratings of bound firms are, on average, too pessimistic relative to the ratings of non-bound firms (see Section 3). In addition, recall that Standard & Poor’s Rating Services (2013) expects that the 2013 change in methodology to rate firms above the sovereign will result mostly in upgrades. This evidence does not support the conjecture that stress testing corrects optimistic ratings for bound firms, but instead they are consistent with rating agencies applying sovereign ceiling rules.

To further rule out the stress test explanation, we restrict our control group to firms with pre-treatment rating just one notch below the sovereign. Since the average sovereign downgrade in our sample is approximately two notches, such control firms would also be subject to a stress test in the event of a sovereign downgrade (after the downgrade their rating is one notch above the sovereign). We find that reductions in ratings are significantly higher for bound firms, even when we compare these firms to control firms with pre-treatment rating one notch below the sovereign.

Our evidence thus suggests that S&P continues to apply the sovereign ceiling rule in the event of a sovereign downgrade. Thus, the differential effect on firm outcomes across bound (treated) firms and non-bound (non-treated) firms in the event of a sovereign downgrade should stem exclusively from the differential change in ratings, and not from differences in firm fundamentals.

2.3 Matching approach

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

One way to tackle this issue is to estimate differences between plausibly counterfactual out-

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

We employ the Abadie and Imbens (2011) estimator, as implemented by Abadie, Drukker, Herr, and Imbens (2004). The Abadie-Imbens matching estimator minimizes the (Mahalanobis) distance between a vector of observed covariates across treated and non-treated firms to find matched control firms. We select one matched control observation for each treated observation. The estimator allows control firms to serve as matches more than once, which (compared to matching without replacement) reduces the estimation bias but increases the variance. The Abadie-Imbens estimator produces exact matches on categorical variables, but less exact matches on continuous variables (though they should be close). The procedure recognizes this difficulty and applies a bias-correction component to the estimates. The categorical variables include year, country, industry (two-digit SIC), and whether a firm has a credit rating. The non-categorical variables include firm size, investment, Tobin's Q, cash flow, cash, leverage, and foreign sales.

Inferences about the treatment of interest are based on the average effect of the treatment on the treated (ATT). We model the outcomes in our experiments in differenced form by performing difference-in-differences estimations. Specifically, rather than comparing levels of the outcome variables in the treatment and control groups, we compare changes in the outcome variables between the groups around the sovereign downgrade. We do so because the outcome levels for treated and controls could be different prior to the event defining the experiment, and continue to be different after that event, in which case the inferences could be potentially biased by firm-specific differences.

2.4 Sample and variable construction

The sample of firms is taken from the WRDS-Factset Fundamentals Annual Fiscal (North America and International) database. It includes firms from 80 countries for the 1990-2012 period. We exclude financial firms (SIC codes 6000-6999) because these firms tend to have significantly different investment and financial policies. We drop any observation with negative total assets. We obtain firm accounting and market variables from Factset and sovereign and corporate credit ratings (foreign currency long-term issuer ratings) from Bloomberg. We match firms in Factset to Bloomberg using ISIN, SEDOL, CUSIP, or company name. The initial sample includes 551,729 firm-year observations and 55,422 different firms. Only a small fraction of these firms have a rating (31,187 firm-year observations and 3,605 unique firms).

In our experiments, the outcome variables are the annual changes in firm investment, debt and equity issuance, leverage and cash around a sovereign downgrade. *Investment* is defined as the ratio of annual capital expenditures (Factset item FF_CAPEX_FIX) to the lagged value of net property, plant, and equipment (Factset item FF_PPE_NET). *Net Debt Issuance* is computed from the statement of cash flows as the ratio of net debt issuance (Factset item FF_DEBT_CF) to the lagged value of total assets. *Net Equity Issuance* is also computed from the statement of cash flows as the ratio of sale of common and preferred stock (Factset item FF_STK_SALE_CF) minus repurchase of common and preferred stock (Factset item FF_STK_PURCH_CF) to the lagged value of total assets. *Long-Term Leverage* is defined as the ratio of long-term debt (Factset item FF_DEBT_LT) to total assets (Factset item FF_ASSETS). *Total Leverage* is defined as the ratio of total debt (Factset item FF_DEBT) to total assets. *Cash* is defined as the ratio of cash and short-term investments (Factset item FF_CASH_ST) to total assets. In some tests, we also use return on assets (*ROA*) after taxes, defined as the ratio of operating income (Factset item OPER_INC) minus income taxes (Factset item FF_INC_TAX) to the lagged value of total assets.

Table 1 reports the number of treated firm-year observations by country and year. Table A.1 in the Internet Appendix presents the full list of treated firms as well as country of domicile, treatment year, and rating at the beginning and end of treatment year. There are 66 observations in the treatment group in 12 different countries that were downgraded a total of 22

times during the sample period. There have been many more sovereign downgrades during our sample period, but we rely only on those for which we can identify treated firms in the downgraded country. The countries include both developed markets (Ireland, Italy, Japan, Portugal, Spain, and the United States) and emerging markets (Argentina, Brazil, Indonesia, Mexico, Philippines, and Thailand). There are countries with multiple downgrades over the sample period, such as Italy with four downgrades, Argentina and Japan with three downgrades, and Indonesia, Portugal, and Thailand with two.¹³ The median sovereign rating downgrade is one notch and the average is two notches. There are 11 downgrades during the post-2007 period corresponding to the global financial crisis and eurozone sovereign debt crises, but there are also a sizable number of downgrades in earlier periods.

The covariates are size, investment, Tobin’s Q , cash flow, cash, leverage, and foreign sales. *Size* is defined as the log 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 the lag of net property, plant and equipment. *Foreign Sales* is the ratio of foreign sales to total sales (Factset item FF_FOR_SALES_PCT). We also present summary statistics on *Long-Term Debt*, defined as the ratio of long-term debt to total debt; and *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).

The matching estimator uses the pre-treatment (year prior to the sovereign downgrade) value of the covariates. To minimize the impact of outliers on these comparisons, we winsorize variables at the top and bottom 1% level. We match firms on year and their country of domicile and industry (two-digit SIC codes). Thus, we impose that the control firm should match exactly the country and year of the treated firm so that we are effectively comparing outcomes within firms in the same country and year.¹⁴ We also require control firms to have a credit rating, as treated firms are necessarily rated. Although we include industry as a covariate in the matching, we do not impose an exact match because in smaller countries it would be difficult to find an

¹³The treatment group includes 18 observations corresponding to Japanese firms. We obtain similar estimates when we exclude these observations from the sample.

¹⁴We drop treated firms for which we were unable to find a match within the same country (15 cases).

exact match within the industry. In subsection 4.5, we present a robustness check with exact industry matching.

2.5 Example

One of the firms in our treatment group comes from the energy business: EDP Energias de Portugal. S&P downgraded Portugal's sovereign rating on March 25, 2011, from A- to BBB and then on March 28, 2011 to BBB-. As a consequence, EDP was downgraded on March 28, 2011, from A- to BBB. The effect of the sovereign downgrade on the firm's rating was explained by Miguel Viana, Head of its Investor Relations Office, in the 2011 year-end results conference call:

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

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

We are reducing CAPEX not only because of the evolution of the energy market but also to improve financials. The CAPEX fell 19% to less than 2.2 billion euros, especially because of the lower additions in the US 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 US market, and by the fact that we went down the road once again in what concerns the deleveraging through disposals.

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

2.6 Summary statistics

Table 2 compares means and medians of the covariates between the 66 treated firm-years and the remaining 24,873 non-treated firm-years (i.e., firms that are not assigned to the treatment group). We restrict the group of non-treated firms to countries that have least one sovereign downgrade over the sample period.¹⁵ The treated firms are bigger and have higher investment, Tobin's Q, cash flow, and leverage values, and more government ownership than non-treated firms, on average. These differences are expected, given that we are relying on observational data rather than running a true experiment. The goal of the matching estimator techniques is to control for these distributional differences, which could affect both selection into the treatment group and post-treatment outcomes.

Table 2 also shows medians and means of the covariates for the matched control firms. The Abadie-Imbens matching estimator identifies a match for each firm in the treatment group. We have 66 firm-year observations in both groups, but because matching is done with replacement, we have 44 unique firms in the control group. The Pearson chi-square statistic tests for differences in the medians of the covariates between the treatment and control groups.

After the matching procedure, there are no statistically significant differences in the pre-downgrade median values of the covariates across treatment and control groups, with the exception of cash flow and Q. The median cash flow and Q is higher for firms in the treatment versus the control group. The difference in cash flow cannot explain our findings, as we would expect firms with higher cash flow to be less affected by the sovereign downgrade than firms with lower cash flow. In contrast, the difference in Q can explain our findings, as firms with higher Q may be more sensitive to shocks than firms with lower Q. In subsection 4.5, we conduct a robustness

¹⁵Table A.2 in the Internet Appendix presents the number of firm-year observations by country.

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.

The last column in Table 2 compares the entire distributions of the matching covariates between the treatment and control groups using the Kolmogorov-Smirnov test. These statistics support the assertion that the matching estimator moves our experiment closer to a test in which treatment and control groups differ only with respect to their post-treatment outcomes (investment, debt and equity issuance, leverage, and cash). While treated firms differ significantly from non-treated firms, these differences disappear when we compare the group of treated firms to the group of matched control firms. Similarly to the median tests, treated firms have higher average Q and cash flow than control firm. Table A.3 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 government ownership. Treated firms have average government ownership of 7% versus 5% for control firms, but the difference is statistically insignificant. The distribution of government ownership is also similar between treatment and control groups. We also check whether treated and control firms differ in terms of debt maturity structure or debt rollover risk (e.g., Almeida, Campello, Laranjeira, and Weisbenner (2012)). There are no significant differences in the distribution of *Long-Term Debt* between treatment and control groups.

3 Effect on corporate ratings

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

Table 3 presents the results of difference-in-differences matching estimators for corporate credit ratings. To perform this test we map the ratings into 22 numerical values (see Table A.4 in the Internet Appendix for details), where 22 corresponds to the highest rating (AAA)

and one to the lowest (default). Table 3 shows the average rating value 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 pre-downgrade rating is significantly higher for treated firms than for control firms. The average treated firm has a rating value of 16 (i.e., A-), and the average control firm has a rating value of 13 (i.e., BBB-). On average, there is a three-notch difference between treated and control firms, with the latter just one notch above speculative-grade ratings.

We find that sovereign downgrades have a much stronger effect on treated firm ratings with a reduction of 1.66 notches, while control firms ratings are reduced by only 0.89 notches. These estimates suggest that ratings decline 0.77 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 (the average sovereign downgrade is slightly below two notches, and the median is one notch), while control firm ratings are less sensitive to sovereign downgrades.¹⁶

Table 3 also reports the differential change in ratings that is produced by the Abadie-Imbens matching estimator of the *Average Effect of the Treatment on the Treated* (ATT). The ATT difference is equal to -1.38 notches, indicating a significant asymmetry in the reaction of treatment and control group ratings to a sovereign downgrade.

Figure 5 plots the evolution of corporate ratings in the two years before and after the sovereign downgrade for the treatment and control groups. The ratings of the two groups follow parallel trends before the sovereign downgrade. Furthermore, the ratings fall significantly more for the treatment group in the year of the downgrade (between year -1 and year 0) than for the control group.

We perform other tests to study the relation between sovereign ratings and corporate ratings. First, we estimate a logit regression of the probability of a credit rating downgrade using a firm-year panel. Table A.5 in the Internet Appendix indicates that the probability of a rating downgrade following a sovereign downgrade is significantly higher for treated firms versus non-treated firms. The marginal effect indicates a five times higher probability of a rating downgrade

¹⁶The difference-in-differences estimate of ratings is robust to the inclusion of country fixed effects and clustered standard errors by country.

for treated firms (58%) versus non-treated firms (13%) when a sovereign downgrade hits the country where the firm is domiciled.

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

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

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

where $Rating_{i,t}$ is the rating (numerical value) for firm i in year t . The regression includes year fixed effects to control for time-specific shocks (α_t) and industry fixed effects (α_d). We estimate the regression using the sample of firms in AAA countries, and then use the estimated coefficients to calculate the predicted ratings for firms in non-AAA countries (which we denote as \widehat{Rating}), where the sovereign rating ceiling potentially represents a meaningful friction. Table A.6 in the Internet Appendix shows the estimated coefficients.

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

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

where $RatingFE$ is a set of dummies for each rating class, $Bound$ is a dummy variable that

takes a value of one for bound firms and zero otherwise, and *SovRatingFE* is a set of dummies to control for differences across sovereign rating classes. The regressions includes year fixed effects (α_t) to account for variations in corporate ratings through the business cycle. β_2 is a vector of coefficients that captures the differential effect, for each rating class, of the sovereign ceiling on a firm’s predicted rating. If bound firms are rated fairly relative to non-bound firms, then predicted ratings should not systematically differ based on whether firms are below or at the sovereign bound. If bound firms tend to be pessimistically rated, then their predicted ratings should be higher than the ratings of other firms with the same actual rating that are not bound by the sovereign.

Table 4 compares predicted ratings for bound versus non-bound firms according to equation (2). We find that bound firms tend to have higher predicted ratings than comparable non-bound firms with the same rating. For example, a bound firm with a B+ rating has a predicted rating that is 1.78 notches higher than a firm that is also rated B+ but that is not bound by the sovereign ceiling. The difference between the predicted ratings of bound versus non-bound firms is positive and statistically significant in 9 of the 15 rating levels. The sovereign ceiling rule represents a less meaningful restriction for the highest rating levels (A or above). These results suggest that the sovereign ceiling rule can have real consequences for firms even outside sovereign downgrade episodes, as bound firms receive lower ratings than they actually should.

4 Effect on investment and financial policy

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

4.1 Investment policy

Table 5 presents the results of difference-in-differences matching estimator for firm investment rates around sovereign downgrades as measured by annual capital expenditures as a percentage of capital (*Investment*). The table shows the investment rates in the year before the sovereign downgrade and in the year of the sovereign downgrade. Firms in the treatment group (those with pre-downgrade rating equal to or above the sovereign rating) are compared with closer

counterfactuals (matched control firms). Not surprisingly, pre-downgrade investment levels of treatment and control firms are economically similar and statistically indistinguishable. The investment rates of the treated and control firms become significantly different after a sovereign downgrade, though. For firms in the treatment group, average investment drops to 18.53% of capital, a fall of 10.20 percentage points. For control firms, investment falls only slightly to 19.22% of capital, a fall of 2.84 percentage points. These estimates suggest that investment is reduced by 7.35 percentage points more for treated firms than control firms.¹⁷

Table 5 also reports the differential change in investment that is produced by the Abadie-Imbens matching estimator of the ATT. The ATT is equal to -16.78 percentage points, which indicates that investment for the treated firms following a sovereign downgrade fell by about half of its pre-downgrade investment levels. More generally, the estimates in Table 5 imply that rating downgrades lead to lower investment. Treated firms cut investment significantly more than control firms following a sovereign downgrade, and this differential effect cannot be explained by any firm-specific differences between the two groups.

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

A concern about inferences from the treatment effects framework is whether the processes generating the treatment and control group outcomes follow parallel trends prior to the treatment. Differences in the post-treatment period can only be attributed to the treatment when this assumption holds. The best way to address this concern is to look at the evolution of the outcome variable (investment rate) in the years leading to the treatment separately for the treatment and control groups.

