Sovereign to Corporate Risk Spillovers*

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Abstract

We document significant spillover effects from sovereign to corporate credit risk using the announcement of the first Greek bailout on April 11, 2010, which represents an unexpected shift in the perception of sovereign risk of *all* European countries. A ten percent increase in sovereign credit risk raises corporate credit risk on average by 1.1 percent after the bailout. These effects are more pronounced in countries that belong to the Eurozone, that are more financially distressed and that have weaker property rights. Financial dependence, public ownership and the sovereign ceiling are channels that enhance the sovereign to corporate risk transfer.

Keywords: Contagion, Cost of Debt, Credit Risk, Greece, Sovereign Risk

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1 Introduction

Financial crises tend to be followed by sovereign distress, which is typically associated with real economic costs. Uncertainty about a government's commitment to service debt payments may restrict its access to capital markets and cause a loss in reputation. Such negative externalities may spill over onto corporations through expected increases in taxation, reductions in subsidies or the decreased value of implicit and explicit government guarantees. Acharya, Drechsler and Schnabl (2014) use the recent bailout of Irish banks as a laboratory in which they quantify the risk transfer from financial institutions to the public balance sheet and the subsequent feedback effect on the financial sector. The sovereign-bank nexus has received considerable attention in light of the sovereign distress wave that followed the 2007-2009 financial crisis.[1] In contrast, there is little empirical evidence on the negative externalities that sovereign credit risk inflicts on the *non-financial* corporate sector. In this paper, we focus on spillovers from sovereign into corporate credit risk.

While it is tempting to believe that the empirical evidence on the relationship between sovereigns and financial institutions carries forward to non-financial institutions, anecdotal evidence highlights that this relationship is not obvious from an ex-ante perspective. For example, a special report on corporations and the Eurozone crisis by FitchRatings claims that:[2]

"So far, the only corporates outside Greece to have experienced sovereign-driven rating action have been utilities." They further state that *"the market broadly agrees with a level of credit separation between Eurozone sovereigns and corporates."*

This paper exploits the announcement of the *first* Greek bailout on April 11, 2010, which

[1] See for example Reinhart and Rogoff (2008).

[2] FitchRatings, Corporates and the Eurozone Crisis: An Updated Q&A on Events So Far (June 14, 2012), $www.fitchratings.com/web_content/pages/grs/eurozone/$.

led to a significant increase in the perception of sovereign risk of *all* European countries. This allows us to rely on exogenous variation in sovereign credit spreads to quantify a direct spillover effect from sovereign to corporate credit risk. We use credit default swaps (CDS) to capture daily changes in credit risk, which may reflect changes in the cost of debt. Our main findings suggest an increase of the interdependence between sovereign and corporate CDS that is due to the unanticipated shock to sovereign credit risk. We estimate that, post-bailout, a ten percent increase in the level of sovereign credit risk is associated with a 1.1 percent increase in the level of corporate credit risk. This relation was insignificant prior to the event.

Establishing a directional spillover effect in such a turbulent macroeconomic environment is particularly challenging. In our case, simple correlations of sovereign and corporate credit risk may suffer from a twofold estimation bias. First, developments within the corporate sector of a country may in return have an effect on sovereign risk. This reverse causality is documented in Acharya, Drechsler and Schnabl (2014) for financial companies. Similar arguments may hold for other industries as well. Increasing unemployment, declining tax income, and uncovered corporate liabilities would support a reverse relationship from corporate to sovereign risk, as all these factors lead to lower growth and unexpected government expenses. Second, omitted variables may affect both sovereign and corporate credit risk jointly, thereby creating a spurious relationship. To address these two issues, the estimation strategy in our paper exploits a quasi-experimental design.

The Greek bailout was a central event in the European sovereign debt crisis on several important dimensions. First, instead of having a calming effect on the market, it triggered a large increase in Greek CDS spreads. This is illustrated in Figure 1, with Greek CDS spreads increasing from an average of 337 basis points (bps) to an average of 697 bps after the bailout. Second, the bailout is an explicit violation of the no-bailout clause of the Maastricht Treaty, making its explicit legal implementation difficult to anticipate. Third,

after requesting financial support, official statistics on the economic outlook had to be revised. This includes, among others, the upward revision of Greece's 2009 budget deficit and the downgrade of Greek bonds to junk status by Standard&Poor's (S&P). Because of the strong ties between the European Union (EU) countries, the Greek bailout also raised concerns about the solvency of other European countries with high deficits. Following the bailout announcement, the level of credit spreads unilaterally increased across Europe. On the one hand, EU members had to bear direct costs by providing equity financing for the bailout package. On the other hand, the Greek bailout raised concerns about fiscal responsibility in other countries as it represented an explicit violation of the no-bailout clause in the Maastricht Treaty. We interpret our event as a structural shift in investors' perception of sovereign default probabilities. Section 2 provides a more detailed discussion on the foundations for this interpretation.[3]

We refine the results of sovereign to corporate risk spillovers by exploiting cross-sectional heterogeneity across countries and companies. First, we show that being part of the Eurozone intensifies negative externalities on corporate credit risk due to the inability to use monetary policy for price adjustments. This underscores the importance of sound fiscal policy when countries are part of a currency union. Second, we observe that companies headquartered in financially distressed countries, represented by Ireland, Italy, Portugal, and Spain (the (G)IIPS countries), suffer relatively more from a rise in sovereign credit risk than companies outside the (G)IIPS countries.[4] Finally, our finding confirms the existing evidence on the economic role of property rights. Due to the possibility of government expropriation, companies in countries with weaker property rights are relatively more affected

[3]The interpretation of a shock to one country adversely affecting other countries is consistent with the theoretical framework in Benzoni et al. (2015). In their model, contagion across countries occurs when investors update their beliefs about the *uncertain* default probabilities of all sovereigns following an adverse shock to one of them. This generates a co-movement in sovereign spreads that is greater than that justified by macroeconomic fundamentals alone.

[4]GIIPS is an acronym for Greece, Italy, Ireland, Portugal, and Spain. By wrapping the letter "G" in brackets, we are emphasizing that we exclude Greek corporations entirely from our analysis.

by the rising credit risk of their governments.

To further mitigate concerns about a potential omitted variables problem in our setup, we develop additional cross-sectional hypotheses at the firm level. Our first test is based on public ownership. European governments hold significant equity stakes in companies of strategic importance. This is particularly common in industries, such as utilities, telecommunications, and transportation. Companies with a large public ownership are likely to be more closely linked to the government and, for that reason, more strongly affected by a sovereign crisis. Our second test exploits cross-sectional variation of companies' dependence on bank financing. Acharya, Eisert, Eufinger and Hirsch (2014) suggest that companies relying mainly on banks affected by the sovereign debt crisis face a risk of credit rationing. We find a similar result in our sample. Companies using relatively more bank financing are more sensitive to increased sovereign risk. At last, we also find support in favor of the proverbial sovereign ceiling. This hypothesis conjectures that a company's corporate borrowing costs should be bound from below by those of its government (see, for example, Almeida et al. (2014)). More specifically, we find that companies with a CDS spread or a rating closer to that of their respective governments are relatively more affected through our event.

The empirical evidence on a direct relationship between sovereign and corporate credit risk has primarily focused on emerging economies. For developed economies, Bai and Wei (2012) study the sovereign-corporate link and argue that the correlation between sovereign and corporate spreads is stronger in countries that have weaker property rights as well as for state-owned companies. Lee et al. (2013) show that companies can decouple themselves from sovereign risk, either through foreign investments in countries with better property and creditor rights, or by cross-listing in countries with more stringent disclosure requirements. Using a smaller sample (i.e., 118 non-financial companies from eight countries compared to 226 firms from fifteen countries in our sample), Bedendo and Colla (2013) document

a positive correlation between sovereign and corporate credit risk. Our paper features an important distinction as we cleanly identify the direct risk transfer from the sovereign to the non-financial corporate sector using a quasi-natural experiment that is motivated by theoretical foundations.

Dittmar and Yuan (2008) suggest that the *primary* issuance of sovereign bonds in *emerging* markets may enhance the efficiency of corporate bonds in the *secondary* market by lowering yields and bid-ask spreads. Similarly, Agca and Celasun (2012) and Dailami (2010) highlight adverse linkages between public external debt and corporate bond spreads in *emerging* economies.[5] We, on the other hand, study *developed* economies using a quasi-natural experiment and the arguably more homogeneous and more frequent information in daily CDS spreads.

Our work is also related to the literature that explores the linkages between sovereign credit risk and the financial sector. One example is Acharya, Drechsler and Schnabl (2014), who illustrate how financial bailouts can transfer risk from the private to the public balance sheet, which then feeds back through the channels of bailout guarantees and public bond holdings. Gennaioli et al. (2012), on the other hand, show how sovereign defaults can lower the amount of private credit provision. This effect is stronger for countries with more developed financial institutions and for countries where banks are strongly invested in government bonds. Our empirical evidence for *non*-financial institutions thus complements their findings for the financial sector. While the above references examine, as we do, the direct risk transfer *within* countries, Kallestrup et al. (2014), for example, study *cross-country* financial linkages between bank and sovereign CDS spreads.[6]

Finally, this paper is related to the literature focusing on contagion and spillover effects.

[5]More specifically, Dailami (2010) focuses on the relationship between public and corporate bond spreads, while Agca and Celasun (2012) show that, ceteris paribus, corporate yield spreads are higher when the level of external public debt is higher.

[6]We refer to Augustin et al. (2014) for an exhaustive survey of this literature.

Brutti and Sauré (2015), for instance, show how a series of real and financial shocks to Greece spread to the neighboring European economies. In contrast, we study how a re-assessment of sovereign credit risk due to a shock originating in Greece influences corporate credit risk within each country. Adelino and Ferreira (2014) show that sovereign rating downgrades impair banks' willingness to lend and increase their loan spreads, while Almeida et al. (2014) suggest that sovereign rating downgrades reduce firm investment and financial leverage.

The rest of the paper proceeds as follows. Section 2 reviews a timeline of the Greek bailout and discusses why the event led to a sudden shift in the perception of sovereign default risk. We develop our hypotheses in Section 3 and we explain our empirical methodology in Section 4. This is followed by an overview of the data in Section 5. A discussion of our main results, robustness tests, and cross-sectional evidence at the country level can be found in Section 6. Additional cross-sectional results at the firm-level are available in Section 7. We conclude in Section 8.

2 A Shift in the Perception of Sovereign Default Risk

To identify spillover effects from sovereign to corporate credit risk, we use the Greek bailout announcement on April 11, 2010 as a negative information shock that altered the perception of sovereign risk within the EU. Traditionally, the ties between members of the EU are particularly strong due to joint trade or monetary policies. This bailout, therefore, inflicted a cost on all EU members, both through direct transfer payments to Greece and indirectly through misleading incentives that undermine sound fiscal responsibility in all EU countries. A major concern was that the bailout opens up a Pandora's box, resulting in massive risk transfers between members of the EU. In the remaining part of this section, we first review the milestones of the Greek bailout, as summarized in Figure 2, and subsequently discuss

why the event allows us to identify spillover effects from sovereign onto corporate credit risk.

2.1 THE GREEK BAILOUT

Sovereign default risk within the EU was low, if not inexistent, prior to the 2007 turmoil in the financial markets. The average sovereign CDS spread in the region was approximately 14 bps from January 2007 to September 2008.[7] Following the financial crisis, with bailouts and fiscal stimulus programs occurring around the globe, financial markets began to re-evaluate the riskiness of sovereign debt.[8] In particular within the EU, there was a lot of uncertainty about excessive deficits and the effectiveness of the measures taken to address structural deficit problems. The EU Special Economic Policy Summit, which convened on February 11, 2010 re-emphasized the responsibility of all euro area members to ensure stability within the Eurozone. Effective measures and programs were discussed for all member states. The initiatives put forward by the Greek government to cut its deficit by 4 percent from the 2009 figure of 12.7 percent were fully supported.