¹⁷The difference-in-differences estimate of investment is slightly stronger economically and statistically when we include country fixed effects and cluster standard errors by country.

Figure 6 plots the evolution of investment rates in the two years before and after the sovereign downgrade. It is hard to argue that the investment processes of the two groups follow different trends before the downgrade. Furthermore, we can see that 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.

To check the sensitivity of our findings to outliers, we obtain estimates by deleting one firm at a time from our sample. In all cases we obtain similar estimates. Furthermore, we need to drop the 11 firms (17% of the entire sample) with the largest reductions in investment to make the estimate statistically insignificant.

We also estimate the effects of sovereign upgrades on corporate investment. Sovereign ceiling policies should not matter as much in the case of upgrades. Firms with ratings at the sovereign bound are not necessarily upgraded following a sovereign upgrade.¹⁸ The market reaction to upgrades is typically insignificant, perhaps because ratings agencies are slow to upgrade firms (Gande and Parsley (2005), Ferreira and Gama (2007)). Additionally, upgrades happen in good times when financial constraints are less binding and a shock to the supply of debt capital might matter less.¹⁹

We identify years of sovereign upgrades, and then construct the treatment and control groups in a similar way to that in Table 5. Table A.8 in the Internet Appendix presents the results. We find no difference in the investment behavior of the two groups following a sovereign upgrade. The estimates suggest that the investment rate increases by 0.85 percentage points less for treated firms than control firms, and this difference is economically and statistically insignificant. The ATT is also statistically insignificant. Figure A.2 in the Internet Appendix plots the evolution of investment rates in the two years before and after sovereign upgrades. These results suggest that sovereign upgrades are not associated with meaningful shocks to firms' investment behavior, which is consistent with evidence that capital structure decisions are not significantly affected by rating upgrades (Kisgen (2009)).

¹⁸Table A.7 and Figure A.1 in the Internet Appendix show that ratings of firms at the sovereign bound do not increase disproportionately relative to firms below the bound.

¹⁹Consistent with previous literature, we find no reaction of sovereign bond yields to upgrades. In contrast, sovereign bond yields increase by about 80 basis points at the time of a downgrade

4.2 Placebo tests

A potential concern regarding our difference-in-differences approach is whether macro factors other than sovereign downgrades affecting both treatment and control firms can explain the differential behavior in the post-treatment period. This concern is valid when there is reason to believe that there are important latent differences between treatment and control firms and that these differences trigger sharp contrasts in the post-treatment period because of other changes in the environment. For example, bound firms can have greater exposure to adverse economic conditions and credit supply shocks, which may happen at the same time as sovereign downgrades. One appealing feature of our identification strategy is that it is difficult to find a story in which higher-quality firms are more affected than lower-quality firms.

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

Panel A of Table 6 presents the results of the placebo test using recession periods without sovereign downgrades. We identify recession periods using the Organisation for Economic Co-operation and Development (OECD) recession indicators for each country drawn from the Federal Reserve Economic Data (FRED) database. For each country, we exclude recession years in which the country is downgraded.²⁰

There are 48 treated and control firms in this placebo test. Treated and control firms have virtually identical investment dynamics before recessions. More important, there is no difference in investment rate between the two groups of firms in the post-treatment period. Both groups invest about 20% of capital in the first recession year; the difference-in-differences estimator

²⁰The recession indicator is available for 38 countries with monthly frequency and we adopt the “From the Period following the Peak through the Trough” definition. We aggregate the monthly series into an annual series, and classify a country as being in a recession in a given year if it has more than six months of recession.

is -1.86 percentage points and statistically insignificant. The ATT effect is also statistically insignificant. Simply put, our treatment-control differences do not appear in recession periods that are not accompanied by sovereign downgrades. Panel A of Figure A.3 in the Internet Appendix plots the evolution of investment rates in the two years before and after recessions. As expected, investment rates for treated firms are higher than those for control firms, but the investment processes follow similar dynamics around recessions that are not accompanied by sovereign downgrades.

Panel B of Table 6 presents the results of the placebo test using the 2007-2009 financial crisis. This crisis was characterized by a large shock to the supply of capital to firms that was not accompanied by sovereign downgrades. We find that the control group cut investment by 3.39 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 -0.86 percentage points. Panel B of Figure A.3 in the Internet Appendix confirms that treated firms are less affected than control firms in the period around the financial crisis.

Panel C of Table 6 presents the results of the placebo test using currency crises that are not accompanied by sovereign downgrades. This placebo addresses the concern that currency crises affect treatment and control groups differently. For example, treated firms may be more affected by a currency depreciation because they use more foreign currency debt than control firms. If this is the case, we should find differential effects between treatment and control groups during currency crises. The currency crises indicators for each country are taken from Reinhart and Rogoff (2009a), (2009b), and (2011).²¹ We find no difference in the investment rates of the two groups at the time of currency crises. The ATT estimate is also statistically insignificant. Panel C of Figure A.3 in the Internet Appendix shows no evidence that treated firms are more affected than control firms in the period around a currency crisis.

An additional concern is that treated firms may have greater exposure to government fiscal crises than control firms. The group of treated firms may include some “national champions” that might be expected to receive support from the government and that the sovereign down-

²¹The currency crises indicators are available up to 2010 on Carmen Reinhart’s website at <http://www.carmenreinhart.com/>. We update the currency crises indicators for 2011 and 2012.

grade reduces the value of these explicit or implicit subsidies.²² Additionally, treated firms might be subject to higher corporate taxes at the time of a sovereign downgrade associated with a public 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 quality and in the same country and industry as those in the treatment group. To further address this concern, Section 5 contains a placebo test using data on corporate bond yields.

First, we check whether there is a differential effect on the after-tax profitability of treated firms versus control firms. If there is differential government support to treated and control firms, we should observe short-term effects on the profitability of these firms. We examine the differential effect on return on assets (ROA) after taxes. Table A.9 in the Internet Appendix presents the results of the difference-in-differences matching estimator for ROA. Figure A.4 in the Internet Appendix plots the evolution of ROA in the two years before and after recessions. While ROA decrease following the sovereign downgrade for the two groups of firms, there is no difference in ROA between the two groups in the post-treatment period.

Second, we repeat our investment rate tests after excluding firms with government ownership from the treatment group. Panel A of Table 7 presents the results. We obtain slightly higher differential effects on investment (ATT is -22.41 percentage points) when we exclude firms with government ownership from the treatment group (9 observations). 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 receive support. The number of treated firms goes down to 47 firm-year observations, but the main results are robust. Panel B of Table 7 shows that the matching ATT is -28.14 percentage points when we exclude utilities. The results are similar when we exclude transportation, communication, and utilities industries (SIC codes 4000-4999)

Finally, Panel C of Table 7 presents the results of the placebo test that compares firms with

²²For 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."

rating one notch below the sovereign (treated firms) relative to matched control firms with rating more than one notch below the sovereign. There are 45 treated and control firms in this placebo test. There is no difference in investment rate between the two groups of firms around sovereign downgrades. The absence of differential effects shows that our effects do not simply capture highly rated firms, but firms that are above the sovereign ceiling.

4.3 Financial policy

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

Table 8 examines the effect of a sovereign downgrade on the flow of debt (*Net Debt Issuance*) in Panel A and equity (*Net Equity Issuance*) in Panel B. Immediately following the downgrade, treated firms experience a sharp decrease in net debt issuance from 8.24% of assets to 2.40%, a fall of 5.84 percentage points. For control firms, the net debt issuance falls only 1.63 percentage points. The table also reports the differential change in net debt issuance that is produced by the Abadie-Imbens matching estimator of the ATT, which is equal to -7.04 percentage points. The effect is statistically significant at the 10% level. Unlike debt issuance, there is no significant change in net equity issuance right after the downgrade for the treatment group. The control group experience a significant decrease in net equity issuance of 2.07 percentage points. The ATT of net equity issuance is equal to 2.85 percentage points, which is statistically significant at the 10% level.

Panels A and B of Figure 7 plot the evolution of net debt and equity issuance in the two years before and after the sovereign downgrade for treatment and control firms. The security issuance processes of firms in the two groups follow similar trends before the downgrade. 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 net debt issuance processes again follow similar dynamics.

Panel B shows that net equity issuance shows a different behavior as it falls significantly for the control group in the year of the downgrade and only slightly for the treatment group. Furthermore, net equity issuance increases for the treatment group in the year after the sovereign

downgrade, while it actually decreases for the control group. Taken together, this evidence suggests that treated firms experience a shock to the ability to raise debt following a sovereign downgrade, and this shock forces firms to replace debt with equity.

We then examine the relative change in leverage and cash holdings for treatment and control groups. Table 9 presents the results of difference-in-differences matching estimators for the long-term debt-to-assets ratio (*Long-Term Leverage*) in Panel A and the total debt-to-assets ratio (*Total Leverage*) in Panel B. Since it may take longer for firms to adjust leverage following a sovereign downgrade, we examine the change in leverage in the subsequent year versus the year of the downgrade.²³

We find that the capital structures of treated and control firms become significantly different after a sovereign downgrade. Panel A of Table 9 shows that the average long-term leverage ratio drops to 24.10% of assets for firms in the treatment group, a fall of 1.91 percentage points. For control firms, the long-term leverage rises to 27.60%, an increase of 1.86 percentage points. These estimates suggest that long-term leverage declines by 3.77 percentage points more for treated firms than control firms. The table also reports the differential change in long-term leverage that is produced by the Abadie-Imbens matching estimator of the ATT, which is equal to -3.78 percentage points. The effect is statistically significant.

Panel B presents the difference-in-differences matching estimator for total leverage. Interestingly, the differential effect between treated and control firms is smaller than that observed for long-term leverage. The ATT is equal to -2.54 percentage points, which is statistically significant at the 10% level. This result suggests that treated firms substitute from long-term debt to short-term debt following a sovereign downgrade, which is consistent with the signaling hypothesis for debt maturity (e.g., Flannery (1986)). Treated firms may prefer to issue short-term debt to avoid the stronger mispricing of long-term debt versus short-term debt and to signal higher quality to investors following the sovereign downgrade.

Panel C presents the effect of sovereign downgrades on the cash-to-assets ratio (*Cash*). In contrast to leverage, which reacts slowly to the downgrade, treated firms react immediately by reducing cash in the year of the sovereign downgrade from the previous year. Moreover, there

²³The difference-in-differences estimates for leverage are similar if we measure the effect relative to the year before the sovereign downgrade.

is a differential reaction between treated and control firms with a statistically significant ATT estimate of -2.14 percentage points.

Panels A and B of Figure A.5 in the Internet Appendix plot the evolution of long-term and total leverage in the two years before and after the sovereign downgrade for treatment and control firms. The leverage processes of firms in the two groups follow similar trends before the downgrade. Furthermore, long-term leverage falls for the treatment group in the year of the downgrade and actually increases for the control group. Panel C shows the evolution of cash in the two years before and after the sovereign downgrade for treatment and control firms. Cash holdings are reduced in the year of the sovereign downgrade, which is consistent with the notion that firms use internal cash to attenuate the effect on investment, but seem to increase in the following years. This behavior is consistent with firms building up cash reserves for precautionary reasons.²⁴

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

4.4 Linear regression model

While the nonparametric matching approach is well-suited for our test strategy, it is useful to show that our results hold when we use a linear regression model. 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 $Bound \times Sovereign Downgrade$. The interaction term coefficient captures the difference in the reaction of the investment rate between bound firms and non-bound firms following a sovereign downgrade.

We estimate the effect of ratings on investment using instrumental variables methods to

²⁴We also examine changes in financial policy in placebo periods. Consistent with the investment results, we do not find differential effects between treated and control firms.

correct for the endogeneity of rating changes.²⁵ The sample includes rated firms in the 1990-2012 period. Table 10 presents the results. The endogenous variable is the change in firm’s rating ($\Delta Ratings$), defined using a numerical scale in which upgrades have a positive sign and downgrades have a negative sign. In the first-stage, we run a regression of $\Delta Ratings$ on the excluded instrument: $Bound \times Sovereign Downgrade$. The first-stage regression estimates show that the interaction term coefficient is negative and significant. The interpretation is that ratings for treated firms drop significantly more (nearly two notches more in column (1)) than ratings for other firms at the time of a sovereign downgrade. This result using a linear model of ratings is consistent with our evidence based on the matching estimator in Table 3.

In the second-stage regression, the dependent variable is the annual change in investment rate, and the main explanatory variable is the predicted $\Delta Ratings$ estimated in the first stage. In column (1) we find that the $\widehat{\Delta Rating}$ coefficient is positive and significant. The point estimate indicates that treated firms cut investment by 4.3 percentage points more than other firms. Columns (2)-(5) show estimates of similar regressions including control variables, and combinations of year, industry, country, and firm fixed effects. Column (6) presents estimates using country-year fixed effects so the effects are driven only by within country-year variation. The differential effect of sovereign downgrades on treated versus other firms is significant in all specifications at 5 to 9 percentage points.

4.5 Robustness

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

The first robustness test excludes firms with ratings above the sovereign from the treatment group, as these firms may be systematically different from firms with rating equal to the sovereign. We do this even though including these firms works against finding a drop in investment for the treatment group. Table A.11 in the Internet Appendix reports the results of the difference-in-differences estimator of investment using this alternative treatment group. Not surprisingly, the effect is even stronger than in Table 5. The differential change in investment rate produced by the matching estimator of the ATT is -21.07 percentage points and is

²⁵Table A.10 in the Internet Appendix reports similar estimates using a pooled OLS regression.

statistically significant.

We also compare the effects for firms that actually get downgraded following a sovereign downgrade, with those that do not; 35 treated firms out of 66 are actually downgraded in the year of the sovereign downgrade.²⁶ 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 -20.51 percentage points, while for firms that are not downgraded is 1.75 percentage points. This result provides additional evidence that the reduction in investment is in fact associated with rating downgrades.

A second robustness test deals with the matching procedure used to create the control group. We require that control firms be from the same country as treated firms. This requirement creates a difficulty in finding exact matches in the same industry, especially in smaller countries. In order to find exact industry matches, we relax the restriction that control firms must be rated. Using this alternative matching procedure, we construct a control group that matches exactly the industry (two-digit SIC) of treated firms. Table A.12 in the Internet Appendix reports the results of the difference-in-differences estimator using this alternative matching specifications. The differential changes in investment produced by the matching estimator of the ATT is 7.72 percentage points. Not surprisingly, the differential effect is smaller as we are relying on a control group that includes lower quality firms.²⁷

We also address the concern that pre-treatment average Q is higher for firms in the treatment versus the control group. We construct a control group in which we use only Q and size (and categorical variables) as matching covariates. In this alternative, the differential effect in investment is only slightly lower at 12.06 percentage points and remains statistically significant.

We also measure the stock market reaction of treated and control firms at the time of the sovereign downgrade, or at the time of the subsequent corporate downgrade of a bound firm. We use raw returns, market-adjusted returns, and market model abnormal returns and event windows of three, five, and eleven days around the downgrade day. While we find no difference in cumulative abnormal returns around the day of the sovereign downgrade, we find a negative

²⁶The fraction of firms that are actually downgraded in the year of a sovereign downgrade is 53% for the treatment group and 26% for the control group.

²⁷We do not find significant effects in investment rate in placebo periods when we use these alternative treatment and control groups.

and significant difference in cumulative abnormal returns of about 4% between treated and control groups around the day of the corporate downgrade.

We also examine the effect of sovereign downgrades on systematic risk as proxied by beta. Beta is estimated using daily stock returns and local market index returns in the one year period before and after the sovereign downgrade. We find that betas increase significantly by 0.06 following a sovereign downgrade but there is no evidence that beta increases more for treated firms than control firms. Interestingly, pre-downgrade average betas are significantly lower for treated firms (0.80) than control firms (0.95), which confirms that, if anything, treated firms are less sensitive to macroeconomic shocks than control firms.

We further check whether treatment and control groups differ in terms of their exposure to foreign currency debt and bank debt using Capital IQ data. Figure A.6 in the Internet Appendix shows the evolution of foreign currency debt (as a percentage of total debt) in the three quarters before and after the sovereign downgrade. We find that treatment and control group have similar exposure to foreign currency debt before the downgrade. Following the downgrade, firms seem to increase the exposure to foreign currency debt, but the increase is more pronounced for the control group. We also examine the evolution of bank debt (as a percentage of total debt) before and after the sovereign downgrade. We find that the debt structure of treatment and control group contains similar levels of bank debt at 12% and 10% of assets, respectively. Thus, there is no indication that treated firms are more affected because they rely less on bank debt and lending relationships (and consequently more on public debt markets) than control firms.

A final concern is that the relative drop in the supply of capital to treated firms may also be caused by a financial repression story. Becker and Ivashina (2014b) show that during the recent Eurozone sovereign debt crisis, governments use the domestic financial sector (e.g., banks, pension funds, insurance companies) to absorb government debt, which monopolizes investor demand for highly rated corporate securities. Such financial repression may affect our treated firms more than control firms, because government debt is a closer substitute to debt securities issued by firms with high ratings. In order to examine whether financial repression may explain our results, we limit the control group to firms within three notches, two notches or one notch of the sovereign rating. If our differential effects are due to financial repression, then they

should disappear or at least be mitigated in these alternative control groups in which corporate debt is a closer substitute to government debt. We find that the results actually get stronger when we consider these alternative control groups. The matching ATT in the investment tests hovers between -20 and -18 percentage points and is statistically significant. These results do not support the financial repression explanation for our results.

5 Effect on cost of debt

The evidence indicates that bound firm ratings are more affected by sovereign downgrades than non-bound firm ratings. Thus, a natural question is whether investors in the corporate bond market “follow the ratings” or whether they see past them and recognize bound firms’ better credit quality. If rating changes resulting from the sovereign ceiling downgrade do not reveal any new information, the extent of rating changes should be predictable *ex ante*, and they should not have any impact on a firm’s cost of debt. Yet, there may be new information revealed by sovereign-related downgrades that results in an even more pronounced increase in the cost of debt for bound firms versus non-bound firms. This increase in the cost of debt would be consistent with a contraction in debt capital supply and the impact on firm investment and financial policy following a sovereign downgrade.²⁸

To evaluate the impact on the cost of debt we rely on corporate bond yields. We collect data from Bloomberg on end-of-the-month yield to maturity of bond issues for the treated and matched control firms in Table 5 from 1990 through 2012. We also collect issue-specific information including issuance and maturity dates, amount issued, currency, coupon payment and frequency, and collateral type. The sample of bond yields includes 40 treated firms and 33 control firms. There may be multiple bond issues for each firm. 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 USD-denominated bonds are limited to a small fraction of our sample.

We first implement reduced-form regressions to examine whether bond yields increase for bound firms versus non-bound firms following a sovereign downgrade. We estimate a pooled

²⁸This would also indicate that treated firms are affected by ratings-based regulations and they are not merely cutting investment and deleveraging to improve their financials and potentially recover their rating.

regression whose dependent variable is the change in yield around the sovereign downgrade, i.e., the yield on firm's i bond j measured t months after each sovereign downgrade minus its yield s months prior to the event ($\Delta Yield_{i,j,t-s}$). Because rating changes can be anticipated, we perform event studies with different values of t around the time of the sovereign downgrade to capture the response of bond markets.

The explanatory variable is a dummy variable (*Bound*) that takes the value of one if a firm has a rating equal to or above the sovereign rating in month $t-1$. The *Bound* coefficient captures the differential effect on the yield of bound firms relative to non-bound firms, as the dependent variable is the change in yield around the sovereign downgrade. We face a trade-off between (1) using as controls firms that are not bound by the sovereign rating but that are not too far away from it, and (2) having enough firms as controls. Thus, we restrict non-bound firms to be three rating notches or less below the sovereign.²⁹ We also require that bond issues have at least one observation in the pre-downgrade period and one in the post-downgrade period. Standard errors are clustered by country event (i.e., sovereign downgrade) to account for within-event residual correlation.

Panel A of Table 11 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 16 basis points more than for non-bound firms. As the event window widens to six months after a sovereign downgrade, the differential effect increases to 67 basis points.

We extend the specification to include country-event fixed effects, which corresponds to estimating the differential impact of the sovereign downgrade on the bond yield of bound firms versus non-bound firms for the same country-event. Panel B of Table 11 shows the estimates. The differential effects on yields actually increase over the pooled OLS results. For example, the yield for bound firms increases by 34 and 80 basis points more than for non-bound firms three months and six months after the event, respectively.

Figure 8 shows the monthly evolution of bond yields for bound and non-bound firms in the ten months before and after the sovereign downgrade. We see that the pre-downgrade bond

²⁹We obtain similar estimates of the differential effect on bond yields when we do not restrict the control group to firms to three rating notches or less below the sovereign.

yields are significantly lower for bound firms than for non-bound firms. While the yields of non-bound firms stay fairly constant over time, the yields of bound firms increase steadily over time after the sovereign downgrade.³⁰

Next we use a fuzzy regression discontinuity design (RDD) to instrument corporate rating changes related to the sovereign ceiling, using as an instrument the *Bound* indicator. More precisely, we implement a fuzzy RDD to estimate the effect on a firm’s bond yield that results from a rating change directly related to a sovereign downgrade. Since S&P does not strictly follow the sovereign ceiling policy, a sovereign rating change does not necessarily lead to the same rating change for bound firms. Thus, the jump in the relation between $\Delta Yield$ and *Bound* can be interpreted as the average treatment effect of a corporate rating change that stems from the sovereign ceiling channel if *Bound* does not affect $\Delta Yield$ beyond its influence through the treatment.

The fuzzy RD design is described by the two equations:

$$\Delta \widehat{Rating}_{i,j} = \gamma_1 Bound_{i,j} + \alpha_k \quad (3)$$

$$\Delta Yield_{i,j,t-s} = \beta_1 (\Delta \widehat{Rating})_{i,j} + \alpha_k + \epsilon_{i,j} \quad (4)$$

where α_k is a country-event fixed effect. Equation (3) corresponds to the first stage, where we estimate the predicted differential change in the ratings of treated firms versus non-treated. Equation (4) corresponds to the second stage, where $\Delta \widehat{Rating}$ is the dependent variable.

Panel C of Table 11 shows the estimates of the RDD obtained using two-stage least squares (2SLS). The RDD estimates are consistent with the results from the reduced-form regressions, but more precisely identify the effect of a one-notch corporate rating change directly related to the sovereign ceiling channel. For example, a one-notch corporate rating downgrade directly stemming from the sovereign ceiling channel has a 78 basis point effect in a three-month post-versus three-month pre-event window. The effect of rating downgrades remains economically and statistically significant as the event window widens.

We conduct a placebo test using periods of large increases in sovereign bond yields without

³⁰It takes approximately two months after the sovereign downgrade for the bond yields of bound firms to increase. If the effect of ratings is indeed induced by ratings-based regulatory constraints, it takes time for investors to adjust their holdings of bond securities. Kisgen and Strahan (2010) find that the regulatory effect on the cost of debt is important, but that it takes a few months to be observed in a sample of U.S. firms.

sovereign downgrades. This test addresses the concern that treated firms have greater exposure to a deterioration in government fiscal position as they are more likely to receive government support. We identify the placebo events by taking the month with the maximum increase in sovereign bond yields in a given country and year. For each country, we exclude periods in which the country is downgraded in the six months before or after the month the event. We estimate the same model with country-event fixed effects as in Panel B of Table 11. Panel A of Table A.13 in the Internet Appendix reports the results. We find that the coefficients are statistically insignificant in this falsification test, which indicates that differences between bound and non-bound firms do not appear during periods of deterioration in government fiscal position without sovereign downgrades. We also perform a placebo test to address the concern that pre-event trends drive the effects on corporate bond yields. We focus now on the differential effect of bound versus non-bound firms one year before the actual sovereign downgrade. We report the results of this test in Panel B of Table A.13. We find that the coefficients are statistically insignificant in this falsification test. Thus, the results of the placebo tests indicate that sovereign ceilings and downgrades are the main drivers of the differential changes in yields we see in Table 11.

6 Conclusion

A quasi-natural experiment using sovereign rating downgrades shows how credit ratings affect firm investment and financial policy. Sovereign downgrades create exogenous and asymmetric variation across firm ratings because of rating agencies' ceiling policy. We exploit this variation to show that following a sovereign downgrade firms with ratings at the sovereign bound (treatment group) cut investment and net debt issuance more than otherwise similar firms with ratings below the bound (control group). The bond yields of treated firms also increase significantly more than yields of control firms. This is consistent with an increase in firms' costs of borrowing and reduction in the supply of debt capital that is caused by the asymmetric effect of sovereign downgrades on corporate ratings, rather than a reduction in the demand for debt capital. An important feature of our identification strategy is that treated firms have higher credit quality than control firms, which helps us to rule out several alternative explanations for

the results.

Our work makes two main contributions to the literature on credit ratings. First, we develop a new strategy to identify the effects of ratings on firm investment and financial policy. Our results show that ratings have causal effects on firm policies, not related to variation in unobservable firm characteristics or macroeconomic conditions. Second, we identify the unintended consequences for real economic activity of the sovereign ceiling policies that the rating agencies typically follow.

Our study is subject to the standard limitations of quasi-natural experiments. We can measure the causal effect of ratings downgrades only if we focus on firms for which sovereign ceiling policies are likely to be binding at the time of a sovereign downgrade, which limits the sample size. We acknowledge as well that the effect of a downgrade on treated firms may not directly translate to an average firm that has different characteristics from treated firms. The results, however, suggest that bound firms are rated pessimistically by ratings agencies even outside of downgrade episodes. Thus, it is likely that bound firms would have improved access to public debt markets and higher investment rates in the absence of sovereign ceiling policies.

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Table 1: Sample of Sovereign Rating Downgrades

This table presents the sample of sovereign credit rating downgrades, and the number of treated observations (i.e., firm-year observations with credit rating equal or above the sovereign 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 |
| Brazil | 2002 | BB- | B+ | 5 |
| Indonesia | 1997 | BBB | BB+ | 1 |
| | 1998 | BB+ | CCC+ | 5 |
| Ireland | 2011 | A | BBB+ | 4 |
| Italy | 2004 | AA | AA- | 1 |
| | 2006 | AA- | A+ | 2 |
| | 2011 | A+ | A | 2 |
| | 2012 | A | BBB+ | 2 |
| 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- | 2 |
| Spain | 2012 | AA- | BBB- | 2 |
| Thailand | 1997 | A | BBB | 1 |
| | 1998 | BBB | BBB- | 2 |
| United States | 2011 | AAA | AA+ | 4 |
| Total | | | | 66 |

Table 2: Summary Statistics: Median and Mean Tests

This table presents the pre-treatment median and mean of non-treated, treated and control groups. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Non-treated firms are all other firms in the sample. Control firms are matched firms using the Abadie and Imbens matching estimator. There are 66 treated, 24,873 non-treated, and 66 control firm-year observations. The Pearson's χ^2 statistic test the difference in medians between treated and control firms. The Kolmogorov-Smirnov statistic test the difference in distribution of treated and control firms. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

| | Median | | | Pearson χ^2 p-value | Mean | | | Kolmogorov- Smirnov p-value |
|-----------------------|-------------|---------|---------|-----------------------------|------------------|------------------|------------------|-----------------------------------|
| | Non-Treated | Treated | Control | | Non-Treated | Treated | Control | |
| <i>Size</i> | 5.30 | 9.43 | 9.20 | 0.60 | 5.32 (0.013) | 8.91 (0.157) | 8.71 (0.170) | 0.65 |
| <i>Investment</i> | 11.46 | 16.13 | 12.17 | 0.12 | 26.25 (0.414) | 28.73 (5.523) | 22.07 (3.420) | 0.31 |
| <i>Q</i> | 1.00 | 1.31 | 1.02 | 0.06* | 2.06 (0.045) | 1.50 (0.097) | 1.15 (0.046) | 0.00*** |
| <i>Cash Flow</i> | 7.53 | 14.80 | 10.53 | 0.00*** | 1.33 (0.362) | 17.36 (1.218) | 11.09 (0.768) | 0.00*** |
| <i>Cash</i> | 10.00 | 8.47 | 6.94 | 0.86 | 15.20 (0.103) | 11.62 (1.317) | 9.17 (0.963) | 0.36 |
| <i>Leverage</i> | 23.32 | 33.31 | 34.19 | 0.22 | 28.60 (0.212) | 32.86 (2.284) | 38.11 (2.152) | 0.36 |
| <i>Foreign Sales</i> | 0.00 | 0.00 | 2.54 | 0.60 | 11.50 (0.148) | 19.19 (3.360) | 21.84 (3.067) | 0.65 |
| <i>Long-Term Debt</i> | 0.47 | 0.78 | 0.80 | 0.55 | 0.46 (0.002) | 0.75 (0.023) | 0.75 (0.021) | 0.55 |
| <i>Gov. Ownership</i> | 0.00 | 0.00 | 0.00 | 0.66 | 0.81 (0.041) | 7.12 (1.837) | 5.26 (2.387) | 0.62 |

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

This table presents the results of the credit rating difference-in-differences Abadie and Imbens matching estimator around the sovereign downgrade. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. There are 66 treated and 66 control firm-year observations. Corporate ratings are converted to a numerical scale with 22 corresponding to the highest rating (AAA) and one to the lowest (default). Robust standard errors are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

| | Year Before Downgrade | Year of Downgrade | Difference |
|---------------------------|--------------------------|----------------------|----------------------|
| Treated Firms | 16.41*** (0.515) | 14.75*** (0.665) | -1.66*** (0.336) |
| Control Firms | 13.09*** (0.505) | 12.20*** (0.652) | -0.89*** (0.3125) |
| Difference | 3.32*** (0.273) | 2.55*** (0.361) | |
| Difference-in-Differences | | | -0.77*** (0.303) |
| Matching Estimator (ATT) | | | -1.38*** (0.309) |