On February 15, 2010, the Economic and Financial Affairs Council (ECOFIN) of the EU approved the proposals put forward by the Greek government to correct its budget deficit.[9] It was agreed that Greece should achieve a deficit in accordance with the Maastricht Treaty (below three percent) by 2012. Furthermore, the implementation would be monitored through a joint effort with the European Central Bank (ECB) and the International Monetary Fund (IMF). A few days later, at the spring European Council meeting of March 25 to 26, 2010, finance ministers were confident that the efforts taken by the Greek government would be sufficient to achieve the 2010 targets. Moreover, the council

[7] See Panel B of Table 1 in Acharya, Drechsler and Schnabl (2014).

[8] In 2011, even the safety of US treasury bonds was debated when the public debt ceiling had to be lifted, and S&P downgraded the United States from AAA to AA+ on August 5, 2011.

[9] ECOFIN is comprised of all the finance ministers of the EU member states.

emphasized that, with such decisive measures, Greece should be able to regain the trust of the financial markets on its own. There was no request from the Greek government for any financial support. On the contrary, its actions and messages suggested that the budgetary targets would be met, and that all the budgetary issues could be resolved. Greece successfully raised €5 billion on the market on March 29, 2010. Nevertheless, it was asked to develop a timeline for the implementation of all the measures by May 15, 2010, and then to report its progress on a quarterly basis.

This notion of control was successfully held up by the Greek government until the weekend preceding April 11, 2010, when Greece requested financial support from the EU. The finance ministers convened immediately and agreed upon a support package of up to €30 billion of bilateral loans over the next three years, with additional financing by the IMF. In return, the Greek authorities would develop a decisive consolidation program, closely monitored by the so-called troika (European Commission, IMF, and the ECB).

Shortly thereafter, on May 2, 2010, the support package was finalized. It contained a three-year support and restructuring program: €80 billion in bilateral loans from the EU plus an additional €30 billion in stand-by loans from the IMF. Greece received immediate support amounting to €45 billion. The support package, having a total volume of €110 billion, was more than three times the size of the initial agreement of €30 billion reached on April 11, 2010. On May 8, 2010, the Summit of the Heads of States and Governments of the Euro area finalized and officially passed the support package for Greece through legislation. As a result of this turmoil around the rescue of Greece, and in order to prevent future emergency rescue packages, an ECOFIN meeting on May 9, 2010 developed comprehensive stability measures such as the European Financial Stabilization Mechanism (EFSM), with the potential to grant support packages of up to €750 billion.

2.2 THE BAILOUT AS AN UNEXPECTED EVENT

The Greek bailout offers a promising research design through which to identify spillover effects from sovereign to corporate credit risk. In this paper, we argue that this event triggered a sudden deterioration in investors' perceptions about the riskiness of public debt of *all* EU countries. Our argument builds on several important observations. First, we would generally expect a bailout to decrease the financial risk of the supported entity, as shown, for example, by Acharya, Drechsler and Schnabl (2014). Therefore, Greek sovereign CDS spreads may have been expected to decrease following the announcement of the bailout on April 11, 2010. The opposite is the case, however. Figure 1 depicts the Greek sovereign CDS and its bid-ask spread from February 15, 2010 to June 25, 2010. After April 11, Greek sovereign borrowing costs show a steep increase. Greek CDS spreads double to about 800 bps and the corresponding bid-ask spreads more than triple to about 30 bps. This negative market reaction after the announcement of positive news for Greek creditors points towards a change in the perception of sovereign risk as a whole.

Second, the Greek bailout is a significant event in the history of the EU. It represents an explicit violation of the no-bailout clause agreed upon in the 1992 ratification of the Maastricht Treaty. More specifically, Article 103 of the treaty stipulates explicitly that *"neither the Community nor any Member State is liable for or can assume the commitments of any other Member State"*.[10] It was, therefore, not clear if and how this bailout could be structured. To underscore the sudden and enhanced focus on the distressed situation, we show that our event date coincides with a dramatic shift in public awareness of European sovereign credit risk. Figure 3 plots the daily Google search intensity of the key words *Euro Crisis*, *Greek Bailout*, and *Greek Debt*. It shows an immediate increase after April 11, suggesting a rise in media coverage and public awareness. We furthermore emphasize that

[10]The no-bailout clause was carried forward to Article 125 of the Lisbon Treaty, which was ratified in 2007.

this event was specific to Europe. It is not reflective of a common trend, but it represents a structural break in the relationship between sovereign risk in the Eurozone and that in the rest of the world. This is highlighted in Figure 4, which plots the evolution of the CDS spread of the US against that of the average sovereign CDS spread in Europe, including all countries in our sample, except Greece.[11] Both measures are standardized by their corresponding levels on February 15, 2010, the beginning of our sample period, to show their evolution as an index value in percentage of their starting values. While both the average European and the US CDS spreads exhibit a common trend prior to April 11, 2010, i.e. our event date, they start to diverge immediately thereafter.

Finally, in April 2010, there was a lot of uncertainty about the actual economic situation of Greece. With the request for financial support and high media coverage, official statistics were continually being updated. Most incoming information was arguably worse than expected. On April 22, 2010, EU officials lifted the estimate of Greece's 2009 deficit from 12.7 percent to 13.6 percent, arguing that it could top 14 percent. Later in the year, the actual budget deficit for 2009 was adjusted to be 15.6 percent, and this was followed by 10.8 percent in 2010. There was also a heated debate about the actual size of the support package. The initial number, as of April 11, was understood to be about €30 billion over the next three years. On Monday, April 19, Bundesbank president Axel Weber publicly announced that Greece may require financial assistance of as much as €80 billion to escape its debt crisis and avoid default. The finalized first support package amounted to €110 billion over the next three years. However, a second bailout package of €130 billion became necessary as early as October 2011. As a result of disappointing Greek financial statistics, S&P downgraded Greece by three notches to BB+, the first level considered to be of junk status, on April 27, 2010.

[11]The results are qualitatively similar if we plot the average CDS spread in Europe against alternative benchmark groups from different geographical regions. These results are available upon request.

The evidence discussed above suggests that the Greek bailout shifted the *perception* of the riskiness of public debt in a way that was not incorporated in CDS prices prior to the event. Benzoni et al. (2015) show how an adverse shock to *one* country is followed by updates of investors' beliefs about the *uncertain* default probabilities of *all* sovereigns. Their theoretical framework is consistent with our interpretation. Nevertheless, the exogenous variation in our identification could come from two plausible interpretations. On the one hand, one can argue that the spread increase in Figure 1 could be a simple consequence of newly generated information outweighing the bailout benefits. In this case, our identification strategy is based on *unexpected* news. On the other hand, if one argues that the sequence of events was anticipated, Figure 1 can only be explained by a change in perception. Either way, both interpretations are equally valid for our identification strategy.

3 Development of Hypotheses

There are several reasons why a shock to sovereign credit risk might affect the credit risk of (non-financial) corporations, and therefore their borrowing costs. Taxation is arguably the most important link. As an integral part of modern society, corporations help to maintain public welfare and infrastructure through the payment of corporate income taxes. With an increase in sovereign risk, governments may be forced to raise current and/or future tax rates. This would directly affect the profitability of corporations and therefore their financing through higher costs of funds. In extreme cases, governments might even seize corporate assets within their jurisdictions. This becomes economically meaningful because the expropriation threat alone can trigger foreign capital flight. The emerging market crises of the 1990s, and particularly Mexico's balance of payment crisis, illustrate how quickly a government liquidity crisis can transform into a general economic crisis. Statistically, the finding that results is that lenders are not willing to provide financing to any institution at

better conditions than they will offer to the government itself. This situation is commonly referred to as a sovereign ceiling, for which Borensztein et al. (2013) provide empirical evidence.[12]

On the other hand, sovereign distress may also have the effect of forcing a government to downsize its financial support for domestic corporations. Subsidies for industries that face fierce international competition are widespread around the world. These policies find less acceptance in periods of sovereign distress. Furthermore, potential bailout guarantees for corporations or industries of national importance are less valuable and less credible if the sovereign is simultaneously in distress.[13]

There are other reasons why a rise in sovereign credit risk may affect corporate credit risk in a negative way. Probably most noteworthy is that public investments tend to be postponed in times of sovereign distress, thereby directly affecting the profitability of corporations. Overall, the above discussion leads to our first hypothesis:

H1: Higher sovereign credit risk leads to higher corporate credit risk.

Hypothesis $H1$ predicts an unconditional relationship between sovereign and corporate credit risk. We also expect cross-sectional differences in the intensity of sovereign shock spillovers as a function of country characteristics. While we believe that the Greek bailout shifted the perception of sovereign default likelihood for all countries, our prior is that companies registered in the countries of the Eurozone would have been more strongly affected.

[12]We acknowledge that certain countries may attempt to avoid the sovereign ceiling by issuing bonds in a foreign legal jurisdiction or collateralizing an individual bond issue with ring-fenced assets. This practice was implemented by Fage Dairy, a Greek company, in December 2012 in response to the risk of Greece exiting the Eurozone (source: http://www.ir.com/Article/3155533/Fage-Dairy-The-bonddocumentation-that-de-risks-the-eurozone.html). However, given the historically low sovereign credit risk in the Eurozone, the sovereign ceiling only became an issue *after* the increase in sovereign credit risk in the Eurozone.

[13]Despite the fact that the provision of social insurance to the corporate sector may be costly, there exists anecdotal evidence of government bailouts, e.g. the bailout of the car manufacturer Opel by the German government in May 2009, and the emergency loans extended to GM by the Obama administration in 2009.

First, countries that adopted the Euro cannot use monetary instruments to increase their competitiveness through inflation. Second, a failure to solve the sovereign debt crisis could potentially result in a break-up of the Eurozone, with unpredictable costs. This scenario would bear more adverse consequences for Eurozone countries. Consequently, our second hypothesis is:

> *H2: Higher sovereign credit risk raises corporate credit risk by a greater amount for companies headquartered in the Eurozone.*

More competitive and financially sound economies are more resilient to external shocks. We therefore believe that negative externalities from a sovereign shock should have a larger impact in the (G)IIPS countries. Therefore, our third hypothesis is:

> *H3: Higher sovereign credit risk raises corporate credit risk by a greater amount in (G)IIPS.*

As previously discussed, expropriation of companies' assets by governments is a potential mechanism for decreasing public debt. The threat of expropriation is limited by the strength of a country's legal institutions, which can be captured by the property rights index provided by the Heritage Foundation. As in Bai and Wei (2012) and Lee et al. (2013), we expect a stronger impact on corporate credit risk in countries with weaker property rights. Our final hypothesis is, therefore:

> *H4: Higher sovereign credit risk raises corporate credit risk by a greater amount in countries with weaker property rights.*

4 Empirical Methodology

To identify spillover effects from sovereign to corporate credit risk, we use the Greek government bailout on April 11, 2010 as an exogenous shock to sovereign default risk in the EU.

We measure changes in corporate credit risk by the log change in the corporate CDS spread, which is denoted as $\Delta cds^{c}_{i,j,t}$ for firm i in country j at time t. On the other hand, $\Delta cds^{s}_{j,t}$ refers to the log change in the sovereign CDS spread for country j at time t. To test the first hypothesis, we specify our baseline regression as a simple difference regression:

$$\begin{aligned} \Delta cds^{c}_{i,j,t} &= \alpha_0 + \alpha_1 \times E_t \times \Delta cds^{s}_{j,t} + \alpha_2 \times \Delta cds^{s}_{j,t} \\ &+ \gamma^{\top} X_{(i),j,t} + \delta_i + \gamma_t + \varepsilon_{i,j,t}. \end{aligned} \tag{1}$$

The variable E denotes a dummy variable that takes the value one after the event and zero otherwise. Our coefficient of interest is α_1, which measures the magnitude of the sovereign to corporate spillover effects, and which is expected to be positive. δ_i and γ_t represent, respectively, firm and time fixed effects.[14] Finally, $\gamma^{\top} X_{(i),j,t}$ contains several control variables that absorb the influence of country-specific and/or company-specific time-varying risk factors that may influence the dependent variables, with different variations that we explore in the robustness section 6.2. We double-cluster all standard errors at the day and company level to account for both time-series and cross-sectional correlation in the error terms, following the suggestion of Petersen (2009).[15]

[14] Note that the term E_t drops out of the specification because of collinearity with the time fixed effects.