Table 4: Predicted Rating by Sovereign Bound Status

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

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

where β_2 is a vector of coefficients that captures the differential effect for each rating class. Robust standard errors clustered by firm are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

| Predicted Rating by Bound Status | | | | |
|----------------------------------|-------|-----------|--|---------|
| | Bound | Non-Bound | Difference between Bound and Non-Bound Firms | |
| | (1) | (2) | (3) = (1) - (2) | p-value |
| AA | 14.49 | 14.98 | -0.49 | 0.263 |
| AA- | 13.90 | 14.36 | -0.46 | 0.101 |
| A+ | 14.30 | 14.19 | 0.11 | 0.852 |
| A | 14.47 | 14.02 | 0.45 | 0.153 |
| A- | 13.89 | 13.64 | 0.25 | 0.430 |
| BBB+ | 14.04 | 13.39 | 0.64* | 0.051 |
| BBB | 14.14 | 13.04 | 1.10*** | 0.000 |
| BBB- | 13.69 | 12.96 | 0.73*** | 0.002 |
| BB+ | 13.40 | 12.58 | 0.82*** | 0.003 |
| BB | 12.55 | 12.15 | 0.39 | 0.234 |
| BB- | 12.57 | 11.44 | 1.13*** | 0.006 |
| B+ | 12.64 | 10.86 | 1.78*** | 0.002 |
| B | 11.20 | 10.00 | 1.21*** | 0.003 |
| B- | 11.40 | 9.97 | 1.43*** | 0.003 |
| CCC+ | 11.91 | 9.92 | 2.00*** | 0.001 |

Table 5: Difference-in-Differences of Investment around a Sovereign Downgrade

This table presents the results of the investment rate difference-in-differences Abadie and Imbens matching estimator around the sovereign downgrade. Investment rate is defined as the ratio of annual capital expenditure to lag net property, plant and equipment. Treated firms have credit rating equal to or above to the sovereign rating in the year before a sovereign downgrade. There are 66 treated and 66 control firm-year observations. Robust standard errors are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

| | Year Before Downgrade | Year of Downgrade | Difference |
|---------------------------|--------------------------|----------------------|----------------------|
| Treated Firms | 28.73*** (5.523) | 18.53*** (1.676) | -10.20** (5.104) |
| Control Firms | 22.07*** (3.420) | 19.22*** (3.127) | -2.84 (3.074) |
| Difference | 6.66 (4.542) | -0.69 (2.943) | |
| Difference-in-Differences | | | -7.35* (4.424) |
| Matching Estimator (ATT) | | | -16.78*** (5.368) |

Table 6: Placebo Tests: Difference-in-Differences of Investment

This table presents the results of the investment rate difference-in-differences Abadie and Imbens matching estimator for the placebo periods. Investment rate is defined as the ratio of annual capital expenditure to lag net property, plant and equipment. Panel A presents the estimates around the first year of a recession not accompanied by a sovereign downgrade. There are 51 treated and 51 control firm-year observations. Panel B presents the estimates around the 2007-2009 financial crisis. There are 70 treated and 70 control firm-year observations. Panel C presents the estimates around a currency crisis not accompanied by a sovereign downgrade. There are 53 treated and 53 control firm-year observations. Treated firms are firms with credit rating equal to or above the sovereign rating in the year before the placebo period. Robust standard errors are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

Panel A: Recession without Sovereign Downgrade

| | Year Before Recession | Year of Recession | Difference |
|---------------------------|--------------------------|---------------------|------------------|
| Treated Firms | 22.89*** (2.039) | 21.81*** (1.794) | -1.08 (1.698) |
| Control Firms | 19.37*** (1.585) | 20.15*** (2.196) | 0.78 (2.060) |
| Difference | 3.52* (1.991) | 1.66 (2.567) | |
| Difference-in-Differences | | | -1.86 (2.428) |
| Matching Estimator (ATT) | | | -0.74 (2.700) |

Panel B: 2007-2009 Financial Crisis

| | 2008 | 2009 | Difference |
|----------------------------|---------------------|---------------------|---------------------|
| Treated Firms | 21.05*** (1.539) | 17.02*** (1.158) | -4.03*** (1.139) |
| Control Firms | 24.17*** (2.582) | 16.74*** (1.538) | -7.42*** (1.997) |
| Difference | -3.12 (2.239) | 0.28 (1.643) | |
| Differences in Differences | | | 3.39** (1.741) |
| Matching Estimator | | | -0.86 (1.880) |

Panel C: Currency Crisis without Sovereign Downgrade

| | Year Before Currency Crisis | Year of Currency Crisis | Difference |
|---------------------------|--------------------------------|----------------------------|--------------------|
| Treated Firms | 23.15*** (2.078) | 23.78*** (2.188) | 0.63 (1.360) |
| Control Firms | 27.27*** (27.132) | 31.36*** (6.203) | 4.09*** (0.534) |
| Difference | -4.12*** (2.841) | -7.58 (6.799) | |
| Difference-in-Differences | | | -3.46 (6.497) |
| Matching Estimator (ATT) | | | -5.25 (7.782) |

Table 7: Government Support Tests: Difference-in-Differences of Investment

This table presents the results of investment rate difference-in-differences Abadie and Imbens matching estimator around the sovereign downgrade for sub-samples. Investment rate is defined as the ratio of annual capital expenditure to lag net property, plant and equipment. Panel A presents the results for a sub-sample that excludes firms with government ownership. There are 57 treated and 57 control firm-year observations. Panel B presents the results for a sub-sample that excludes firms with government ownership and utilities (SIC codes 4900-4999). There are 47 treated and 47 control firm-year observations. In Panels A and B, treated firms have credit rating equal to or above to the sovereign rating in the year before a sovereign downgrade. Panel C presents the results for a placebo test in which treated firms have credit rating one notch below the sovereign and control firms have credit rating more than one notch below the sovereign. There are 45 treated and 45 control firm-year observations. Robust standard errors are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

| <i>Panel A: Excluding Firms with Government Ownership</i> | | | |
|---|--------------------------|----------------------|----------------------|
| | Year Before Downgrade | Year of Downgrade | Difference |
| Treated Firms | 31.36*** (9.294) | 19.89*** (2.342) | -11.47 (8.128) |
| Control Firms | 21.98*** (6.379) | 20.61*** (4.544) | -1.37 (5.424) |
| Difference | 9.38* (4.682) | -0.72 (3.674) | |
| Differences in Differences | | | -10.10* (5.090) |
| Matching Estimator | | | -22.41*** (7.227) |
| <i>Panel B: Excluding Utilities</i> | | | |
| Treated Firms | 37.01*** (10.13) | 22.62*** (2.059) | -14.39 (9.406) |
| Control Firms | 24.92*** (7.080) | 23.69*** (5.051) | -1.23 (6.541) |
| Difference | 12.09** (5.383) | -1.07 (4.437) | |
| Differences in Differences | | | -13.16** (5.852) |
| Matching Estimator | | | -28.14*** (7.990) |
| <i>Panel C: Firms with Rating One Notch Below Sovereign</i> | | | |
| Treated Firms | 16.25*** (2.055) | 17.63*** (2.068) | 1.38 (1.653) |
| Control Firms | 14.37*** (1.864) | 15.11*** (2.482) | 0.74 (1.391) |
| Difference | 1.88 (2.173) | 2.52 (2.286) | |
| Differences in Differences | | | 0.64 (1.407) |
| Matching Estimator | | | 2.05 (1.890) |

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

This table presents the results of debt and equity issuance (as a percentage of assets) difference-in-differences Abadie and Imbens matching estimator around the sovereign downgrade. Panel A presents net debt issuance estimates, Panel B presents net equity issuance estimates. Treated firms have credit rating equal to or above to the sovereign rating in the year before a sovereign downgrade. There are 66 treated and 66 control firm-year observations. Robust standard errors are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

| <i>Panel A: Net Debt Issuance</i> | | | |
|-------------------------------------|--------------------------|----------------------|---------------------|
| | Year Before Downgrade | Year of Downgrade | Difference |
| Treated Firms | 8.24*** (2.923) | 2.40** (1.072) | -5.84* (3.030) |
| Control Firms | 3.51** (1.670) | 1.88* (1.154) | -1.63 (1.982) |
| Difference | 4.73** (2.379) | 0.52 (1.672) | |
| Differences in Differences | | | -4.21 (3.038) |
| Matching Estimator | | | -7.04* (3.746) |
| <i>Panel B: Net Equity Issuance</i> | | | |
| Treated Firms | -0.24 (0.652) | -0.87** (0.352) | -0.63 (0.622) |
| Control Firms | 1.66** (0.709) | -0.41 (0.424) | -2.07*** (0.776) |
| Difference | -1.90** (0.736) | -0.46** (0.101) | |
| Differences in Differences | | | 1.44* (0.819) |
| Matching Estimator | | | 2.85* (1.494) |

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

This table presents the results of financial policy difference-in-differences Abadie and Imbens matching estimator around the sovereign downgrade. Panel A presents long-term leverage estimates, Panel B presents total leverage estimates, and Panel C presents cash-to-assets ratio estimates. Treated firms have credit rating equal to or above to the sovereign rating in the year before a sovereign downgrade. There are 66 treated and 66 control firm-year observations. Robust standard errors are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

| <i>Panel A: Long-Term Leverage</i> | | | |
|------------------------------------|--------------------------|-------------------------|--------------------|
| | Year of Downgrade | Year after Downgrade | Difference |
| Treated Firms | 26.01*** (2.322) | 24.10*** (2.241) | -1.91* (0.962) |
| Control Firms | 25.74*** (1.851) | 27.60*** (2.244) | 1.86* (1.061) |
| Difference | 0.27 (2.123) | -3.50 (2.421) | |
| Difference-in-Differences | | | -3.77** (1.621) |
| Matching Estimator (ATT) | | | -3.78** (1.90) |
| <i>Panel B: Total Leverage</i> | | | |
| Treated Firms | 34.99*** (2.812) | 34.21*** (2.926) | -0.78 (1.292) |
| Control Firms | 37.11*** (2.591) | 38.87*** (3.072) | 1.75 (1.425) |
| Difference | -2.12 (1.972) | -4.65 (2.560) | |
| Difference-in-Differences | | | -2.53* (1.300) |
| Matching Estimator (ATT) | | | -2.54* (1.546) |
| <i>Panel C: Cash</i> | | | |
| | Year Before Downgrade | Year of Downgrade | Difference |
| Treated Firms | 11.62*** (1.317) | 10.89*** (1.304) | -0.73* (0.691) |
| Control Firms | 9.43*** (0.963) | 9.63*** (1.026) | 0.20 (0.634) |
| Difference | 2.19** (0.979) | 1.26 (0.108) | |
| Difference-in-Differences | | | -0.93 (0.735) |
| Matching Estimator (ATT) | | | -2.14** (1.145) |

Table 10: Instrumental Variable Regression of Investment

This table presents estimates of instrumental variable regressions of investment rate using two stage least squares (2SLS). The dependent variable is the annual change in investment rate ($\Delta Investment$) in year t . Investment rate is defined as the ratio of annual capital expenditure to lag net property, plant and equipment. The endogenous variable is the change in corporate credit rating ($\Delta \widehat{Rating}$). *Bound* is a dummy variable that takes the value of one if a firm has a credit rating equal to or above to the sovereign rating in a 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 size, Tobin's Q, cash flow, cash holdings, leverage, foreign sales, and a dummy that takes the value of one if the firm has a credit rating. The sample consists of WRDS-Factset Fundamentals Annual Fiscal (North America and International) non-financial firms with credit rating from 1990 to 2012. Clustered standard errors are reported in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% level respectively.

| | Dependent Variable: $\Delta Investment$ | | | | | |
|---|---|----------------------|----------------------|----------------------|----------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| <i>Second Stage</i> | | | | | | |
| $\Delta \widehat{Rating}$ | 0.043** (0.019) | 0.049 (0.036) | 0.050** (0.026) | 0.049** (0.022) | 0.050*** (0.018) | 0.089*** (0.032) |
| <i>First Stage</i> | | | | | | |
| <i>Bound</i> × <i>Sovereign Downgrade</i> | -1.920*** (0.309) | -1.525*** (0.357) | -1.529*** (0.461) | -1.472*** (0.418) | -1.374*** (0.295) | -0.735** (0.328) |
| Controls | No | Yes | Yes | Yes | Yes | Yes |
| Year FE | No | Yes | Yes | Yes | Yes | No |
| Industry FE | No | No | Yes | No | No | No |
| Country FE | No | No | No | Yes | No | No |
| Firm FE | No | No | No | No | Yes | No |
| Country x Year FE | No | No | No | No | No | Yes |
| Cluster | Firm | Year | Industry | Country | Firm | Country x Year |
| Observations | 26,114 | 24,511 | 24,508 | 24,187 | 24,509 | 24,383 |
| R^2 | 0.00 | 0.01 | 0.00 | 0.01 | 0.43 | 0.40 |

Table 11: Difference-in-Differences of Corporate Bond Yields around a Sovereign Downgrade

This table presents estimates of the effects of sovereign downgrades on corporate bond yields. The dependent variable is the corporate bond yield change around the sovereign downgrade for different event windows. *Bound* is a dummy variable that takes a value of one if a corporate bond issue has a rating equal to or above sovereign rating prior to the sovereign downgrade. $\Delta Rating$ is instrumented with the *Bound* dummy variable in the two stage least squares (2SLS) estimates in Panel C. The sample consists of treated and control firms in Table 5 for which yields on local currency bond issues are available. Control firms with rating more than three notches below the sovereign rating are excluded. A bond issue is required to have at least one observation in the pre-downgrade period and one in the post-downgrade period. Robust standard errors clustered by country-event are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

Panel A: OLS

| | (1) 1mPost–3mPre | (2) 3mPost–3mPre | (3) 4mPost–3mPre | (4) 5mPost–3mPre | (5) 6mPost–3mPre |
|--------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| <i>Bound</i> | -0.113 (0.115) | 0.157 (0.269) | 0.473 (0.278) | 0.544* (0.278) | 0.671** (0.254) |
| Observations | 472 | 465 | 439 | 438 | 434 |
| R^2 | 0.0329 | 0.00971 | 0.0410 | 0.0463 | 0.0669 |

Panel B: Country-Event Fixed Effects

| | (1) 1mPost–3mPre | (2) 3mPost–3mPre | (3) 4mPost–3mPre | (4) 5mPost–3mPre | (5) 6mPost–3mPre |
|------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| <i>Bound</i> | -0.025 (0.038) | 0.335** (0.120) | 0.633*** (0.148) | 0.695*** (0.161) | 0.802*** (0.153) |
| Country-Event FE | Yes | Yes | Yes | Yes | Yes |
| Observations | 472 | 465 | 439 | 438 | 434 |
| R^2 | 0.817 | 0.394 | 0.287 | 0.287 | 0.318 |

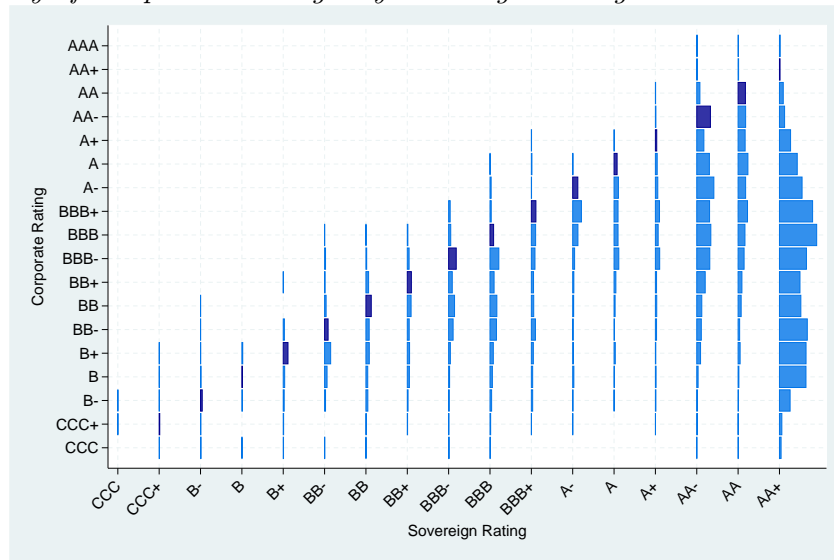
Panel C: 2SLS

| | (1) 1mPost–3mPre | (2) 3mPost–3mPre | (3) 4mPost–3mPre | (4) 5mPost–3mPre | (5) 6mPost–3mPre |
|---------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| $\widehat{\Delta Rating}$ | -0.031 (0.047) | 0.776*** (0.116) | 1.419*** (0.124) | 1.556*** (0.134) | 1.777*** (0.112) |
| Country-Event FE | Yes | Yes | Yes | Yes | Yes |
| Observations | 472 | 465 | 439 | 438 | 434 |
| R^2 | 0.816 | 0.404 | 0.298 | 0.299 | 0.330 |

Figure 1: Sovereign Ceiling Rule

This figure shows the relation between sovereign and corporate credit ratings. Panel A shows the frequency of S&P long-term foreign-currency corporate credit ratings by the sovereign rating of the corresponding 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. The bars in dark blue in the diagonal represent the sovereign rating ceiling. Panel B plots the distribution of the difference between corporate ratings and sovereign ratings.