[15] Clustering at the firm level may lead to downward biased standard errors as the variation of the key dependent variable is at the country level (Moulton (1990)). Clustering at the country level is similarly problematic as we have only fifteen countries in our sample, which is less than the critical level of 42 clusters recommended by Angrist and Pischke (2009). For completeness, we verify that our results are robust against clustering at the country level, which produces for most tests *smaller* standard errors than those obtained with clustering at the firm dimension.

Note that we eliminate the influence of any unobserved (time-invariant) firm specific characteristics by including firm fixed effects. Moreover, we include in our regressions (day) time fixed effects in order to purge out the influence of any common macroeconomic or financial factors that could potentially be responsible for a stronger relationship between sovereign and corporate credit risk. In addition, Greek corporations are excluded from all regressions in order to ensure that the effect is not driven by distressed Greek corporations.[16] To summarize, we focus on the channel from domestic sovereign risk to companies within the same country using the Greek bailout as an exogenous source of variation to other (non-Greek) sovereigns' credit risk.

Testing hypotheses H2 to H4 requires us to add one additional interaction to our benchmark specification. Specifically, we run the following difference-in-difference regressions:

$$\begin{aligned} \Delta cds^{c}_{i,j,t} &= \alpha_0 + \alpha_1 \times E_t \times \Delta cds^{s}_{j,t} \times C_j + \alpha_2 \times E_t \times \Delta cds^{s}_{j,t} \\ &+ \alpha_3 \times E_t \times C_j + \alpha_4 \times \Delta cds^{s}_{j,t} \times C_j \\ &+ \alpha_5 \times \Delta cds^{s}_{j,t} + \gamma^{\top} X_{(i),j,t} + \delta_i + \gamma_t + \varepsilon_{i,j,t}. \end{aligned} \tag{2}$$

To test cross-sectional differences in sovereign risk spillovers, the term C_j is defined in relation to each hypothesis. To test hypotheses H2 and H3, C_j is an indicator that is equal to one for countries in the Eurozone and distressed countries, respectively. When testing hypothesis H4, C_j is equal to the property rights score of each country. The coefficient of interest in these regressions is α_1, which captures the differential impact of the sovereign risk spillover for the treatment group (Eurozone countries) relative to the control group (non-Eurozone countries) after the shock to Greece.

[16] We exclude Greek corporations in order to make sure that our result is not driven by Greek companies, which are the most strongly affected by the Greek bailout. We should emphasize that the estimated coefficient will, as a result, *underestimate* the average effect.

5 Data

We use CDS data to measure the market's perception of both sovereign and corporate credit risk. This has several advantages over using bond yield-spreads. First, CDS allow for a meaningful and consistent comparison of corporate borrowing costs across companies and countries as they are highly standardized products with pre-determined and identical contractual agreements. In contrast, bond data are highly heterogeneous with respect to the legal jurisdiction of the issuing country (for public bonds), covenants, coupon structures, maturities and issue amounts. The attractiveness of CDS data is further underscored by the availability of high-frequency constant-maturity spreads. Declining maturities are a key characteristic implicit in bond spreads, making it challenging to find readily available and highly comparable data.

Second, from a theoretical perspective, a CDS spread is equivalent to the spread of a floating rate note above a risk-free threshold (Duffie 1999). This assertion relies on the assumption of frictionless markets. However, recent research provides evidence of a persistent negative "CDS-bond basis" during the financial crisis, suggesting that CDS spreads were persistently *lower* than bond spreads (Bai and Collin-Dufresne 2013). From this perspective, we are likely to *underestimate* any effect on corporate credit risk, compared to tests using yield-spreads.

Third, the fall of Lehman Brothers emphasized that CDS spreads may be biased estimates of sovereign and corporate credit risk because of counterparty risk. Arora et al. (2012), however, show that, even though counterparty risk is priced in credit derivatives, the order of magnitude is economically insignificant. The credit risk of a counterparty would need to increase by more than six percentage points in order to decrease CDS spreads by one basis point. Moreover, the effect of counterparty risk on CDS spreads is negative, suggesting that we may *underestimate* the real impact from a rise in sovereign credit risk.

Finally, anecdotal evidence suggests that CDS spreads, despite their unfunded nature, may be less liquid than originally assumed, and there is recent academic evidence provided by Tang and Yan (2007) and Bongaerts et al. (2011) of liquidity and liquidity risk in credit derivatives.[17] Illiquidity is, however, likely to be greater for bond spreads than for CDS spreads. To mitigate any concerns, we verify that our results are robust against liquidity effects by controlling for each company's CDS bid-ask spreads.

Our final sample consists of 21,470 observations for 226 corporate reference companies in 15 countries. Our sample period spans from February 15, 2010, eight weeks before the event date on April 11, 2010 to June 25, 2010, eight weeks after the bailout package was officially approved on May 2, 2010.[18] Focusing on the immediate weeks around the event limits the risk of identifying a relationship that is due to other confounding effects that happened during the turbulent European sovereign debt crisis. We source Credit Market Analysis (CMA) data through Datastream. We start with the available universe of sovereign 5-year mid-market, bid and ask quotes for Europe, as the 5-year horizon represents the most liquid maturity in both the sovereign and corporate CDS markets. We choose the full-restructuring credit event clause, which is the standard contract documentation for Western European sovereign reference entities. The currency denomination available for members of the Eurozone, the United Kingdom, and Norway is USD, while the reference contracts for Switzerland, Sweden and Denmark are EUR denominated.[19] Within each country, we identify all EUR-denominated *non-financial* corporate reference entities which trade under the modified modified restructuring (MMR) contract clause for the senior unsecured capital structure.[20] Thus, we use the most standardized contract specification

[17]Longstaff et al. (2005), for example, assume that CDS spreads are perfectly liquid in order to estimate the liquidity component implicit in bond spreads.

[18]The total sample includes 19 weeks of data, including the three weeks between the bailout announcement and its approval, a period marked by uncertainty and a gradual reevaluation of sovereign risk.

[19]While it would be preferable to have all CDS quotes denominated in USD, we ensure that our results are not affected by including interactions between the EUR/USD exchange rate return and a dummy variable for countries with USD denominated CDS spreads.

[20]There is only limited pricing availability in the CMA database, provided through Thomson Reuters

in the European CDS market and end up with a sample of 226 companies.

To complement our database, we collect country-specific and firm-specific variables. More specifically, we collect country-specific stock market returns based on the Morgan Stanley Composite Total Return indices and we take the EUR/USD foreign exchange rate from the Federal Reserve Bank of St. Louis website. We also seek information on each country's property rights from the Heritage Foundation.[21] We source foreign currency long-term sovereign credit ratings from Fitch Ratings, we get sovereign bond yield data from Bloomberg, and we obtain data on countries' financial structure from the Financial Structure Database published by the World Bank.

In addition, we collect the CMA CDS bid-ask spreads from Thomson Reuters Datastream to control for liquidity effects. We use Datastream to source other firm-specific control variables such as each company's stock returns, which we use to control for endogenously deteriorating values of firm fundamentals. Furthermore, we manually match our database with Bureau van Dijk's Amadeus database for non-financial companies. We use balance sheet information, in particular companies' dependence on bank loans, and information on public ownership, which we manually verify for consistency. All information is based on the fiscal year 2009, which is the latest available information immediately preceding our event date. Finally, we obtain the Standard & Poor's long-term issuer credit

Datastream, for European corporate reference contracts with the full-restructuring clause, which is standard for Western European sovereign CDS. One concern is that our results could be driven by the restructuring premium implicit in CDS contract clauses, as suggested by Berndt et al. (2007). This effect is muted by the MMR clause, which limits the maturity of deliverable debt obligations to a maximum of 60 months. In other words, the Cheapest-to-Deliver (CTD) option is less of a concern in contracts issued under the MMR clause compared to the full-restructuring clause. Thus, as long as we use a corporate contract clause for which the CTD is *less* of a problem than for the sovereign contract clause, we will *underestimate* the effect on corporate credit risk.

[21] The property rights indicator is used, among others, in Dittmar and Yuan (2008) and Lee et al. (2013). According to the Heritage Foundation website: "The property rights component is an assessment of the ability of individuals to accumulate private property, secured by clear laws that are fully enforced by the state. It measures the degree to which a country's laws protect private property rights and the degree to which its government enforces those laws. It also assesses the likelihood that private property will be expropriated and analyzes the independence of the judiciary, the existence of corruption within the judiciary, and the ability of individuals and businesses to enforce contracts."

ratings for all companies from the ECB Centralised Securities Database.

Descriptive summary statistics for the pre- and post-event windows are reported in Table 1. There is substantial heterogeneity in the sample, both across time and across countries. The average corporate CDS spread increased from 161 bps in the pre-event period to 181 bps in the aftermath period that included the Greek IMF bailout. The lowest average spread, at 81 bps in the pre-event period, is found for Belgium, going up to a maximum of 390 bps for Norway. Portugal recorded the highest *increase* in average corporate spread, going from 122 to 206 bps, followed by Spain, where the average corporate CDS increased by 71 bps from 161 to 232, i.e., an increase of 44%. The lowest average sovereign spreads in the pre-event window are observed for the Nordic countries, with values of 17, 26, and 37 bps for Norway, Finland, and Sweden, respectively, while in the post-event window the average spreads for the same countries are 22, 29, and 39 bps. Greek spreads experience the greatest rise, going from an average of 337 to 697 bps, i.e., an increase of 107%.

Table 2 provides further cross-sectional statistics at the country level on sub-groups of our sample. The table illustrates that, during our time period, companies in the Eurozone are, on average, riskier than companies outside the monetary union. The average difference in spreads is 17 bps before Greece's shock, and increases to 26 bps thereafter. Similarly, the average firm in the (G)IIPS countries, excluding Greece, is riskier than the average firm in the remaining Euro-member states, but after the bailout announcement, the average spread increases from 158 to 221 bps. In the non-(G)IIPS comparison group, the spread of the average firm rises by nine percent from 171 to 186 bps. Finally, in the last two rows of the table, we highlight that there was a much greater increase in credit risk after the announcement for the average firm in countries with weak property rights. For those countries that have a below-median property rights score, the spreads rise, on average, by 28 percent from 140 to 179 bps, while among their above-median peers, the average spread

rose only by eight percent from 169 to 182 bps.

6 Discussion of Results

This section describes our empirical results. We begin with a detailed analysis of the unconditional spillover effect of sovereign to corporate credit risk in Section 6.1. We discuss various robustness tests and alternative specifications in Section 6.2. Section 6.3 focuses on the cross-sectional results across countries, discussing the differential effects for Eurozone and distressed countries. Section 6.4 investigates the role of property rights.

6.1 SOVEREIGN TO CORPORATE CREDIT RISK SPILLOVERS

Our main hypothesis suggests a risk transfer from sovereigns to the corporate sector, measured by an increased interdependence in their respective CDS spreads following the Greek bailout. Estimation results for the simple difference specification, outlined in equation 1, are reported in Panel A of Table 3. Columns 1 and 2 include only observations from the pre-bailout period. Prior to April 11, there is no statistically significant relationship between corporate and sovereign entities. The regression coefficient on the domestic sovereign CDS has the expected positive sign, but is statistically insignificant. This model captures approximately 32 to 34 percent of the variation in corporate CDS spread changes.

In contrast, the relationship between corporate and sovereign CDS becomes positive and statistically significant in the period after the bailout, as demonstrated in columns 3 and 4. A one percent increase in the sovereign CDS is associated, on average, with a 0.11 percent increase in credit risk for domestic corporations after the bailout, which is economically significant, as the following simple calculation shows: The mean sovereign CDS spread increases from the pre-bailout period to the post-bailout period by 67 per-

cent. Following the previously mentioned estimate, this leads to an increase in the average corporate spread in Europe of 12.9 bps ($161bps \times 67\% \times 0.11$).[22] Putting it differently, a one standard deviation increase in sovereign CDS (0.071) increases corporate CDS by 0.14 standard deviations ($(0.11 \times 0.071)/0.058 = 0.14$, see Table 1). Also, the explanatory power of the benchmark model increases to 60 percent in the post-event period. All model specifications include daily time fixed effects, thereby controlling for the influence of any common macroeconomic or financial factors. In addition, the result is robust against controlling for any unobservable and time-invariant firm-specific characteristics. Including company fixed effects does not significantly influence the magnitude of the regression's coefficient of interest. In the following robustness section, we will further show that controlling for time-varying firm or country-specific variables does not alter our results.