Panel A: Frequency of Corporate Ratings By Sovereign Rating



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

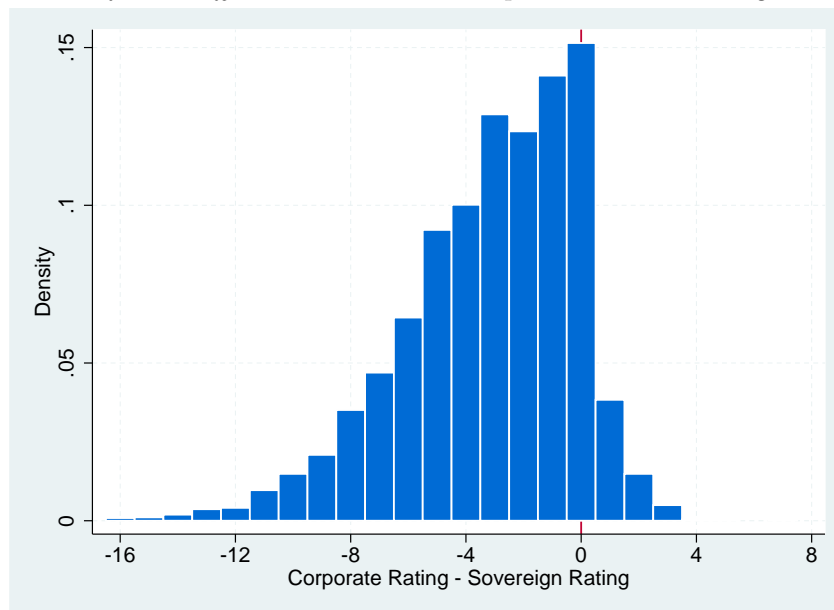


Figure 2: Frequency of Corporate Downgrades around Sovereign Downgrade by Distance from Sovereign

This figure shows the fraction of firms in each group whose rating was downgraded in the month before, the month of, and the month after a sovereign downgrade. Observations are grouped according to the pre-downgrade difference between the corporate rating and its corresponding sovereign rating. Differences lower than -6 and greater than +2 are grouped at the “ ≤ -6 ” and “ $\geq +2$ ” bins.

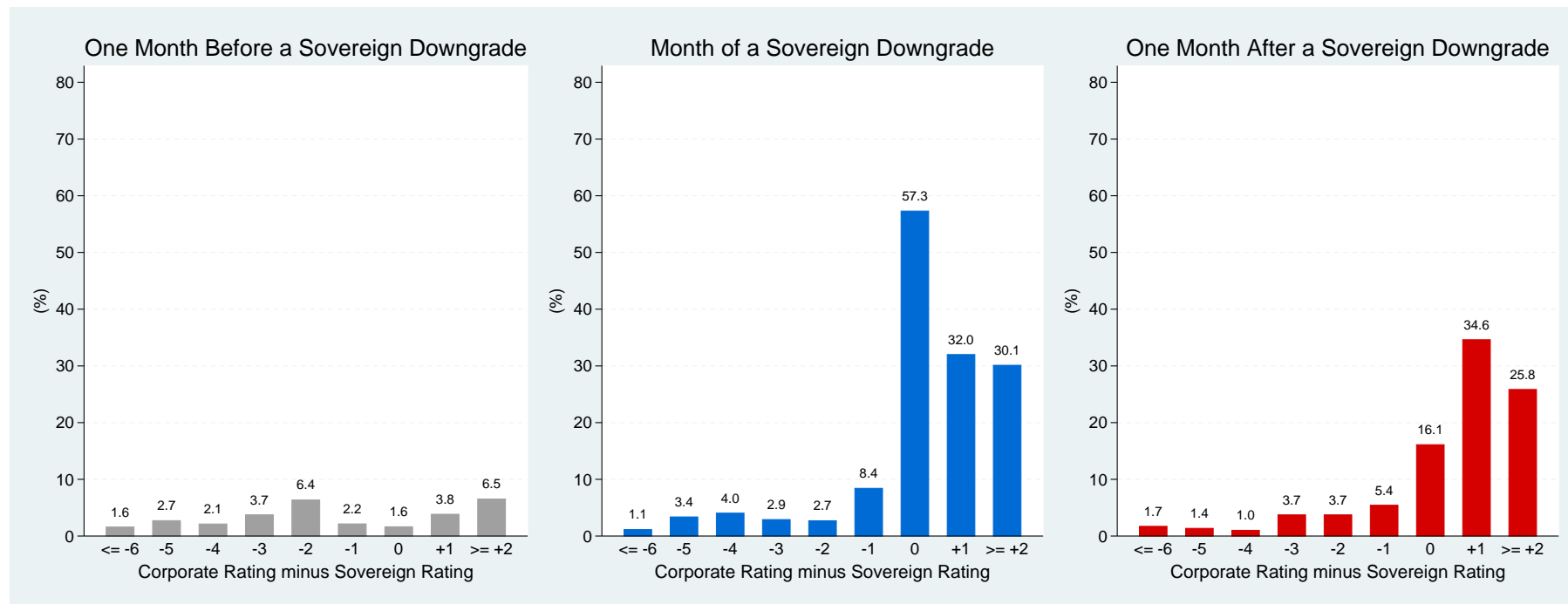


Figure 3: Corporate Rating Downgrades during 2007-2009 Financial Crisis

This figure shows the fraction of firms in each corporate rating class whose rating was downgraded during the 2007-2009 financial crisis.

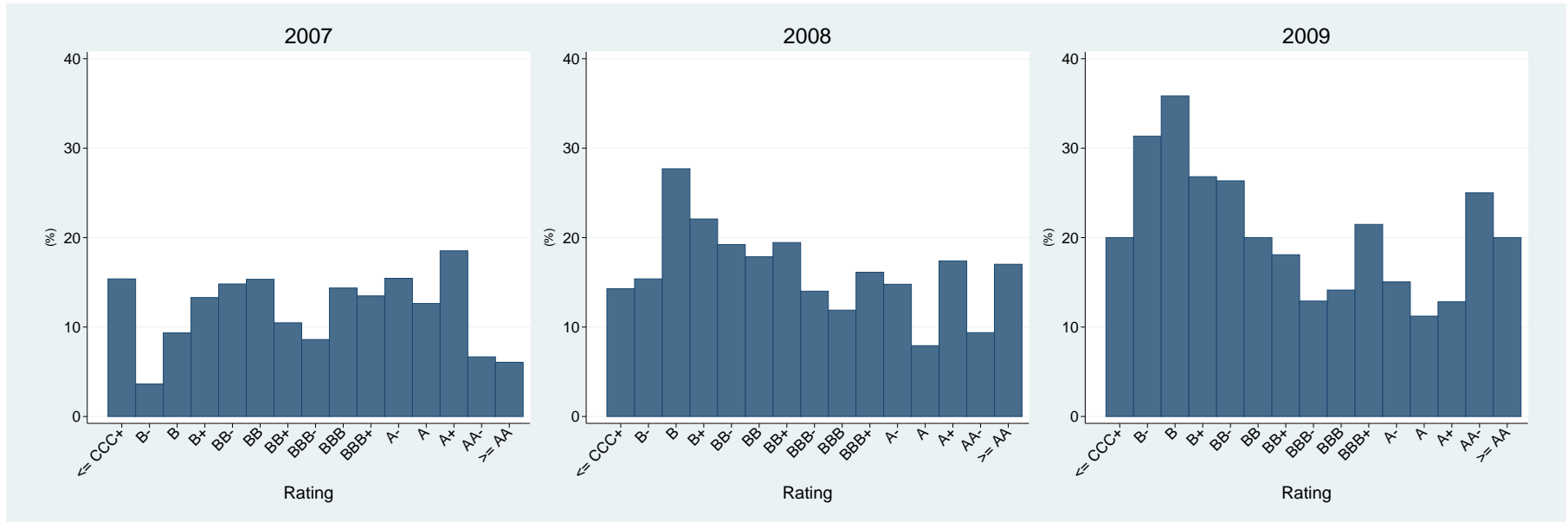


Figure 4: Corporate Ratings during 2007-2009 Financial Crisis

This figure shows the parallel trends of corporate ratings of treatment and control groups during the 2007-2009 financial crisis. Treated firms have credit rating equal to or above the sovereign rating in the year before the crisis. Control firms are matched firms using the Abadie and Imbens matching estimator. Corporate ratings are converted to a numerical scale with 22 corresponding to the highest rating (AAA) and one to the lowest (default).

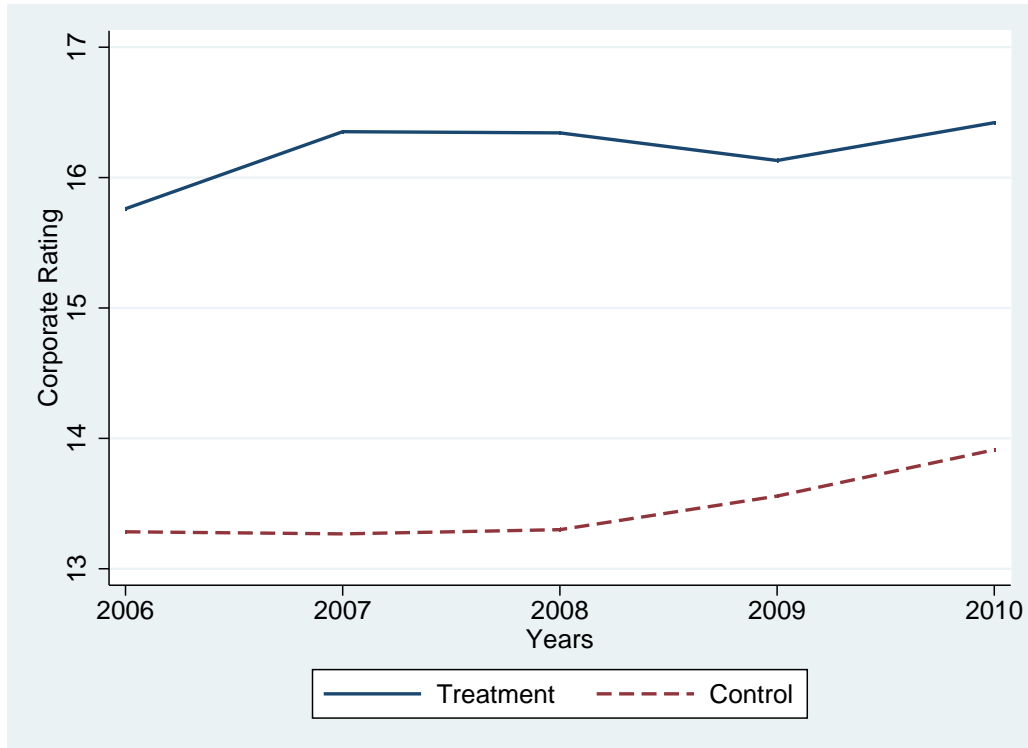


Figure 5: Corporate Ratings around Sovereign Downgrade

This figure shows the parallel trends of corporate ratings of treatment and control groups around the sovereign downgrade. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. Corporate ratings are converted to a numerical scale with 22 corresponding to the highest rating (AAA) and one to the lowest (default).

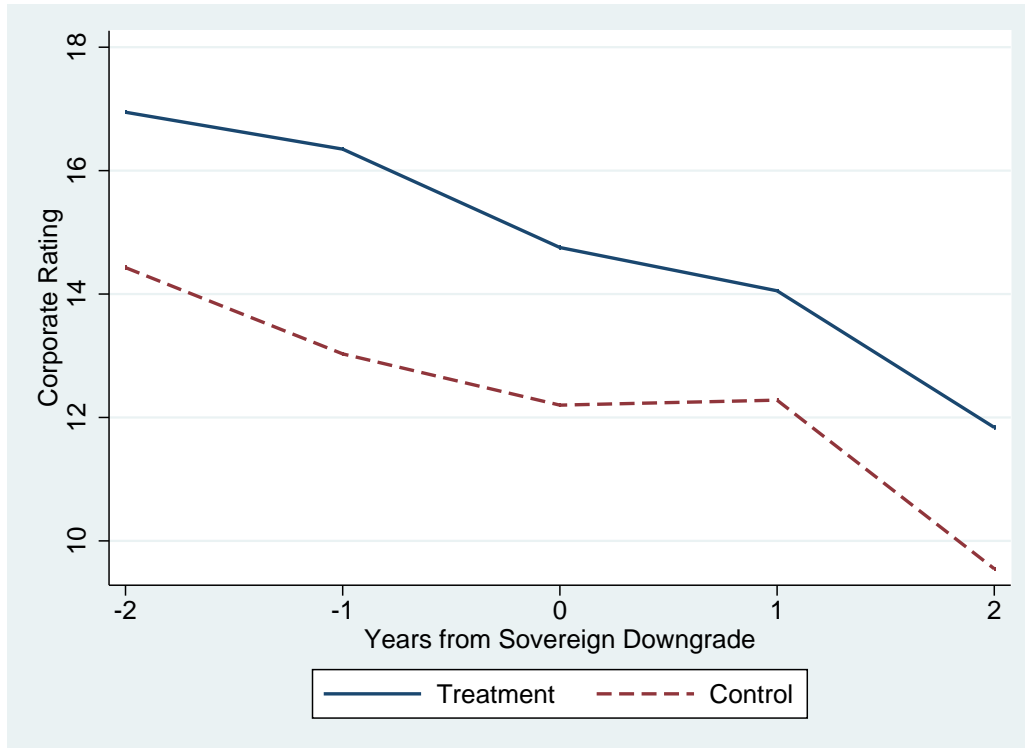


Figure 6: Investment around Sovereign Downgrade

This figure shows the parallel trends of investment of treatment and control groups around the sovereign downgrade. Investment rate is defined as the ratio of annual capital expenditure to lag net property, plant and equipment. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator.