Finally, columns 5 and 6 highlight the spillover effects of sovereign risk shocks following the bailout. In a regression for the full sample period, we interact the sovereign credit risk proxy with an indicator variable marking the period after April 11, as indicated in equation 1. The difference estimator suggests that a ten percent increase in domestic sovereign credit risk would raise corporate credit risk approximately by an additional one percent percent after the bailout. The unexpected shock to sovereign credit risk across Europe spills over to corporations and introduces an interdependence between sovereign and corporate credit risk that was non-existent in the pre-bailout period. The effect is statistically significant at the one percent level.[23]

Through most of our analysis, we use CDS spreads as a measure of both sovereign and corporate credit risk. We have verified our results using log changes in sovereign bond yield spreads. As expected, we find a greater magnitude of the spillover effect if we base our test

[22]The effect is more pronounced if we consider corporations in other distressed countries separately. In Portugal, for example, the mean sovereign CDS increases by 105 percent. According to our model, this leads to an increase in corporate credit risk of 14.1 bps.

[23]In unreported results, we find that the standard errors *decrease* if we cluster at the country dimension, and so statistical significance increases.

on sovereign bond data, as is reported in Panel B of Table 3. The estimated coefficient is now 0.16, which is statistically significant and which has a larger economic significance than the result we obtain based on CDS spreads. Finally, we show that our results are robust when we collapse the corporate credit risk information to a single representative firm in each country. Table A-1 in the internet appendix examines the increase in co-movement between the average corporate CDS spread in each country and its corresponding sovereign CDS spread. The estimated coefficient is 0.11, thus similar in magnitude, and also highly statistically significant.

6.2 ROBUSTNESS AND ALTERNATIVE SPECIFICATIONS

Our objective is to capture spillover effects from a shock to sovereign credit risk. We have provided strong empirical evidence that the Greek bailout represents a *sudden* shift in the perception of sovereign risk of *all* countries, underscored by the unprecedented rupture of the no bail-out clause embedded in the Maastricht Treaty. This explanation is supported by a theoretical mechanism described in Benzoni et al. (2015). In this section, we attempt to rule out that our effects are not endogenously determined by deteriorating firm or country fundamentals, and that they are not influenced by direct cross-country spillover effects or direct exposure to Greece.

Returning to our benchmark specification with, we now add further control variables to the model, individually and jointly, with the results shown in Table 4. Among these are company-specific bid-ask spreads for CDS contracts, country-specific equity index returns, a foreign exposure measure with respect to other European countries, as well as company-specific stock returns.[24]

[24]In unreported estimations, we also include the variance of country-specific equity index returns to additionally account for country-specific volatility. All results remain unchanged.

Given the extraordinary nature of the sample period of interest, one could argue that the documented spillover effects to corporate credit risk may arise because of an increased illiquidity of CDS contracts. We proxy for liquidity as the percentage change in a company's bid-ask spread.[25] There exists a positive relationship between corporate CDS spreads and their corresponding bid-ask spreads after April 11. Accounting for illiquidity, however, has no impact on the estimate of sovereign CDS, neither for the pre-bailout period in column 1, nor for the post-bailout period in column 5. Second, we control for the domestic equity index return in order to tease out any residual relationship between the financial sector and sovereign credit risk. This also controls for the possibility that the relationship between sovereign and corporate credit risk may counterfactually arise because of deteriorating macroeconomic fundamentals. As can be seen in columns 2 and 6, our regression coefficient of interest changes only marginally in magnitude and remains statistically significant. A one percent higher sovereign CDS raises corporate credit risk by 0.09 percent after the bailout. The effect of the domestic stock market return is highly significant and has the expected negative sign throughout the whole sample period.

Third, as we explicitly focus on within-country spillover effects from domestic sovereign to corporate credit risk, we control for the cross-country spillover effects that may arise through companies' exposure to other sovereigns. More specifically, we construct a foreign-country exposure measure for each corporation as the GDP-weighted average of all other countries' CDS spreads in the sample, excluding that of the domestic country itself. This helps to mitigate the concern that our findings are impacted by regional spillover effects. Again, controlling for cross-country exposure does not have any impact on the estimate of interest, as shown in columns 3 and 7. Adding all control variables simultaneously leads to a similar result. Also the difference estimator of equation 1 remains statistically significant

[25]We have verified that there was no general drop in CDS trading liquidity around our event date using the publicly available data on gross and net notional amounts of CDS outstanding from the Depository Trust and Clearing Corporation. Data is available for all countries in our sample, except for Norway and Switzerland.

and of similar magnitude after taking all previously discussed control variables into account.

Fourth, we provide additional evidence that the effect is truly the result of a shock to the sovereign government of a country's headquarter location rather than of a direct exposure to Greece. If this were the case, we would expect to observe differential effects for companies in countries that are comparatively more exposed to Greece. We compute the exposure of each country to Greece based on consolidated foreign claims vis-à-vis Greece on an ultimate risk basis by nationality of reporting banks. This data is publicly available from the BIS. The falsification test is based on a difference-in-difference regression for which we interact a Greek exposure variable with both the percentage changes in sovereign CDS spreads and the shock indicator variable. We show results for two specifications: for the first one, *Greek Exposure* is defined to be one for countries with an exposure to Greece above that of the median country in the sample, and zero otherwise. For the second one, *Greek Exposure* is defined to be one for the three countries that are the most exposed to Greece (France, Ireland, and Portugal), and zero for the three countries that are the least exposed (Italy, Spain, and Sweden). The results, which we report in Table A-2 in the internet appendix show that all coefficients on the triple interaction term are insignificant and small in magnitude, suggesting that differential exposure to Greece is insufficient to explain the post-bail-out interdependence between sovereign and corporate credit risk. This suggests that our documented effect is a within-country risk transmission.

Next, we control in Table A-3 for each company's stock return to rule out that our result is not counterfactually driven by endogenously deteriorating fundamentals. A classical Merton model predicts that equity returns should be sufficient to locally capture the company's debt returns (see also Acharya, Drechsler and Schnabl (2014) on this point). Thus, if the difference estimator remains unaffected by the inclusion of the stock return as a control variable, then this should provide strong support for the empirical evidence of a sovereign to corporate risk spillover in response to the unanticipated change in the

perception of sovereign credit risk. The results reported in columns 5 and 6 are consistent with the view that stock returns are insufficient to fully capture the return variation in corporate CDS spreads. The difference estimator remains highly statistically significant with a value of 0.09 and a regression R^2 of 47%. Another possibility is to control for company-specific characteristics that vary at a lower frequency than stock returns, such as firm size, corporate ratings, and leverage. Given our identification strategy that uses a short window around the event, information on company characteristics that usually varies only at a quarterly frequency is already accounted for by the firm fixed effects, which effectively control for time-invariant firm characteristics. Finally, in unreported results, we test our results using only investment-grade companies. The coefficients are of similar magnitude, and significant at the 5% significance level.

We focus in our analysis on a short period around the announcement of the Greek bailout to avoid picking up other news that entered the market during the turbulent European sovereign debt crisis. While we have defined a pre-event and a post-event period, one may argue that the true post-bailout period is after May 2, 2010, the date when the final support package to Greece was officially approved. Thus, we verify our results using a different sample cut, for which we define the bailout period as the three weeks in between the bailout announcement on April 11 and the official approval of the bailout on May 2. This period is marked with substantial uncertainty about the actual size and implementation of the Greek bailout. In addition, we define the post-bailout period as the eight weeks after the official approval of the bailout from May 2 to June 25, 2010. The results, which are reported in Table A-4 of the internet appendix, show that there is a gradual increase in the interdependence between sovereign and corporate credit risk. In Panel A, in which we examine the bailout period (from April 11 to May 2), the difference estimator increases to a value of 0.05. This demonstrates an immediate greater interdependence between corporate and sovereign credit risk, although the effect is insignificant. In Panel B, on the other hand,

in which we compare two balanced sample periods using a cleaner definition of the pre- and post-bailout periods, the difference estimator has a greater magnitude, i.e. 0.12, and it is statistically significant at the one percent level.

6.3 DIFFERENTIAL EFFECTS FOR EUROZONE MEMBERS AND DISTRESSED COUNTRIES

The EU is an economically integrated region. The formal violation of the no-bailout clause and the financial lifeline offered to Greece immediately increased the probability of further bailouts of other distressed sovereigns. The costs of such bailouts must ultimately be shared among the member states. It is plausible, though, that countries sharing the common currency will be hit harder. The inability to use monetary policy and currency depreciation imposes additional restrictions on members of the Eurozone. In that spirit, we test hypothesis H2, which conjectures that the spillover of the sovereign risk shocks will be comparatively greater for companies in the Eurozone.

Therefore, we include an additional cross-sectional dimension in our empirical model, as outlined in equation 2. We begin with an indicator variable marking whether the company is headquartered within the Eurozone area. Columns 1 and 2 in Table 5 provide empirical support to the stated hypothesis. Companies in the Eurozone are comparatively more sensitive to changes in the domestic CDS spread after April 11. The difference is statistically significant at the one percent level. A one percent increase in sovereign risk increases borrowing costs by 0.06 percent more for companies in Eurozone countries than companies in non-Eurozone countries after April 11. Continuing with an even finer separation of the Eurozone, we divide the sample into crisis and non-crisis countries. We define as crisis countries the (G)IIPS states, excluding Greece as it is the epicenter of the shock we are looking at. Thus, we can test whether the previous cross-sectional results for the Eurozone

can largely be attributed to Italy, Ireland, Portugal and Spain, or to the other countries in the Eurozone. The results are reported in columns 3 to 6 of Table 5. In line with a contagion/"wake-up call" interpretation of sovereign risk spillovers, we find that the result is stronger in the crisis countries, which we compare to non-crisis countries *outside* the Eurozone, in which a one percent increase in sovereign risk increases corporate credit risk by 0.10 percent. This estimate is statistically significant at the one percent level. The magnitude of the effect can be compared to an increase of 0.02 percent for the non-crisis countries in the Eurozone. This increase, however, is not significant. In particular the results for the Eurozone countries underscore that monetary union membership reduces a country's flexibility for adjustment which may make its corporate sector more vulnerable to unexpected sovereign risk shocks.

6.4 THE ROLE OF PROPERTY RIGHTS

Hypothesis H4 conjectures that a sovereign risk shock impacts corporate credit risk to a greater extent in countries with weaker property rights, because the corporate sector in such countries faces a higher likelihood of government expropriation. Table 6 confirms this conjecture. The coefficient of the triple interaction in column 1 implies that a one percent increase in domestic sovereign CDS translates into a spillover to corporate credit risk that is approximately 0.34 percent smaller for a country with the highest property rights score (Netherlands: 0.9) compared to a country at the 25th percentile of the property rights indicator (Belgium 0.8). This effect is statistically significant at 5% level.[26]

[26]While the role of property rights is conceptually appealing, we do point out that there is some overlap with the group of crisis countries. The additional countries are Belgium and France.

7 Cross-sectional Tests at the Firm Level

Despite our identification design, stringent control variables and robustness tests, one may still be concerned that our effect could be impacted by an unobserved factor that is correlated with both sovereign and corporate credit risk. In order to further mitigate concerns that an omitted variable is responsible for the direct relationship between sovereign and corporate credit risk, we examine three additional cross-sectional relationships at the firm level that should more granularly capture the monotonic relationship between both sides. First, we investigate whether greater public ownership positively predicts greater corporate distress. Second, if the effect of sovereign on corporate credit risk is channeled through the financial sector, then we should observe a greater impact on companies that are more financially dependent. Third, the sovereign ceiling rule suggests that companies should not be able to borrow at better rates than the government of the country in which they are incorporated.[27] Therefore, companies closer to the ceiling should be more vulnerable to a sovereign credit risk shock.