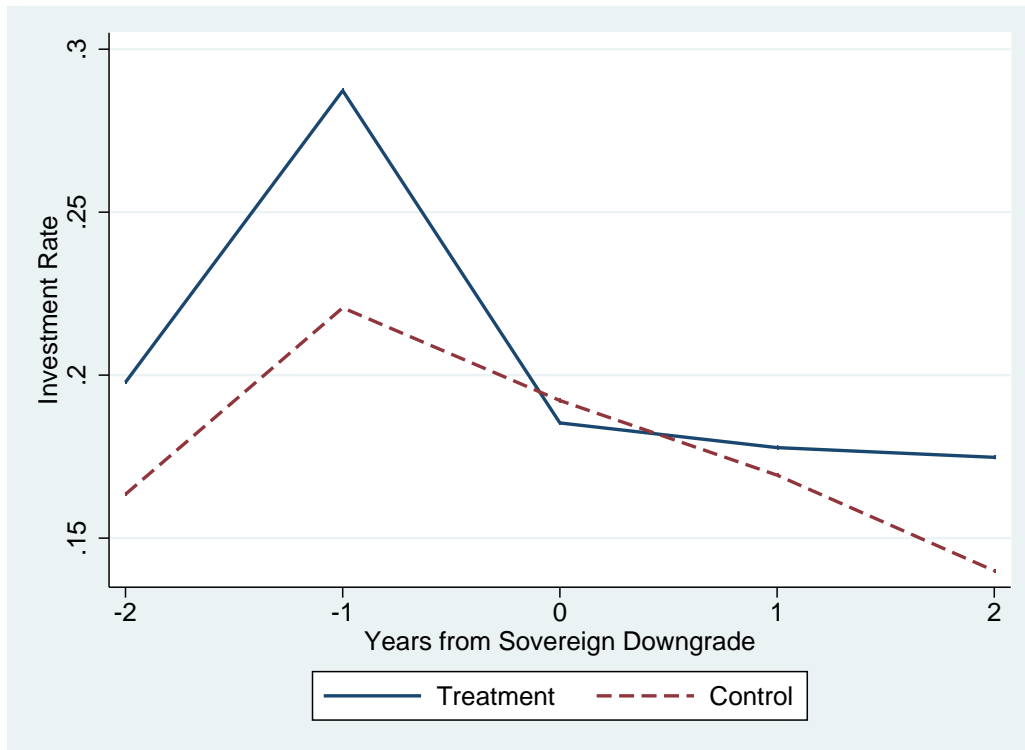
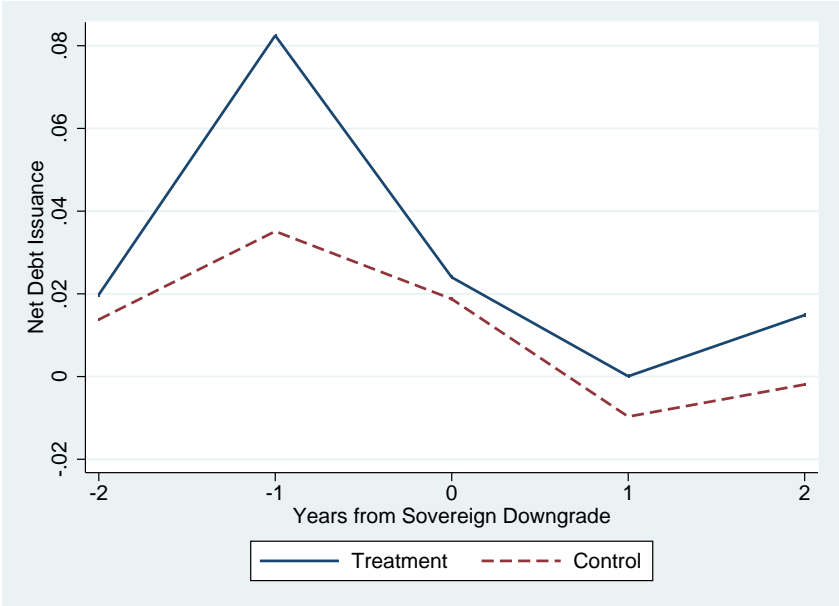


Figure 7: Debt and Equity Issuance around Sovereign Downgrade

This figure shows the parallel trends of debt and equity issuance of treatment and control groups around the sovereign downgrade. Net debt issuance is defined as the ratio of net issuance/reduction of debt to the lag of total assets. Net equity issuance is defined as the ratio of sale of common and preferred stock minus repurchase of common and preferred stock to the lag of total assets. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator.

Panel A: Net Debt Issuance



Panel B: Net Equity Issuance

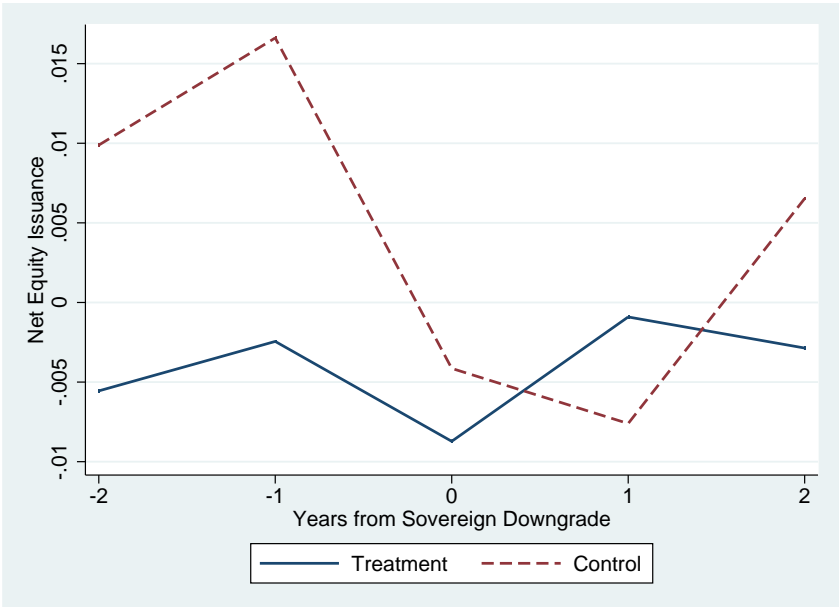
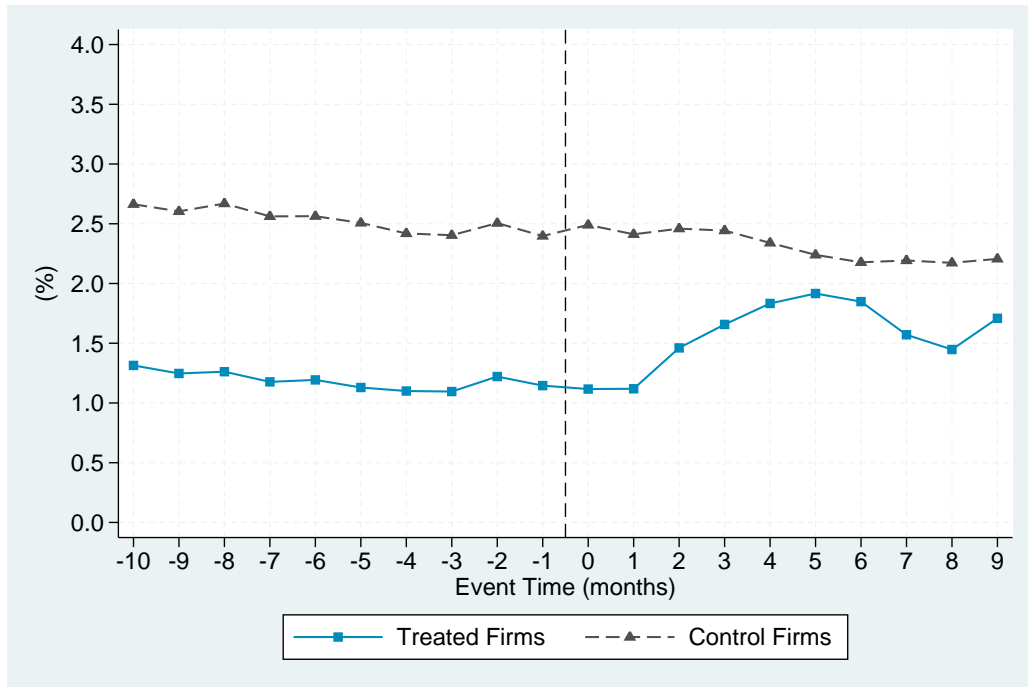


Figure 8: Corporate Bond Yields around Sovereign Downgrades

This table shows point estimates for the effect over time of a sovereign downgrade on corporate bond yields of treatment and control groups. 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 (i.e., a dummy variable for each bond-sovereign downgrade pair). The coefficients can be interpreted as the change in bond yields around sovereign downgrades. The vertical dotted line between zero and one represents the event occurrence, which happens after the end of the month at $t=-1$ and before $t=0$. The sample consists of treated and control firms in Table 5 for which yields on local currency bond issues are available. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms with rating more than three notches below the sovereign rating are excluded. A bond issue is required to have at least one observation in the pre-downgrade period and one in the post-downgrade period. The base level for each groups yield is the average yield ten months prior to the event.



Internet Appendix for
“The Real Effects of Credit Ratings:
The Sovereign Ceiling Channel”

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A Probability of downgrade

We present supporting evidence of an asymmetric reaction of corporate ratings to sovereign rating downgrades for firms in treatment and control groups. We estimate a logit regression of the probability of a rating downgrade using a firm-year panel of rated firms as an alternative to the numerical scale for ratings in Table 3. 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 $Bound \times Sovereign Downgrade$. The interaction term coefficient measures the difference in the probability of a rating downgrade between treated and other firms when a sovereign downgrade hits the country where a firm is domiciled.

Table A.5 in the Internet Appendix, column (1), shows that the interaction term coefficient is positive and significant, which indicates a significantly higher probability of a corporate downgrade following a sovereign downgrade for treated firms than for other (non-treated) firms. The marginal effect (shown at the bottom of the table) indicates that ratings of treated firms are five times more likely to be downgraded than non-treated firm ratings when a sovereign downgrade hits their country of domicile. As expected, the *Bound* coefficient is positive and significant as higher-quality firms are less likely to be downgraded unconditionally. The *Sovereign Downgrade* coefficient is positive and significant, which is consistent with the idea that corporate ratings are negatively affected by sovereign downgrades.

The next columns of Table A.5 show additional specifications that control for firm characteristics. Columns (2)-(4) include control variables (size, investment, Tobin's Q, cash flow, cash holdings, leverage, and foreign sales), and combinations' of year, industry, country, and firm fixed effects. The firm fixed effects estimate in column (4) is driven only by within-firm variation in ratings and therefore controls for any source of time-invariant unobserved heterogeneity. Column (5) presents estimates including country-year fixed effects that control for any country-specific macro shock.

The results are consistent in all specifications. In short, the results of the logit regression confirm the results of the difference-in-differences matching estimator in Table 3 that the reaction of corporate ratings to sovereign downgrades is asymmetric for treated and control firms.

B Linear regression

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. We run a pooled OLS regression using the sample of all firms in the 1990-2012 period. Column (1) of Table A.10 in the Internet Appendix shows that treated firms cut their investment by 9.6 percentage points more than other firms as indicated by the interaction term coefficient. The group difference estimate is significant at the 5% level. Outside the sovereign downgrade periods, the difference in investment rate between the two groups of firms is 3 percentage points. Interestingly, the *Sovereign Downgrade* coefficient is positive at 1.6 percentage points, indicating that non-bound firms actually increase investment following a sovereign downgrade.

In column (2), we estimate the investment rate regressions including the covariates (coefficients not shown) used in Table 5 (size, Tobin's Q, cash flow, cash holdings, leverage, foreign sales, and a dummy that takes the value of one if a firm has a credit rating). 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 11.4 percentage points, which is statistically significant at the 1% level. Columns (3)-(5) present additional estimates using combinations of year, industry, country, and firm fixed effects. Column (6) presents estimates using country-year fixed effects so the effect is driven only by within country-year variation.¹

Overall, the magnitude of the group difference estimates in Table A.10 in the Internet Appendix are similar at about 10 percentage points and statistically significant in all speci-

¹The country-year fixed effect in our setting is equivalent to a country-event fixed effect.

fications. Furthermore, the difference between the two groups of firms outside the sovereign downgrade period becomes statistically insignificant when we include country or firm fixed effects. The linear model regression estimates are consistent with those reported under the matching estimator approach.

Table A.1: List of Treated Firms

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

Table A.2: Country Coverage

| Country | Number of Firm-Years | Country | Number of Firm-Years |
|----------------|----------------------|--------------------|----------------------|
| Argentina | 215 | Lebanon | 2 |
| Belgium | 85 | Sri Lanka | 148 |
| Bulgaria | 46 | Lithuania | 48 |
| Bahrain | 14 | Latvia | 57 |
| Brazil | 340 | Macedonia | 2 |
| Canada | 275 | Malta | 8 |
| China | 122 | Mexico | 139 |
| Colombia | 29 | Malaysia | 465 |
| Cyprus | 156 | Nigeria | 63 |
| Czech Republic | 34 | New Zealand | 115 |
| Ecuador | 1 | Peru | 45 |
| Estonia | 12 | Philippines | 232 |
| Egypt | 229 | Pakistan | 221 |
| Spain | 451 | Portugal | 209 |
| Finland | 109 | Romania | 30 |
| France | 451 | Serbia | 9 |
| Greece | 817 | Russian Federation | 186 |
| Hong Kong | 220 | Sweden | 94 |
| Croatia | 189 | Slovenia | 64 |
| Hungary | 124 | Slovakia | 11 |
| Indonesia | 473 | Thailand | 378 |
| Ireland | 197 | Tunisia | 62 |
| India | 255 | Turkey | 160 |
| Iceland | 20 | Taiwan | 1,336 |
| Italy | 865 | Ukraine | 338 |
| Jamaica | 16 | United States | 4,081 |
| Japan | 9,712 | Venezuela | 54 |
| Kenya | 23 | Vietnam | 475 |
| South Korea | 251 | South Africa | 174 |
| Kazakhstan | 2 | | |
| | | Total | 24,939 |

Table A.3: Distribution Support

This table presents the distribution support of the covariates.