7.1 PUBLIC OWNERSHIP

Our first test relates to the shareholder structure of non-financial companies. Governments are often major shareholders in companies that are deemed to be of strategic relevance. If a sovereign government experiences a negative shock, then we would expect this shock to be reflected relatively more in the credit risk of those companies that are characterized through a large public ownership. This explanation would be consistent with a public-to-private risk transfer, as documented for financial companies by, among others, Acharya, Drechsler and Schnabl (2014). For non-financial companies, one may also expect a reduction in implicit

[27]Note that this is a "soft" rule that companies can violate, i.e. they can break the sovereign ceiling, if they have a greater asset exposure to countries with better property rights or with more stringent disclosure requirements (Lee et al. (2013)).

subsidies and support provided to those companies that are of strategic relevance to the government.

> *H5: Higher sovereign credit risk raises corporate credit risk more for companies with a greater public ownership.*

We capture public ownership through an indicator that takes on the value one if the government of a company's headquarter holds an equity stake that is larger than 5% of the company's market capitalization, and zero otherwise. We find in our sample 34 (201) companies with public ownership exceeding (below) 5%. The results are presented in Table 7. The results in columns 1 and 2 support our conjecture with a statistically significant difference at the 5% level between companies with a high and a low public ownership. The magnitude of the coefficient suggests that a one percent increase in sovereign credit risk increases the corporate credit risk of companies with a high public ownership by 0.07 percent more after the bailout than that of companies with a low public ownership. The statistically significant spillover effect associated with the public ownership indicator indicates that the public ownership channel contains information above that captured by time-invariant firm characteristics.

7.2 FINANCIAL DEPENDENCE

The second test builds on an established literature showing that a deteriorating health in the financial sector is followed by a reduction in bank credit supply. Ivashina and Scharfstein (2010) document a greater reduction in bank lending during the recent financial crisis for those companies that suffered larger financial losses. Santos (2011) and Bord and Santos (2014) show that loan spreads increased more for less healthy banks. Similarly, Campello et al. (2010) show that firm's corporate policies are more adversely affected if they are more

financially dependent. While this evidence relates to the United States, similar evidence is available in the context of the European sovereign debt crisis. Using syndicated loan data, Popov and Horen (2013) document a greater contraction in bank credit supply for non-GIIPS countries that were more heavily exposed to GIIPS government bonds, while Acharya, Eisert, Eufinger and Hirsch (2014) show that firms exposed to affected banks had lower employment growth, capital expenditures and sales growth. This effect could potentially be amplified through financial repression, which implies a crowding out effect of corporate lending as governments "nudge" banks to purchase more sovereign debt (Becker and Ivashina (2014b)).[28] We test for the bank-lending channel through the following hypothesis:

> *H6: Higher sovereign credit risk raises corporate credit risk more for companies which are more financially dependent.*

We construct a measure of financial dependence as the ratio of total bank loans to total liabilities for each firm. The average (median) ratio of total bank loans to total liabilities is 11.5% (5.4%), and ranges between 0% and 100%, as we show in Table A-5 in the internet appendix. We classify firms into high and low financial dependence based on the median level of financial dependence, and create a financial dependence dummy that takes on the value one if a firm has a ratio of total bank loans to liabilities that is higher than that of the median firm in the sample. The results in column 1 of Table 8 suggest that a one percent increase in domestic sovereign credit risk increases corporate credit risk on average by 0.064 percent more for companies that are more financially dependent, after the bailout, compared to those that are below the median level of financial dependence. The coefficient is statistically significant at the 5% level. In column 2, we further include firm fixed effects.

[28] Becker and Ivashina (2014a) argue that firms could substitute bond financing for bank loans as an alternative source of funding. Such an explanation is less relevant in our case as we look at the relationship between sovereign and corporate credit risk around the window *immediately* surrounding the Greek bailout.

Both the statistical significance and the economic magnitude does not change.

As an alternative measure of financial dependence, we classify countries based on the importance of their banking system. In other words, we compare countries based on their culture of bank financing. Following Levine (2002), we use the ratio of the aggregate value of all bank deposits extended by banks to the private sector in each country to the corresponding stock market capitalization.[29] A ratio above one indicates that the financial system is bank based. Table A-5 in the internet appendix suggests that the average measure of bank-based financial systems is 1.783, with a median of 1.550. The results in columns 3 and 4 of Table 8 confirm that the sovereign risk spillovers are indeed stronger the greater the size of the banking sector relative to the country's stock market capitalization. The coefficient of 0.050 is of similar magnitude to the estimate obtained from a classification of financial dependence at the firm level, and it remains statistically significant at the 5% level.

7.3 SOVEREIGN CEILING

Our last hypothesis relates to the sovereign ceiling rule, which suggests that firms' credit ratings are bound from above by the rating of their government. Accordingly, corporate borrowing costs should be bound from below by the borrowing costs of their government. Almeida et al. (2014) provide support for the existence of sovereign ceilings by showing that companies with ratings close to the one of their government reduce investment and net debt issuance relatively more following a sovereign downgrade than other similar firms that are rated below the sovereign. In addition, bond yields of firms close to the sovereign ceiling increase comparatively more. In a similar spirit, we conjecture that firms with a

[29] We use data on countries' financial structure for the year 2010, downloaded from the Financial Structure Database published by the World Bank. Robustness tests using data for 2005, or using the average across multiple years, does not change the results.

CDS spread above (but close to) that of the sovereign are affected relatively more from the external shock than firms that are less bound by the sovereign ceiling.

> *H7: Higher sovereign credit risk raises corporate credit risk more for companies whose CDS spread is closer to that of the sovereign (from above).*

To test this hypothesis, we compute, for each company before the event date, the difference between the average corporate CDS spread and the average spread of their corresponding sovereign, and we label the measure *CorpSovDiff*.[30] The test is based on a dummy variable that takes on the value one for the first quartile of companies that have the closest spread to that of their respective sovereign, and zero otherwise. We expect that a shock to sovereign risk has a greater negative effect on those firms whose credit risk is more closely tied to that of their sovereign. Columns 1 and 2 in Table 9 shows evidence in favor of our conjecture. Indeed, the results suggest that a one percent increase in domestic sovereign credit risk leads to an increase of corporate credit risk that is 0.072 percent higher after the shock for those companies whose CDS spreads are close to that of their sovereign (from above) compared to other companies. This effect is statistically significant at the 5% level. Including firm fixed effects to the model specification does not change our estimates in any meaningful way.

As a robustness test, we also verify the sovereign ceiling hypothesis based on credit ratings. Thus, we conjecture that sovereign to corporate risk spillovers are stronger for companies with ratings close to the one of their corresponding government. We classify companies into the sovereign ceiling treatment group if their credit rating is equal to or one category below that of their sovereign counterpart. We use the Standard & Poor's long-

[30] We eliminate all observations for which the average corporate CDS spread is below that of the corresponding sovereign. Lee et al. (2013) show that these firms are able to decouple from their sovereign as they have a substantial fraction of their assets exposed to countries with better property rights and with more stringent disclosure requirements. This eliminates 56 firms from the sample. The results are, however, robust if we keep all firms in the sample.

term issuer credit ratings for corporate companies from the ECB Centralised Securities Database. For sovereigns, we use the foreign currency long-term credit rating from Fitch Ratings. The results, which we have reported in columns 3 and 4 of Table 9, confirm that the sovereign ceiling can have negative externalities for corporate credit risk in the presence of unexpected shocks to sovereign credit risk. The estimated coefficient, 0.107, is similar to the one obtained using a classification of the sovereign ceiling treatment and control groups based on the pre-event difference between sovereign and corporate spreads. In addition, the statistical significance is stronger and valid at the one percent level.

8 Conclusion

We provide empirical evidence that a sudden and unexpected shock to the perception of a government's financial viability can induce negative externalities on its private sector by increasing the credit risk of domestic corporations, which is typically associated with higher funding costs. To identify spillover effects from sovereign to corporate credit risk, we use the Greek bailout as a negative exogenous shock to the credit risk of *all* governments within the EU. This event drastically increased economic uncertainty and raised the public perception of the likelihood of future default contingencies.

The quantitative effects are economically meaningful. We find strong evidence in favor of increased interdependence after the bailout, a ten percent increase in sovereign credit risk raising corporate credit risk, on average, by 1.1 percent after the shock. Cross-sectionally, this effect is comparatively stronger for countries within the common currency union, suggesting that the importance of fiscal responsibility is relatively greater for countries that are bound by a common currency. Moreover, firms in countries that were more harshly affected by the sovereign debt crisis and in countries with weaker property rights face a larger rise in corporate credit risk. Additionally, we show that companies with a large pub-

lic ownership base, that rely comparatively more on bank financing, and whose borrowing costs are more closely tied to that of their sovereign, are more negatively affected by the increase in sovereign credit risk.

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Figure 1: Sovereign CDS of Greece

Figure 1 plots the Greek bid-ask spread (in basis points) on the right axis against the Greek CDS spread (in basis points) on the left axis. The solid vertical line in the graph marks our event date, April 11, 2010. The dashed vertical line refers to May 2, 2010, the day that the Greek bailout package was finalized. The sample period spans from February 15, 2010 to June 25, 2010. Source: CMA Datavision.

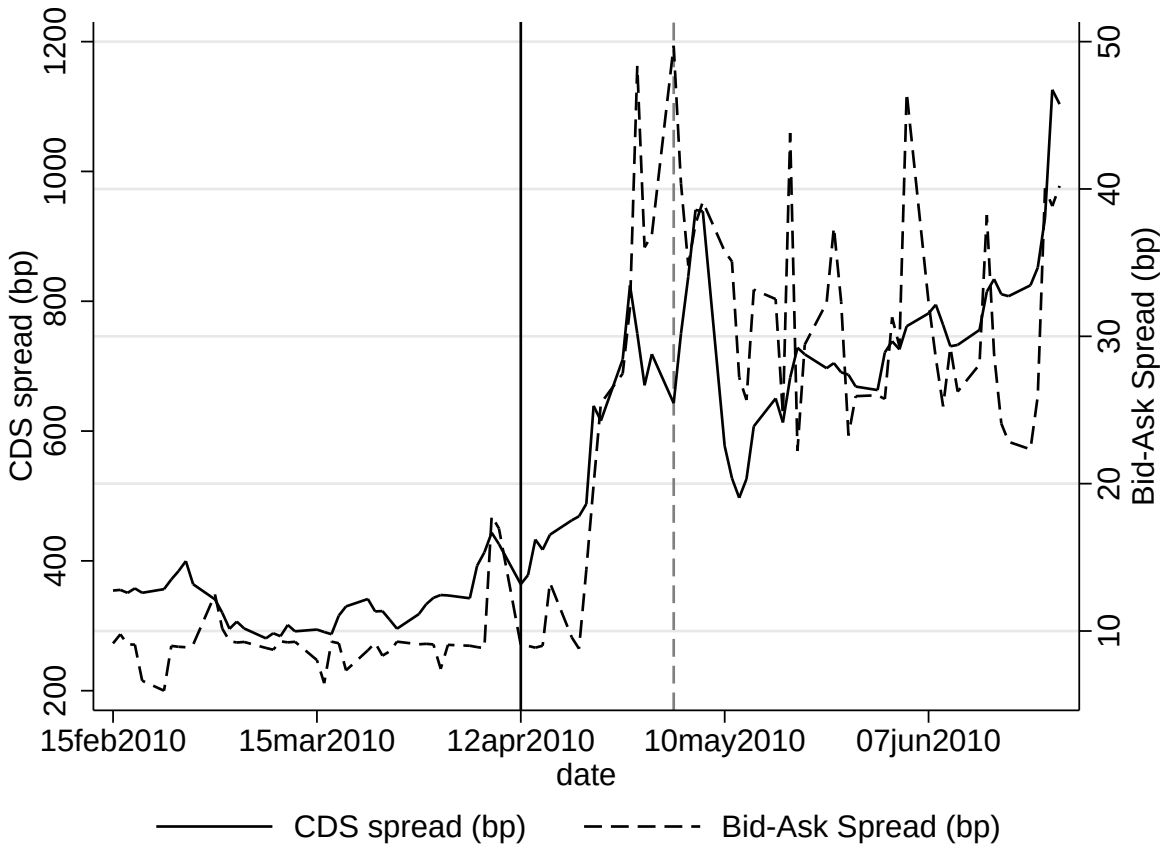

Figure 2: Timeline of Events

This figure summarizes the milestones of the Greek bailout over the period from February 11, 2010 to May 9, 2010.

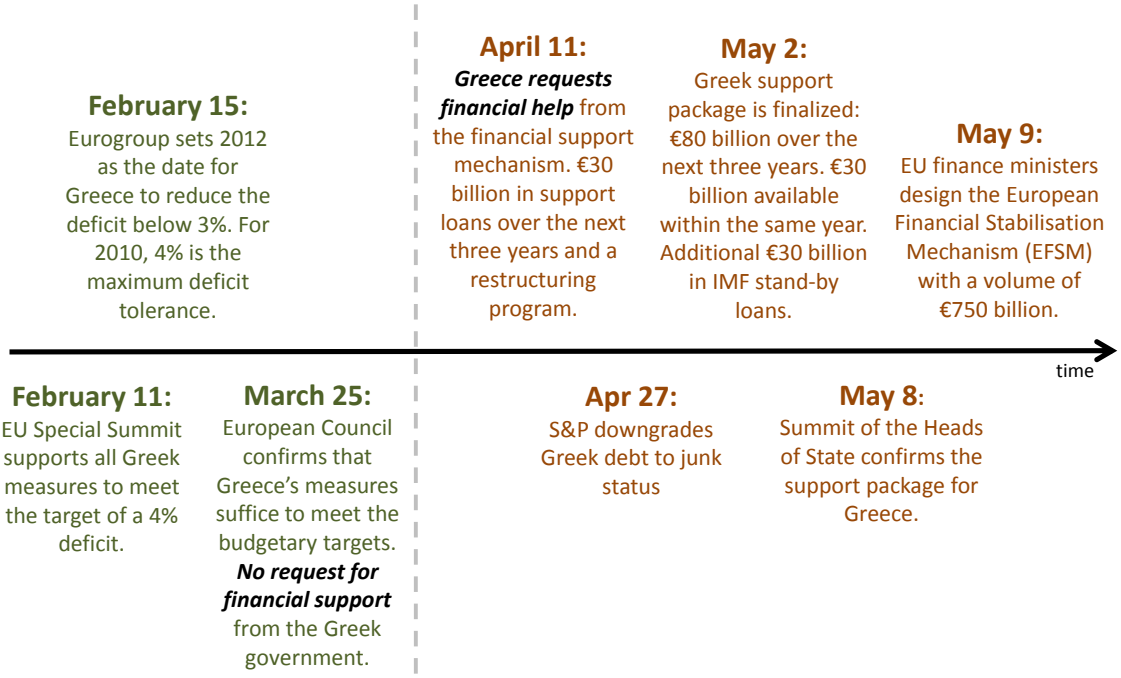

Figure 3: Google Trend Search

This graph plots the search intensity on the internet-based search platform Google for the keywords "Greek bailout," "Greek debt," and "Euro crisis," over the time period from January 2007 to January 2011. Google does not disclose the absolute number of hits for searches, but rather a relative search intensity over time. Source: Google.

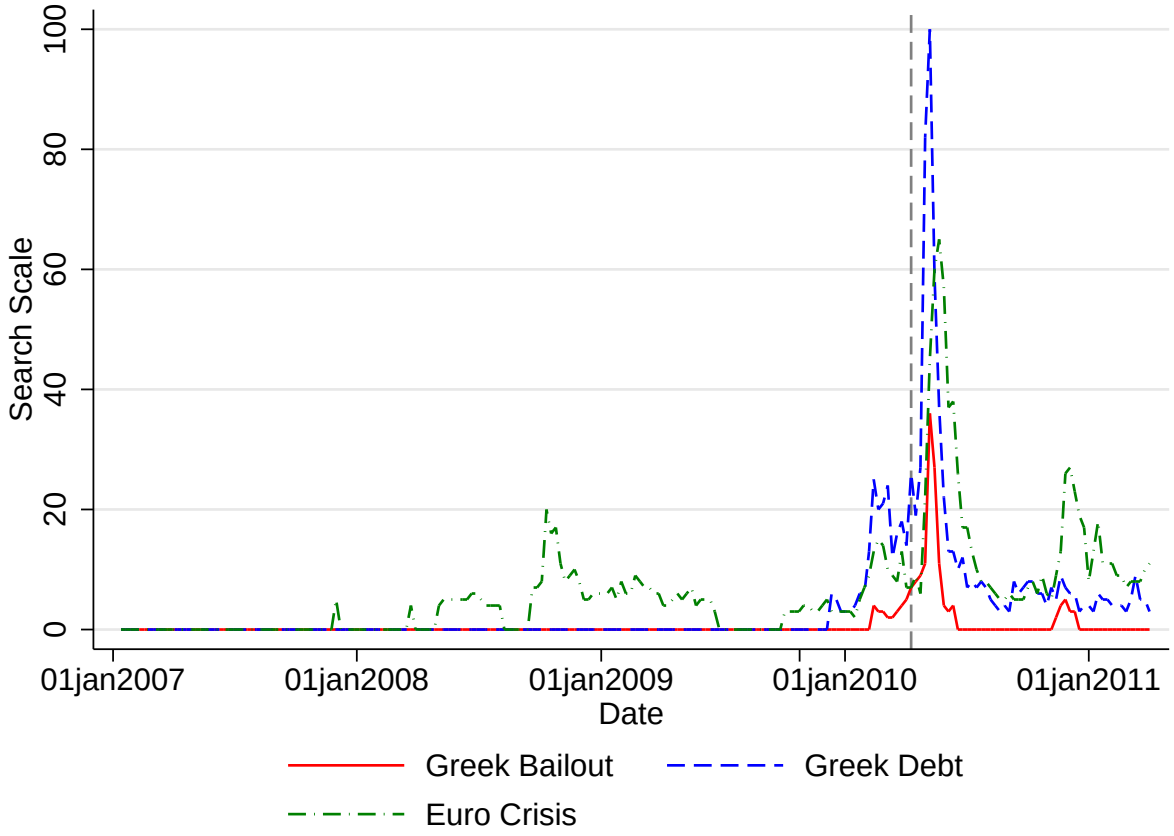

Figure 4: Sovereign CDS

Figure 4 plots the evolution of an average European sovereign CDS spread against that of the US CDS spread. The European index includes all countries in our sample, except Greece. We standardize each CDS spread by its corresponding level on February 15, 2010, and we plot the evolution as an index level, expressed as a percentage relative to the respective starting value. The solid vertical line in the graph marks our event date, April 11, 2010. The dashed vertical line refers to May 2, 2010, the day that the Greek bailout package was finalized. The sample period spans from February 15, 2010 to June 25, 2010. Source: CMA Datavision.

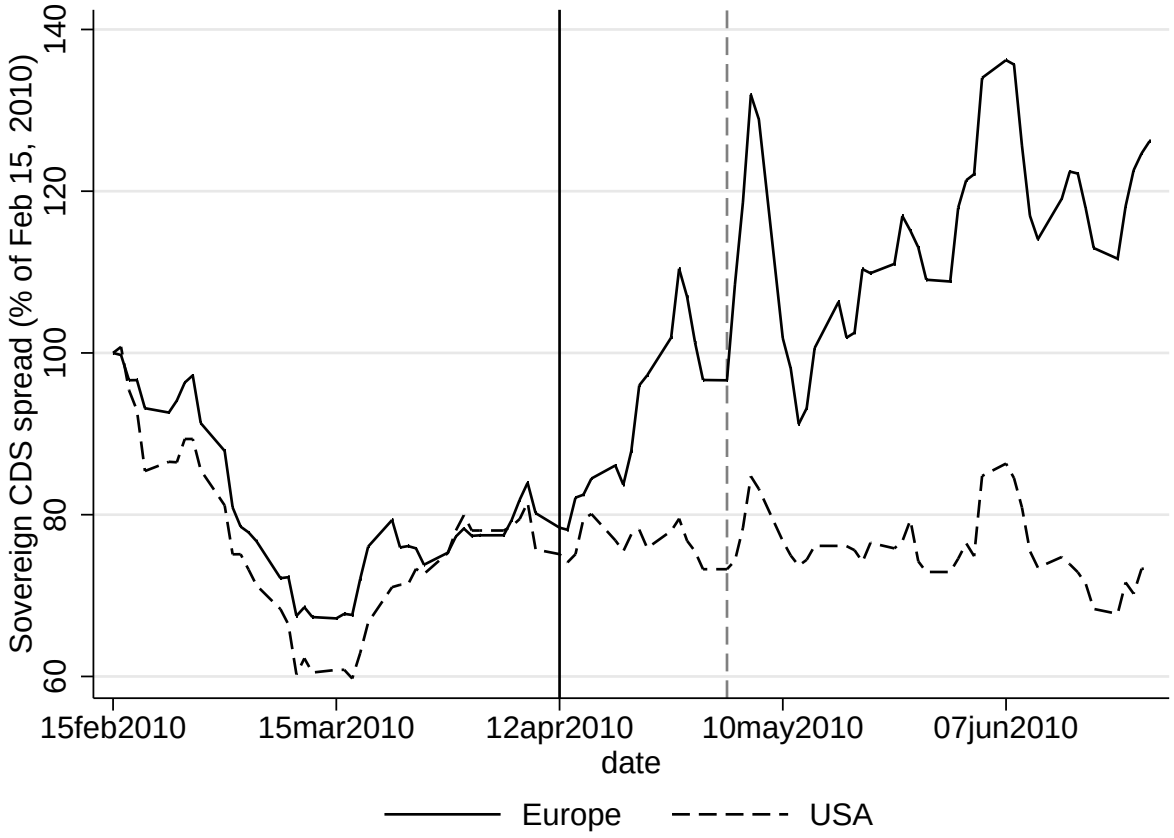

Table 1: Country Summary Statistics for CDS Spreads

This table provides basic summary statistics (in basis points) of daily CDS spreads for corporate and sovereign reference entities in Panels A and B, respectively, broken down by country over two different time periods. We report the mean (*mean*), the standard deviation (*sd*), the minimum (*min*), the maximum (*max*) and the number of observations (*obs*). Also, log changes for all observations are listed for both panels in the rows titled *Delta*. The last column, with the header *N*, reports the number of companies in Panel A, and the number of countries for each line in Panel B. The pre-bailout period stretches from the start of the sample on February 15, 2010 to the Greek bailout on April 11, 2010. The post-bailout period refers to the time after the event, up to the end of the sample period on June 25, 2010. Source: CMA Datavision.