| | | 5% | 25% | 50% | 75% | 95% |
|--|-------------|--------|-------|-------|-------|--------|
| <i>Panel A: Treated vs Non-Treated Group</i> | | | | | | |
| <i>Size</i> | Treated | 6.60 | 7.71 | 9.43 | 10.08 | 10.08 |
| | Non-Treated | 2.02 | 4.14 | 5.30 | 6.57 | 8.76 |
| <i>Investment</i> | Treated | 3.91 | 12.26 | 16.13 | 25.40 | 82.32 |
| | Non-Treated | 0.43 | 4.49 | 11.46 | 24.22 | 83.58 |
| <i>Q</i> | Treated | 0.85 | 1.03 | 1.31 | 1.59 | 2.78 |
| | Non-Treated | 0.57 | 0.82 | 1.00 | 1.36 | 3.75 |
| <i>CashFlow</i> | Treated | 7.68 | 11.00 | 14.80 | 21.11 | 33.10 |
| | Non-Treated | -18.79 | 2.90 | 7.53 | 13.43 | 27.60 |
| <i>Cash</i> | Treated | 0.94 | 2.86 | 8.47 | 15.20 | 34.11 |
| | Non-Treated | 0.54 | 4.18 | 10.00 | 20.31 | 48.73 |
| <i>Leverage</i> | Treated | 0.72 | 19.03 | 33.31 | 46.98 | 62.41 |
| | Non-Treated | 0.00 | 6.46 | 23.32 | 40.50 | 69.20 |
| <i>Foreign Sales</i> | Non-Treated | 0.00 | 0.00 | 0.00 | 0.10 | 0.71 |
| | Treated | 0.00 | 0.00 | 0.00 | 0.44 | 0.63 |
| <i>Long-Term Debt</i> | Non Treated | 0.00 | 0.17 | 0.47 | 0.74 | 0.99 |
| | Treated | 0.52 | 0.62 | 0.78 | 0.88 | 0.99 |
| <i>Gov. Ownership</i> | Non-Treated | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Treated | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 |
| <i>Panel B: Treated vs Control Group</i> | | | | | | |
| <i>Size</i> | Treated | 6.60 | 7.71 | 9.43 | 10.08 | 10.08 |
| | Control | 6.75 | 7.33 | 9.20 | 10.08 | 10.08 |
| <i>Investment</i> | Treated | 3.91 | 12.26 | 16.13 | 25.40 | 82.32 |
| | Control | 4.20 | 8.01 | 12.17 | 23.75 | 106.09 |
| <i>Q</i> | Treated | 0.85 | 1.03 | 1.31 | 1.59 | 2.78 |
| | Control | 0.75 | 0.90 | 1.01 | 1.27 | 1.64 |
| <i>CashFlow</i> | Treated | 7.68 | 11.00 | 14.80 | 21.11 | 33.10 |
| | Control | 1.83 | 6.98 | 10.53 | 14.55 | 23.35 |
| <i>Cash</i> | Treated | 0.94 | 2.86 | 8.47 | 15.20 | 34.11 |
| | Control | 1.47 | 3.14 | 6.94 | 11.52 | 20.88 |
| <i>Leverage</i> | Treated | 0.72 | 19.03 | 33.31 | 46.98 | 62.41 |
| | Control | 15.45 | 24.50 | 34.19 | 49.62 | 62.75 |
| <i>Foreign Sales</i> | Treated | 0.00 | 0.00 | 0.00 | 0.44 | 0.63 |
| | Control | 0.00 | 0.00 | 0.03 | 0.44 | 0.72 |
| <i>Long-Term Debt</i> | Treated | 0.52 | 0.62 | 0.78 | 0.88 | 0.99 |
| | Control | 0.43 | 0.61 | 0.80 | 0.88 | 0.97 |
| <i>Gov. Ownership</i> | Treated | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 |
| | Control | 0.00 | 0.00 | 0.00 | 0.00 | 0.51 |

Table A.4: Credit Ratings Numerical Scale

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

Table A.5: Probability of Corporate Downgrade Following a Sovereign Downgrade

This table presents estimates of the logit regressions of the probability of a corporate downgrade. The dependent variable is a dummy that takes the value of one if a firm rating is downgraded in year t . *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 a 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 . Robust standard errors are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

| | Dependent Variable: <i>Corporate Downgrade</i> | | | | |
|--|--|----------------------|----------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) |
| <i>Bound</i> x <i>Sovereign Downgrade</i> | 2.959*** (0.255) | 2.939*** (0.285) | 2.644*** (0.291) | 2.407*** (0.347) | 1.880*** (0.404) |
| <i>Bound</i> | -0.758*** (0.120) | -0.563*** (0.135) | -0.446*** (0.136) | 0.192 (0.210) | -0.183 (0.174) |
| <i>Sovereign Downgrade</i> | -0.048 (0.080) | -0.059 (0.086) | 0.445*** (0.115) | 0.417*** (0.134) | |
| Controls | No | Yes | Yes | Yes | Yes |
| Year FE | No | No | Yes | Yes | No |
| Industry FE | No | No | Yes | No | No |
| Firm FE | No | No | No | Yes | No |
| Country x Year FE | No | No | No | No | Yes |
| Observations | 27,268 | 24,627 | 24,609 | 17,486 | 23,114 |
| R^2 | 0.01 | 0.04 | 0.06 | 0.07 | 0.04 |
| <i>Marginal Effects:</i> | | | | | |
| $\Pr(\text{Corporate Downgrade} \text{Bound} = 0, \text{SovDowngrade} = 1, X = \bar{X})$ | 0.13*** (0.009) | 0.12*** (0.009) | | | |
| $\Pr(\text{Corporate Downgrade} \text{Bound} = 1, \text{SovDowngrade} = 1, X = \bar{X})$ | 0.58*** (0.051) | 0.58*** (0.058) | | | |
| $\frac{\partial \Pr(\text{Corporate Downgrade})}{\partial \text{Bound}} _{\text{Sovereign Downgrade}=1, X=\bar{X}}$ | 0.45*** (0.052) | 0.46*** (0.059) | | | |

Table A.6: Determinants of Corporate Ratings in AAA Countries

This table reports the estimates of regression of corporate ratings using the sample of firms domiciled in AAA countries. Standard errors are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

| | Dependent Variable: <i>Rating</i> |
|------------------------------|--------------------------------------|
| | (1) |
| <i>ROA</i> | 6.798*** (0.37) |
| <i>Size</i> | 1.240*** (0.31) |
| <i>Leverage</i> | -7.525*** (0.37) |
| <i>ROA</i> ² | 1.097*** (0.11) |
| <i>Size</i> ² | 0.010 (0.02) |
| <i>Leverage</i> ² | 2.288*** (0.22) |
| Year FE | Yes |
| Industry FE | Yes |
| <i>R</i> ² | 0.596 |

Table A.7: Difference-in-Differences of Corporate Ratings around a Sovereign Upgrade

This table presents the results of the credit rating difference-in-differences Abadie and Imbens matching estimator around the sovereign upgrade. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. There are 182 treated and 182 control firm-year observations. Corporate ratings are converted to a numerical scale with 22 corresponding to the highest rating (AAA) and one to the lowest (default). Robust standard errors are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

| | Year Before Upgrade | Year of Upgrade | Difference |
|---------------------------|------------------------|---------------------|---------------------|
| Treated Firms | 13.14*** (0.149) | 13.38*** (0.173) | 0.24*** (0.042) |
| Control Firms | 9.49*** (0.175) | 9.91*** (0.176) | 0.42*** (0.142) |
| Difference | 3.65*** (0.314) | 3.47*** (0.339) | |
| Difference-in-Differences | | | -0.18 (0.129) |
| Matching Estimator (ATT) | | | -0.54*** (0.138) |

Table A.8: Difference-in-Differences of Investment around a Sovereign Upgrade

This table presents the results of the investment rate difference-in-differences Abadie and Imbens matching estimator around the sovereign upgrade. Investment rate is defined as the ratio of annual capital expenditure to lag net property, plant and equipment. Treated firms have credit rating equal to or above to the sovereign rating in the year before a sovereign upgrade. There are 182 treated and 182 control firm-year observations. Robust standard errors are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

| | Year Before Upgrade | Year of Upgrade | Difference |
|---------------------------|------------------------|---------------------|------------------|
| Treated Firms | 21.11*** (1.277) | 21.90*** (1.208) | 0.83 (0.745) |
| Control Firms | 13.95*** (0.945) | 15.66*** (1.144) | 1.68 (0.913) |
| Difference | 7.16*** (1.340) | 6.23*** (1.368) | |
| Difference-in-Differences | | | -0.85 (1.093) |
| Matching Estimator (ATT) | | | -0.57 (1.266) |

Table A.9: Difference-in-Differences of Returns on Assets

This table presents the results of returns on assets (ROA) differences-in-differences Abadie and Imbens matching estimator around the sovereign downgrade. ROA is defined as the ratio of operating income minus income taxes to the lag of total assets. Treated firms have credit rating equal to or above to the sovereign rating in the year before a sovereign downgrade. There are 66 treated and 66 control firm-year observations. Robust standard errors are reported in parentheses. ***, **, * indicated significance at the 1%, 5% and 10% level respectively.

| | Year Before Downgrade | Year of Downgrade | Difference |
|---------------------------|--------------------------|----------------------|------------------|
| Treated Firms | 8.44*** (0.898) | 7.84*** (0.988) | -0.60 (0.552) |
| Control Firms | 6.10*** (0.640) | 5.54*** (0.690) | -0.56 (0.434) |
| Difference | 2.34*** (0.847) | 2.30** (0.101) | |
| Difference-in-Differences | | | -0.04 (0.715) |
| Matching Estimator (ATT) | | | -0.13 (0.805) |

Table A.10: Linear Regression of Investment

This table presents estimates of linear regressions of investment rate. The dependent variable is the annual change in investment rate ($\Delta Investment$) in year t . Investment rate is defined as the ratio of annual capital expenditure to lag net property, plant and equipment. *Bound* is a dummy variable that takes the value of one if a firm has a credit rating equal to or above the sovereign rating in a 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 size, Tobin's Q, cash flow, cash holdings, leverage, foreign sales, and a dummy that takes the value of one if the firm has a credit rating. The sample consists of WRDS-Factset Fundamentals Annual Fiscal (North America and International) non-financial firms from 1990 to 2012. Clustered standard errors are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---------------------|----------------------|---------------------|--------------------|----------------------|---------------------|
| <i>Bound</i> × <i>Sovereign Downgrade</i> | -0.096** (0.038) | -0.114*** (0.043) | -0.116** (0.050) | -0.107* (0.058) | -0.117*** (0.032) | -0.073** (0.037) |
| <i>Bound</i> | 0.030*** (0.005) | 0.021*** (0.007) | 0.020** (0.008) | -0.016 (0.011) | -0.020 (0.015) | 0.005 (0.015) |
| <i>Sovereign Downgrade</i> | 0.016*** (0.005) | 0.029*** (0.005) | 0.041*** (0.014) | 0.021 (0.016) | 0.006 (0.007) | |
| Controls | No | Yes | Yes | Yes | Yes | Yes |
| Year FE | No | No | Yes | Yes | Yes | No |
| Industry FE | No | No | Yes | No | No | No |
| Country FE | No | No | No | Yes | No | No |
| Firm FE | No | No | No | No | Yes | Yes |
| Country x Year FE | No | No | No | No | No | Yes |
| Cluster | Firm | Firm | Industry | Country | Firm | Country x Year |
| Observations | 391,702 | 357,229 | 355,670 | 357,229 | 357,229 | 357,229 |
| R^2 | 0.00 | 0.01 | 0.02 | 0.02 | 0.04 | 0.15 |

Table A.11: Difference-in-Differences of Investment around a Sovereign Downgrade - Firms with Rating Equal to the Sovereign

This table presents the results of the investment rate difference-in-differences Abadie and Imbens matching estimator around the sovereign downgrade. Investment rate is defined as the ratio of annual capital expenditure to lag net property, plant and equipment. Treated firms have credit rating equal to the sovereign rating in the year before a sovereign downgrade. There are 56 treated and 56 control firm-year observations. Robust standard errors are reported in parentheses. ***, **, * indicated significance at the 1%, 5% and 10% level respectively.

| | Year Before Downgrade | Year of Downgrade | Difference |
|---------------------------|--------------------------|----------------------|----------------------|
| Treated Firms | 30.47*** (6.451) | 18.56*** (1.751) | -11.91** (5.931) |
| Control Firms | 19.82*** (3.159) | 20.94*** (3.905) | 1.12 (3.725) |
| Difference | 10.66 (4.934) | -0.24 (3.547) | |
| Difference-in-Differences | | | -13.03** (5.462) |
| Matching Estimator (ATT) | | | -21.07*** (7.029) |

Table A.12: Difference-in-Differences of Investment around a Sovereign Downgrade - Treated and Control Firms in the Same Industry

This table presents the results of the investment rate difference-in-differences Abadie and Imbens matching estimator around the sovereign downgrade imposing that treated and control firms are in the same two-digit SIC industry. Investment rate is defined as the ratio of annual capital expenditure to lag net property, plant and equipment. Treated firms have credit rating equal to or above to the sovereign rating in the year before a sovereign downgrade. There are 76 treated and 76 control firm-year observations. Robust standard errors are reported in parentheses. ***, **, * indicated significance at the 1%, 5% and 10% level respectively.

| | Year Before Downgrade | Year of Downgrade | Difference |
|----------------------------|--------------------------|----------------------|---------------------|
| Treated Firms | 27.29*** (5.55) | 16.92*** (1.570) | -10.37** (5.037) |
| Control Firms | 21.97*** (2.969) | 17.89*** (1.66) | -4.08* (2.411) |
| Difference | 5.32 (4.893) | -0.96 (1.811) | |
| Differences in Differences | | | -6.29 (4.102) |
| Matching Estimator | | | -7.72* (4.293) |

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

This table presents the results of the placebo tests of the effects of sovereign downgrade on corporate bond yields. Panel A presents the estimates around placebo periods identified by taking the month with the maximum increase in sovereign bond yields in a given country and year not accompanied by a sovereign downgrade. Panel B presents the estimates assuming the downgrade takes place one year before the actual date. The dependent variable is the corporate bond yield change around the sovereign downgrade for different event windows. *Bound* is a dummy variable that takes a value of one if a corporate bond issue has a rating equal to or above sovereign rating prior to the sovereign downgrade. The sample consists of treated and control firms in Table 5 for which yields on local currency bond issue are available. Control firms with rating more than three notches below the sovereign rating are excluded. A bond issues is required to have at least one observation in the pre-downgrade period and one in the post-downgrade period. Robust standard errors clustered by country-event are reported in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% level respectively.

Panel A: Large Increases in Sovereign Bond Yields

| | (1) | (2) | (3) | (4) | (5) |
|------------------|-------------------|-------------------|------------------|-------------------|-------------------|
| | 1mPost--3mPre | 3mPost--3mPre | 4mPost--3mPre | 5mPost--3mPre | 6mPost--3mPre |
| Bound | -0.003 (0.012) | -0.007 (0.014) | 0.004 (0.015) | -0.003 (0.019) | -0.001 (0.015) |
| Country-Event FE | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,816 | 1,780 | 1,776 | 1,751 | 1,741 |
| r2 | 0.625 | 0.692 | 0.767 | 0.785 | 0.745 |

Panel B: One Year Before Sovereign Downgrade

| | (1) | (2) | (3) | (4) | (5) |
|------------------|-------------------|---------------------|-------------------|-------------------|---------------------|
| | 1mPost-3mPre | 3mPost-3mPre | 4mPost-3mPre | 5mPost-3mPre | 6mPost-3mPre |
| <i>Bound</i> | -0.014 (0.010) | -0.016** (0.006) | -0.009 (0.014) | -0.011 (0.011) | 0.022*** (0.007) |
| Country-Event FE | Yes | Yes | Yes | Yes | Yes |
| Observations | 446 | 441 | 440 | 437 | 436 |
| R^2 | 0.660 | 0.654 | 0.757 | 0.831 | 0.808 |

Figure A.1: Corporate Ratings around Sovereign Upgrade

This figure shows the parallel trends of corporate ratings of treatment and control groups around the sovereign upgrade. Treated firms have credit rating equal to or above the sovereign rating in the year before the sovereign upgrade. Control firms are matched firms using the Abadie and Imbens matching estimator. Corporate ratings are converted to a numerical scale with 22 corresponding to the highest rating (AAA) and one to the lowest (default).