	Pre-Bailout					Post-Bailout					
	mean	sd	min	max	obs	mean	sd	min	max	obs	**N**
Panel A: Corporate CDS Spreads											
Austria	118	35	73	165	80	139	37	85	215	110	2
Belgium	81	24	53	115	80	92	26	53	135	110	2
Denmark	109	37	61	198	160	147	75	60	342	220	4
Finland	272	249	46	925	240	248	206	45	755	330	6
France	135	120	42	700	1520	160	141	43	820	2090	38
Germany	194	216	40	1253	1480	211	211	41	1065	2035	38
Ireland	271	17	250	320	40	270	15	249	316	55	1
Italy	153	118	49	437	360	207	149	48	644	495	9
Netherlands	179	272	35	1482	720	185	260	36	1322	990	19
Norway	390	476	48	1324	120	443	544	47	1475	165	3
Portugal	122	14	90	157	120	206	45	122	307	165	3
Spain	161	129	38	612	440	232	172	39	837	605	11
Sweden	146	192	45	932	560	150	186	49	916	770	14
Switzerland	84	51	17	213	440	109	98	19	595	605	11
UnitedKingdom	155	198	17	1670	2680	168	176	19	1233	3685	67
Total	161	195	17	1670	9040	181	193	19	1475	12430	226
Delta	-0.003	0.029	-0.883	0.414		0.006	0.058	-0.603	0.651		
Panel B: Sovereign CDS Spreads											
Austria	62	11	49	85	40	76	13	56	110	55	1
Belgium	58	8	46	72	40	100	25	56	144	55	1
Denmark	35	4	29	42	40	42	4	32	51	55	1
Finland	26	4	21	34	40	29	4	23	36	55	1
France	48	8	36	62	40	73	13	48	100	55	1
Germany	34	6	26	45	40	43	6	29	60	55	1
Greece	337	41	281	443	40	697	162	364	1126	55	1
Ireland	137	15	115	166	40	220	43	142	285	55	1
Italy	111	14	90	136	40	171	37	123	245	55	1
Netherlands	36	4	30	44	40	45	6	33	56	55	1
Norway	17	1	15	19	40	22	3	17	29	55	1
Portugal	144	23	112	193	40	295	66	152	461	55	1
Spain	115	15	92	142	40	207	43	125	275	55	1
Sweden	37	5	32	47	40	39	3	33	45	55	1
Switzerland	41	5	34	55	40	51	5	43	62	55	1
UnitedKingdom	79	7	68	93	40	81	6	71	100	55	1
Total	82	78	15	443	640	137	171	17	1126	880	16
Delta	-0.005	0.044	-0.157	0.185		0.008	0.071	-0.543	0.329		

Table 2: Summary Statistics for Corporate CDS Spreads in the Country Cross-Sections

This table provides basic summary statistics (in basis points) of daily CDS spreads for corporate reference entities, categorized according to the cross-sectional tests at the country level we conduct in this paper. We report the mean (*mean*), the standard deviation (*sd*), the minimum (*min*), the maximum (*max*) and the number of observations (*obs*). The statistics are reported separately for the periods before and after the event, on April 11, 2010. The first two rows report summary statistics for countries inside and outside the Eurozone. The third and fourth rows separate the statistics for the (G)IIPS and non-(G)IIPS countries inside the Eurozone. (G)IIPS stands for Greece, Italy, Ireland, Portugal, and Spain. The parentheses around G are there to emphasize that Greece is omitted from the group. The last two rows report sample statistics for those corporations headquartered in a country whose property rights score is above the median value against those in countries with a below-median property rights score. The sample period spans from February 15, 2010 to June 25, 2010. The pre-bailout period stretches from the start of the sample on February 15, 2010 to the Greek bailout on April 11, 2010. The post-bailout period refers to the time after the event up to the end of the sample period on June 25, 2010. Source: CMA Datavision, The Heritage Foundation, Bureau Van Dijk Amadeus, World Bank, Fitch Ratings, Standard & Poor's, ECB Centralised Securities Database.

	Pre-Bailout					Post-Bailout				
	mean	sd	min	max	obs	mean	sd	min	max	obs
Euro country	168	187	35	1482	5080	192	189	36	1322	6858
$non - Euro\ country$	151	203	17	1670	3960	166	197	19	1475	5346
$(G)IIPS$	158	117	38	612	960	221	150	39	837	1320
$non - (G)IIPS$	171	200	35	1482	4120	186	196	36	1322	5665
High Property Rights (*above median*)	169	217	17	1670	6520	182	208	19	1475	8965
Low Property Rights (*below median*)	140	118	38	700	2520	179	147	39	837	3465

Table 3: Sovereign and Corporate Credit Risk

Panel A in this table reports the results from regressing the log changes in the corporate CDS spreads of company i in country j, $\Delta log\left(CDS^{c}_{i,j,t}\right)$, on log changes in the sovereign CDS spread of the same country $\Delta log\left(CDS^{s}_{j,t}\right)$. Panel B in this table reports the results from regressing the log changes in the corporate CDS spreads of company i in country j, $\Delta log\left(CDS^{c}_{i,j,t}\right)$, on log changes in 5-year sovereign yields of the same country $\Delta log\left(BY^{s}_{j,t}\right)$. The first two columns include only observations before the event date (April 11, 2010), whereas columns 3 and 4 only include observations after the event date. The last two columns include all the observations and report the difference estimator. *Post* is a dummy variable that takes the value one after the event, and zero otherwise. The sample period goes from February 15, 2010 to June 25, 2010. Standard errors are double clustered by firm (Cluster Firm) and time (Cluster Time). Each column indicates whether the regression contains time (Time FE) and firm fixed effects (Firm FE). Source: CMA Datavision.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Pre-Bailout	Pre-Bailout	Post-Bailout	Post-Bailout	Difference	Difference
Panel A: Sovereign CDS Spreads						
Post*Sov CDS					0.094***	0.098***
					(0.036)	(0.038)
Sovereign CDS (%)	0.016	0.014	0.111***	0.109***	0.016	0.012
	(0.014)	(0.014)	(0.037)	(0.039)	(0.014)	(0.014)
Observations	9,040	9,040	12,430	12,430	21,470	21,470
R-squared	0.3246	0.3431	0.5988	0.6066	0.5592	0.5647
-	-	-	-	-	-	-
Time FE	YES	YES	YES	YES	YES	YES
Firm FE	NO	YES	NO	YES	NO	YES
-	-	-	-	-	-	-
Cluster Time	YES	YES	YES	YES	YES	YES
Cluster Firm	YES	YES	YES	YES	YES	YES
Panel B: Sovereign Yield Spreads						
Post*Sov yield					0.161***	0.155**
					(0.059)	(0.061)
Sov yield (%)	0.008	0.013	0.168***	0.163**	0.008	0.008
	(0.012)	(0.012)	(0.062)	(0.065)	(0.012)	(0.012)
Observations	9,040	9,040	12,430	12,430	21,470	21,470
R-squared	0.3244	0.3430	0.5994	0.6070	0.5597	0.5651
-	-	-	-	-	-	-
Time FE	YES	YES	YES	YES	YES	YES
Firm FE	NO	YES	NO	YES	NO	YES
-	-	-	-	-	-	-
Cluster Time	YES	YES	YES	YES	YES	YES
Cluster Firm	YES	YES	YES	YES	YES	YES

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

Table 4: Controlling for Liquidity, Equity Index Returns and Foreign Country Exposures

This table reports the results from regressing the log changes in the corporate CDS spreads of company i in country j, $\Delta log\left(CDS^{c}_{i,j,t}\right)$, on log changes in the sovereign CDS spread of the same country j, $\Delta log\left(CDS^{s}_{j,t}\right)$. *Post* is a dummy variable that takes the value one after the event (April 11, 2010) and zero otherwise. We control for liquidity effects using changes in the CDS bid-ask spreads (Bid-Ask Spread), for the relationship with the domestic stock market using the daily equity index returns (Daily Equity Index), and for foreign (European) country exposure using the GDP-weighted changes of sovereign CDS spreads of all other European countries $\neq j$. The sample period goes from February 15, 2010 to June 25, 2010. Standard errors are double-clustered by firm (Cluster Firm) and time (Cluster Time). Each column indicates whether the regression contains time (Time FE) and firm fixed effects (Firm FE). Source: CMA Datavision, MSCI.

VARIABLES	(1) Pre-Bailout	(2) Pre-Bailout	(3) Pre-Bailout	(4) Pre-Bailout	(5) Post-Bailout	(6) Post-Bailout	(7) Post-Bailout	(8) Post-Bailout	(9) Difference
Post*Sov CDS									0.085***
									(0.031)
Sovereign CDS (%)	0.014	0.013	0.017	0.016	0.108***	0.091***	0.137**	0.115**	0.027
	(0.014)	(0.014)	(0.023)	(0.023)	(0.039)	(0.029)	(0.062)	(0.050)	(0.030)
Bid-Ask Spread (%)	-0.001			-0.001	0.032***			0.032***	0.020***
	(0.005)			(0.005)	(0.005)			(0.005)	(0.004)
Daily Equity Index (%)		-0.089		-0.089		-0.406***		-0.403***	-0.343***
		(0.083)		(0.083)		(0.135)		(0.134)	(0.120)
Foreign Exposure (%)			0.033	0.027			0.229	0.200	0.149
			(0.186)	(0.182)			(0.274)	(0.242)	(0.207)
Observations	9,040	9,040	9,040	9,040	12,430	12,430	12,430	12,430	21,470
R-squared	0.3431	0.3432	0.3431	0.3432	0.6162	0.6089	0.6067	0.6187	0.5715
-	-	-	-	-	-	-	-	-	-
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
-	-	-	-	-	-	-	-	-	-
Cluster Time	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster Firm	YES	YES	YES	YES	YES	YES	YES	YES	YES

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

Table 5: Euro versus non-Euro and Crisis versus Non-Crisis Countries

This table reports the results from a difference-in-difference regression where we test whether the credit risk of companies situated in the Eurozone member countries is more adversely affected than the credit risk of companies outside the Eurozone. The table also reports the results from a difference-in-difference regression where we test whether the credit risk of companies situated in the crisis countries excluding Greece (Italy, Ireland, Portugal, Spain) is more adversely affected than the credit risk of companies outside the Eurozone. *Post* is a dummy variable that takes the value one after the event date (April 11, 2010), and zero otherwise. *Euro Country* is a dummy variable that takes the value one if a country is a member of the Eurozone, and zero otherwise. *(G)IIPS* is a dummy variable that takes the value one for crisis countries, i.e., the (G)IIPS countries (Italy, Ireland, Portugal, Spain), and zero for non-crisis countries outside the Eurozone. *Non-(G)IIPS* is a dummy variable that takes the value one for non-crisis countries in the Eurozone, and zero for non-crisis countries outside the Eurozone. The sample period goes from February 15, 2010 to June 25, 2010. Standard errors are double-clustered by firm (Cluster Firm) and time (Cluster Time). Each column indicates whether the regression contains time (Time FE) and firm fixed effects (Firm FE). Source: CMA Datavision.

VARIABLES	(1) Euro	(2) Euro	(3) (G)IIPS	(4) (G)IIPS	(5) Non-(G)IIPS	(6) Non-(G)IIPS
Euro*Post*Sov CDS	0.060**	0.060**				
	(0.025)	(0.025)				
(G)IIPS*Post*Sov CDS			0.104***	0.103***		
			(0.039)	(0.039)		
Non-(G)IIPS*Post*Sov CDS					0.023	0.023
					(0.019)	(0.019)
Euro * Sov CDS	0.052***	0.051***				
	(0.019)	(0.019)				
(G)IIPS * Sov CDS			0.096**	0.096**		
			(0.041)	(0.042)		
Non-(G)IIPS * Sov CDS					0.042**	0.042**
					(0.018)	(0.018)
Euro * Post	-0.000	-0.000				
	(0.001)	(0.001)				
(G)IIPS * Post			-0.000	-0.000		
			(0.002)	(0.002)		
Non-(G)IIPS * Post					-0.000	-0.000
					(0.001)	(0.001)
Post*Sov CDS	0.039	0.042	-0.023	-0.022	0.024	0.026
	(0.030)	(0.030)	(0.022)	(0.022)	(0.029)	(0.029)
Sovereign CDS (%)	-0.026	-0.030	0.010	0.009	-0.035	-0.036
	(0.019)	(0.020)	(0.014)	(0.013)	(0.022)	(0.022)
Euro-country	0.000					
	(0.001)					
(G)IIPS			0.002**			
			(0.001)			
Non-(G)IIPS					-0.000	
					(0.001)	
Observations	21,470	21,470	11,685	11,685	19,190	19,190
R-squared	0.5618	0.5673	0.5440	0.5493	0.5636	0.5691
-	-	-	-	-	-	-
Time FE	YES	YES	YES	YES	YES	YES
Firm FE	NO	YES	NO	YES	NO	YES
-	-	-	-	-	-	-
Cluster Time	YES	YES	YES	YES	YES	YES
Cluster Firm	YES	YES	YES	YES	YES	YES

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Property Rights

This table reports the results from a difference-in-difference regression where we test whether the credit risk of companies in countries with worse property rights is more adversely affected than the credit risk of companies in countries with better property rights. *Post* is a dummy variable that takes the value one after the event date (April 11, 2010), and zero otherwise. A country's property rights score is indicated through the variable *PropertyRights*, which is sourced from the Heritage Foundation. The property rights score is rescaled to be between zero and one. The sample period goes from February 15, 2010 to June 25, 2010. Standard errors are double clustered by firm (Cluster Firm) and time (Cluster Time). Each column indicates whether the regression contains time (Time FE) and firm fixed effects (Firm FE). Source: CMA Datavision and the Heritage Foundation.