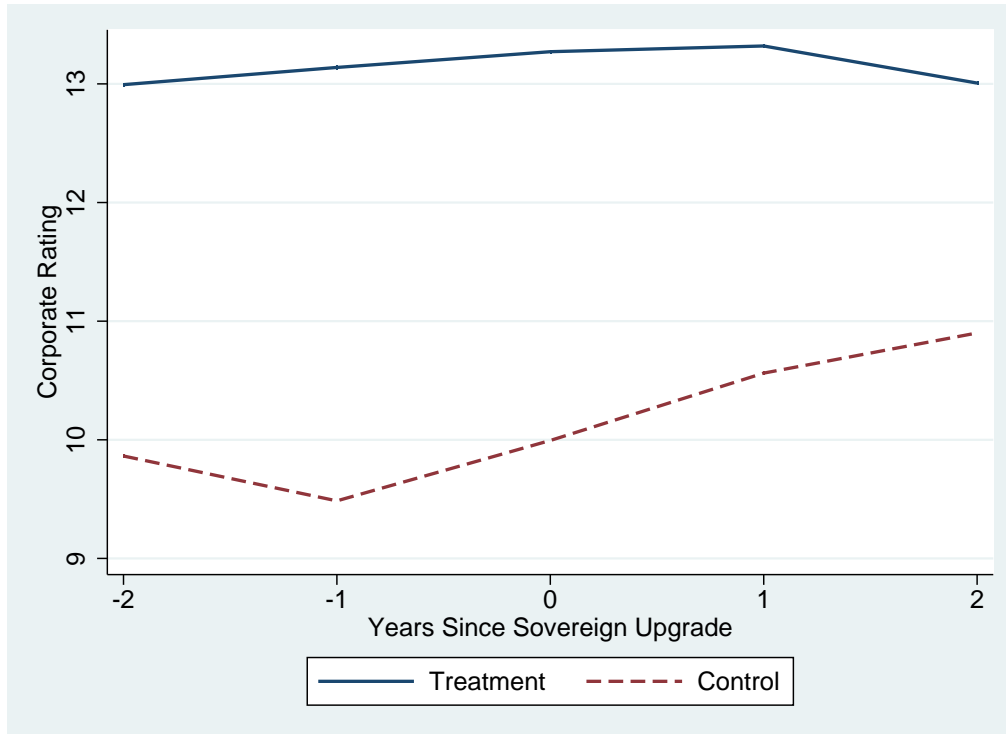


Figure A.2: Investment around Sovereign Upgrade

This figure shows the parallel trends of investment rate of treatment and control groups around the sovereign upgrade. Investment rate is defined as the ratio of annual capital expenditure to lag net property, plant and equipment. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign upgrade. Control firms are matched firms using the Abadie and Imbens matching estimator.

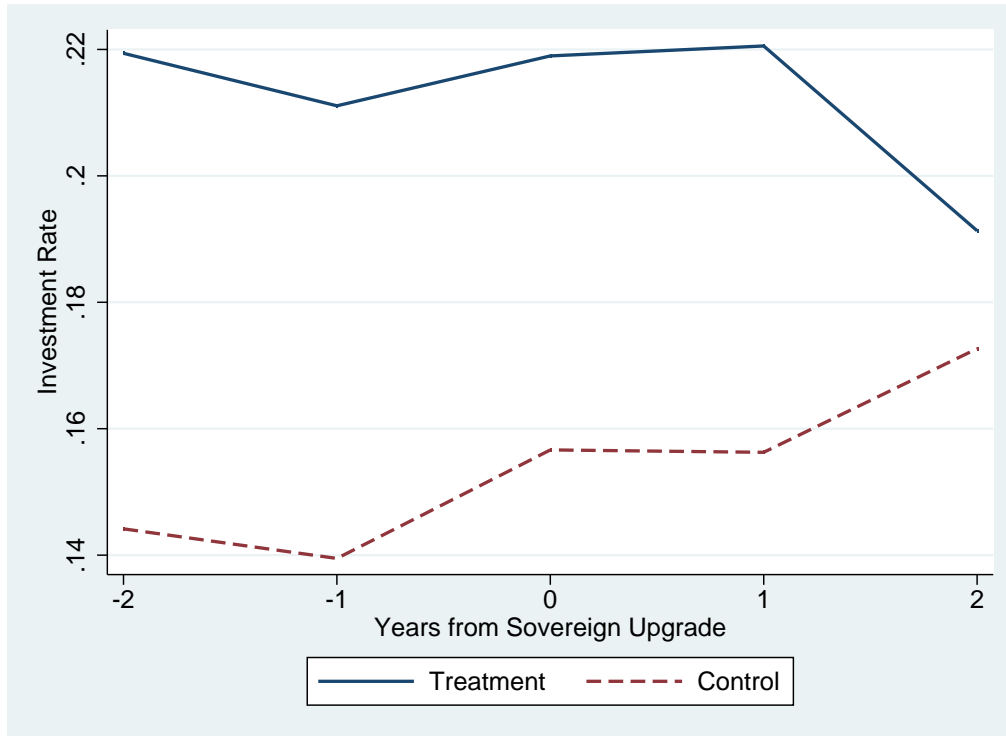
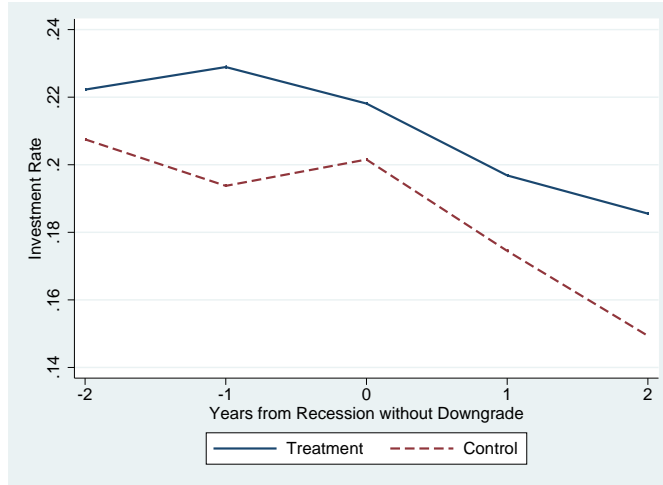


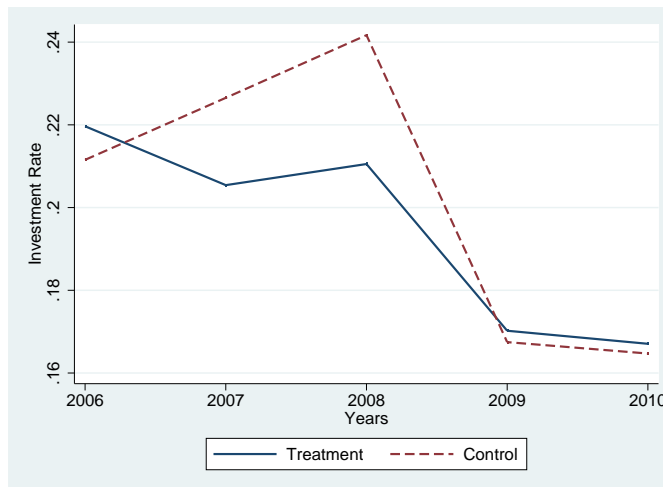
Figure A.3: Placebo Tests for Investment

This figure shows the parallel trends of investment rate of treatment and control groups around the placebo periods. Investment rate is defined as the ratio of annual capital expenditure to lag net property, plant and equipment. Panel A presents the estimates around the first year of recession without sovereign downgrade. Panel B presents the estimates around the 2007-2009 financial crisis. Panel C presents the estimates around a currency crisis without sovereign downgrade. Treated firms have credit rating equal to or above the sovereign rating in the year before the placebo period. Control firms are matched firms using the Abadie and Imbens matching estimator.

Panel A: Recession without Sovereign Downgrade



Panel B: 2007-2009 Financial Crisis



Panel C: Currency Crisis without Sovereign Downgrade

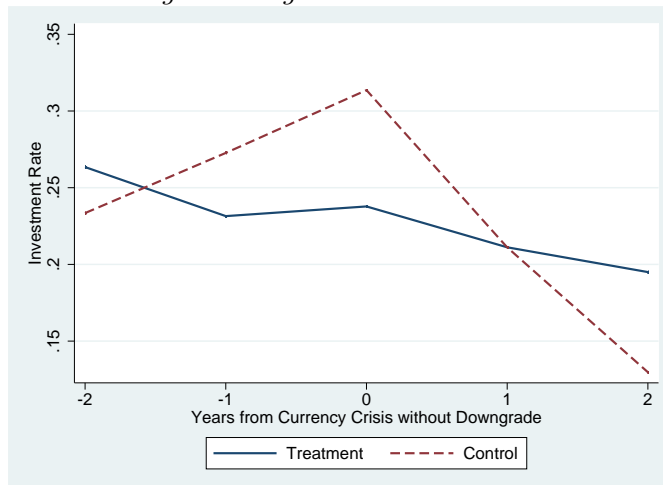


Figure A.4: Returns on Assets around Sovereign Downgrade

This figure shows the parallel trends of returns on assets (ROA) of treatment and control groups around the sovereign downgrade. ROA is defined as the ratio of operating income minus income taxes to the lag of total assets. Treated firms have credit rating equal or above to the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator.

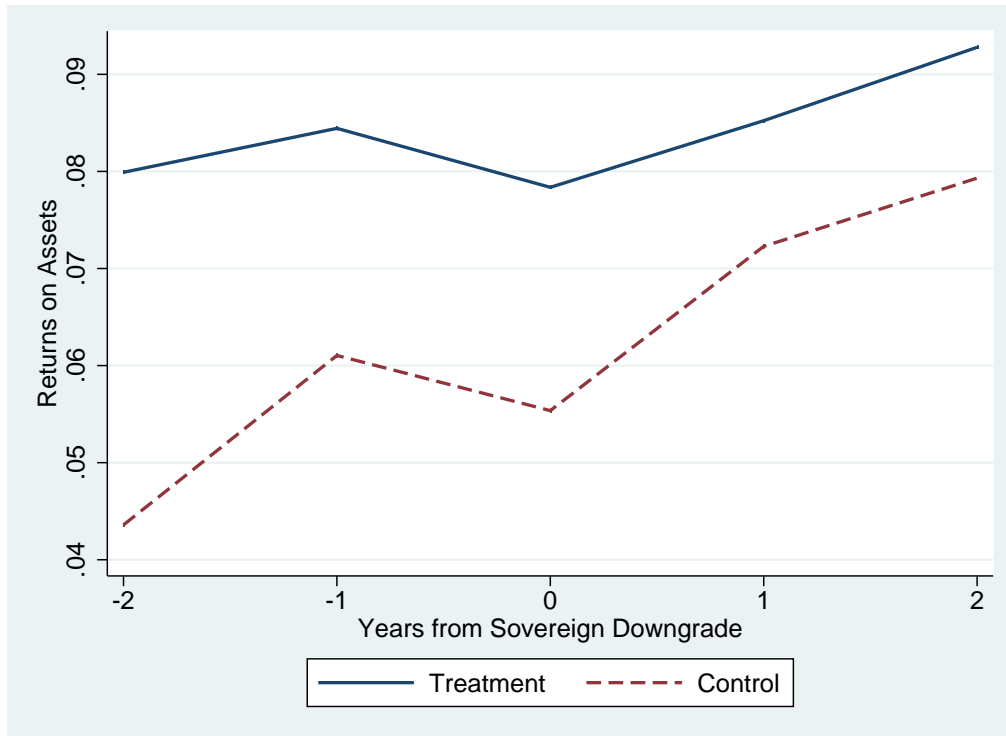
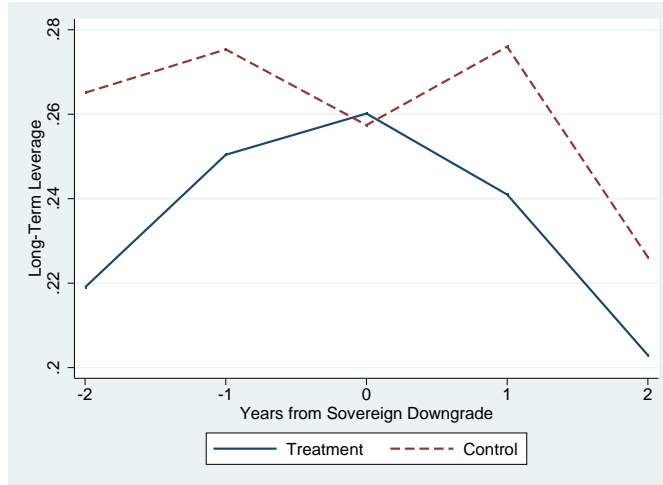


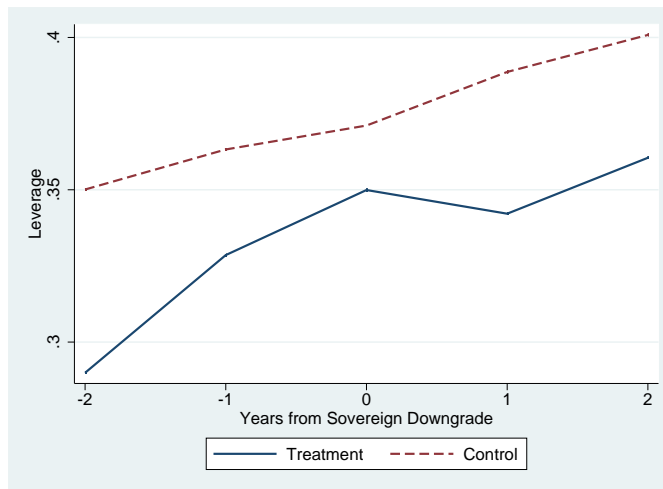
Figure A.5: Financial Policy around Sovereign Downgrade

This figure shows the parallel trends of leverage and cash of treatment and control groups around the sovereign downgrade. Long-term leverage is defined as the ratio of long-term debt to total assets. Total leverage is defined as the ratio of total debt to total assets. Cash is defined as the ratio of cash and short-term investments to total assets. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator.

Panel A: Long-Term Leverage



Panel B: Total Leverage



Panel C: Cash

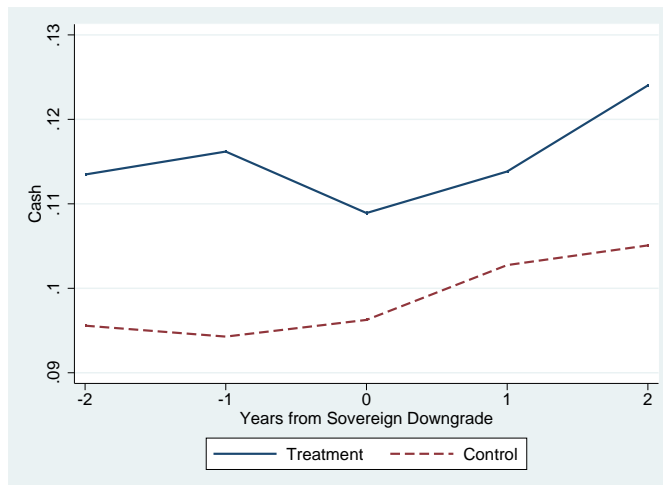


Figure A.6: Percentage of Debt in Foreign Currency

This figure shows the parallel trends of the percentage of debt in foreign currency of treatment and control groups around the sovereign downgrade. Percentage of debt in foreign currency is defined as the ratio of debt in foreign currency to total debt. Treated firms have credit rating equal to or above the sovereign rating in the year before a sovereign downgrade. Control firms are matched firms using the Abadie and Imbens matching estimator.