	(1)	(2)
VARIABLES	Non-Financial	Non-Financial
PropertyRights*Shock*Sov CDS	-0.335***	-0.329***
	(0.126)	(0.127)
Property Rights * Sov CDS	-0.252**	-0.255**
	(0.126)	(0.127)
Property Rights * Shock	-0.002	-0.002
	(0.005)	(0.005)
Shock*Sov CDS	0.323***	0.319***
	(0.110)	(0.110)
Sovereign CDS (%)	0.225**	0.226**
	(0.111)	(0.112)
PropertyRights	-0.007*	
	(0.004)	
Observations	21,470	21,470
R-squared	0.5648	0.5699
-	-	-
Time FE	YES	YES
Firm FE	NO	YES
-	-	-
Cluster Time	YES	YES
Cluster Firm	YES	YES

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

Table 7: Public Ownership

This table reports results from a difference-in-difference regression based on cross-sectional variation in government stock ownership. *Post* is a dummy variable that takes the value one after the event date (April 11, 2010), and zero otherwise. *Pub Own* is a dummy variable that indicates whether the government of a company's headquarter holds an equity stake that is larger than 5% of the companys's market capitalization. We extract information on major shareholders from the Bureau van Dijk's Amadeus database and manually verify the public ownership data. The sample period goes from February 15, 2010 to June 25, 2010. Standard errors are double clustered by firm (Cluster Firm) and time (Cluster Time). Each column indicates whether the regression contains time (Time FE) and firm fixed effects (Firm FE). Source: CMA Datavision and Bureau van Dijk.

	(1)	(2)
VARIABLES	Non-Financial	Non-Financial
Pub Own*Post*Sov CDS	0.066*	0.064*
	(0.035)	(0.035)
Pub Own * Sov CDS	-0.001	0.001
	(0.027)	(0.027)
Pub Own * Post	0.000	-0.001
	(0.001)	(0.001)
Post*Sov CDS	0.082**	0.086**
	(0.035)	(0.037)
Sovereign CDS (%)	0.016	0.012
	(0.015)	(0.015)
PublicOwnership	0.000	
	(0.000)	
Observations	21,470	21,470
R-squared	0.5598	0.5653
-	-	-
Time FE	YES	YES
Firm FE	NO	YES
-	-	-
Cluster Time	YES	YES
Cluster Firm	YES	YES

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

Table 8: Financial Dependence

This table reports results from a difference-in-difference regression based on cross-sectional variation in firms' dependence on the financial sector. *Post* is a dummy variable that takes the value one after the event date (April 11, 2010), and zero otherwise. *Findep* is a dummy variable that is equal to 1 for firms that have a ratio of total bank loans to total liabilities above that of the median firm in the sample. *Bank Based* is a dummy variable indicating the relative importance of the size of the banking sector to the stock market capitalization in each country. We follow Levine (2002) and divide the value of all bank deposits extended by banks to the private sector by the stock market capitalization in each country in order to have a measure of bank-based financial systems. The variable *Bank Based* takes the value one if the ratio is above one and zero otherwise. The sample period goes from February 15, 2010 to June 25, 2010. Standard errors are double clustered by firm (Cluster Firm) and time (Cluster Time). Each column indicates whether the regression contains time (Time FE) and firm fixed effects (Firm FE). Source: CMA Datavision and Bureau van Dijk, World bank.

	(1)	(2)	(3)	(4)
VARIABLES	Non-Financial	Non-Financial	Non-Financial	Non-Financial
Findep*Post*Sov CDS	0.064**	0.063**		
	-0.027	-0.027		
Bank based*Post*Sov CDS			0.050**	0.051**
			(0.025)	(0.025)
Findep * Sov CDS	0.001	0.001		
	(0.019)	(0.019)		
Bank based * Sov CDS			0.014	0.013
			(0.023)	(0.022)
Findep * Post	-0.001	-0.001		
	(0.001)	(0.001)		
Bank based * Post			-0.001	-0.001
			(0.001)	(0.001)
Post*Sov CDS	0.059*	0.062*	0.048*	0.050*
	(0.034)	(0.035)	(0.028)	(0.029)
Sovereign CDS (%)	0.019	0.016	0.005	0.002
	(0.014)	(0.014)	(0.019)	-0.02
Findep	0.000			
	(0.000)			
Bank based			0.001**	
			(0.001)	
Observations	20,425	20,425	21,470	21,470
R-squared	0.5746	0.5791	0.5596	0.5651
-	-	-	-	-
Time FE	YES	YES	YES	YES
Firm FE	NO	YES	NO	YES
-	-	-	-	-
Cluster Time	YES	YES	YES	YES
Cluster Firm	YES	YES	YES	YES

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

Table 9: Sovereign Ceiling

This table reports results from a difference-in-difference regression based on cross-sectional variation in the difference between corporate and sovereign CDS. *Post* is a dummy variable that takes the value one after the event date (April 11, 2010), and zero otherwise. We classify firms based on the average difference between corporate and sovereign CDS spreads before the event date, after removing those companies whose average CDS spread before the bailout is lower than that of its sovereign. *CorpSovDiff* is a dummy variable that takes on the value one if the corporate CDS is equal or close (from above) to that of its sovereign and zero otherwise. More precisely, the cut-off level is the 25th percentile of the distribution. As an alternative, we classify firms based on their rating relative to that of their corresponding sovereign. We use the Standard & Poor's long-term issuer credit ratings for corporate companies from the ECB Centralised Securities Database. For sovereigns, we use the foreign currency long-term credit rating from Fitch Ratings. *CorpSovDiffRating* is a dummy variable that takes on the value one if a company has a credit rating equal to or one category below that of its corresponding sovereign. The sample period goes from February 15, 2010 to June 25, 2010. Standard errors are double clustered by firm (Cluster Firm) and time (Cluster Time). Each column indicates whether the regression contains time (Time FE) and firm fixed effects (Firm FE). Source: CMA Datavision, Fitch Ratings, ECB Centralised Securities Database.

	(1)	(2)	(3)	(4)
VARIABLES	Non-Financial	Non-Financial	Non-Financial	Non-Financial
CorpSovDiff*Post*Sov CDS	0.072**	0.071**		
	(0.032)	(0.033)		
CorpSovDiffRating*Post*Sov CDS			0.107***	0.108***
			(0.033)	(0.033)
CorpSovDiff*Sov CDS	-0.037	-0.036		
	(0.023)	(0.023)		
CorpSovDiffRating*Sov CDS			-0.023	-0.022
			(0.045)	(0.046)
CorpSovDiff*Post	-0.001	-0.001		
	(0.001)	(0.001)		
CorpSovDiffRating*Post			0.003	0.003
			(0.003)	(0.003)
Sov CDS * Post	0.012	0.014	0.053*	0.054*
	(0.028)	(0.028)	(0.029)	(0.030)
Sov CDS	0.009	0.006	0.031*	0.029
	(0.018)	(0.020)	(0.018)	(0.018)
CorpSovDiff	0.001			
	(0.001)			
CorpSovDiffRating			0.001	
			(0.001)	
Observations	16,150	16,150	14,060	14,060
R-squared	0.5953	0.5995	0.5880	0.5924
-	-	-	-	-
Time FE	YES	YES	YES	YES
Firm FE	NO	YES	NO	YES
-	-	-	-	-
Cluster Time	YES	YES	YES	YES
Cluster Firm	YES	YES	YES	YES

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

Internet Appendix

Sovereign to Corporate Risk Spillovers

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Abstract

We document significant spillover effects from sovereign to corporate credit risk using the announcement of the first Greek bailout on April 11, 2010, which represents an unexpected shift in the perception of sovereign risk of *all* European countries. A ten percent increase in sovereign credit risk raises corporate credit risk on average by 1.1 percent after the bailout. These effects are more pronounced in countries that belong to the Eurozone, that are more financially distressed and that have weaker property rights. Financial dependence, public ownership and the sovereign ceiling are channels that enhance the sovereign to corporate risk transfer.

Table A-1: Sovereign and Corporate Credit Risk - Country Averages

This table reports the results from regressing the log changes in the average corporate CDS spread of company i in country j, $\Delta log\left(CDS^{c}_{i,j,t}\right)$, on log changes in the sovereign CDS spread of the same country $\Delta log\left(CDS^{s}_{j,t}\right)$. The first two columns include only observations before the event date (April 11, 2010), whereas columns 3 and 4 only include observations after the event date. The last two columns include all the observations and report the difference estimator. *Post* is a dummy variable that takes the value one after the event, and zero otherwise. The sample period goes from February 15, 2010 to June 25, 2010. Standard errors are double clustered by firm (Cluster Country) and time (Cluster Time). Each column indicates whether the regression contains time (Time FE) and country fixed effects (Firm FE). Source: CMA Datavision.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Pre-Bailout	Pre-Bailout	Post-Bailout	Post-Bailout	Difference	Difference
Post*Sov CDS					0.114***	0.116***
					(0.031)	(0.034)
Sovereign CDS (%)	0.017	0.015	0.131***	0.131***	0.017	0.015
	(0.031)	(0.031)	(0.048)	(0.048)	(0.031)	(0.031)
Observations	600	600	825	825	1,425	1,425
R-squared	0.7002	0.7094	0.8848	0.8873	0.8657	0.8681
-	-	-	-	-	-	-
Time FE	YES	YES	YES	YES	YES	YES
Country FE	NO	YES	NO	YES	NO	YES
-	-	-	-	-	-	-
Cluster Time	YES	YES	YES	YES	YES	YES
Cluster Country	YES	YES	YES	YES	YES	YES

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A-2: Greek Exposure

This table reports results from a difference-in-difference regression based on cross-sectional variation in countries' exposure to Greece, where the dependent variable is the log change in the corporate CDS spreads of company i in country j, $\Delta log\left(CDS^{c}_{i,j,t}\right)$, and *Sov CDS* defines the change in the sovereign CDS spread of the same country, $\Delta log\left(CDS^{s}_{j,t}\right)$. *Post* is a dummy variable that takes the value one after the event date (April 11, 2010), and zero otherwise. *Greek Exposure* is a dummy variable indicating the relative exposure of a country to Greece based on consolidated foreign claims vis-à-vis Greece on an ultimate risk basis by nationality of reporting banks. For columns 1 and 2, *Greek Exposure* is defined to be one for countries with an exposure to Greece above that of the median country in the sample, and zero otherwise. For columns 3 and 4, *Greek Exposure* is defined to be one for the three countries that are the most exposed to Greece (France, Ireland, and Portugal), and zero for the three countries that are the least exposed (Italy, Spain, and Sweden). The sample period goes from February 15, 2010 to June 25, 2010. Standard errors are double clustered by firm (Cluster Firm) and time (Cluster Time). Each column indicates whether the regression contains time (Time FE) and firm fixed effects (Firm FE). Source: CMA Datavision, Bank for International Settlements.

VARIABLES	(1) Non-Financial	(2) Non-Financial	(3) Non-Financial	(4) Non-Financial
Greek Exposure*Post*Sov CDS	-0.035	-0.037	-0.073	-0.078
	(0.029)	(0.030)	(0.053)	(0.054)
Greek Exposure * Sov CDS	0.037**	0.039**	0.029	0.035
	(0.018)	(0.018)	(0.031)	(0.031)
Greek Exposure * Post	-0.001	-0.001	-0.000	-0.000
	(0.001)	(0.001)	(0.002)	(0.002)
Post*Sov CDS	0.119***	0.122***	0.149***	0.163***
	(0.043)	(0.044)	(0.053)	(0.053)
Sovereign CDS (%)	0.000	-0.006	0.064	0.048
	(0.020)	(0.019)	(0.040)	(0.038)
Greek Exposure Countries (median)	-0.000			
	(0.001)			
Greek Exposure Countries (high)			-0.001	
			(0.001)	
Observations	20,235	20,235	7,220	7,220
R-squared	0.5542	0.5597	0.6004	0.6036
-	-	-	-	-
Time FE	YES	YES	YES	YES
Firm FE	NO	YES	NO	YES
-	-	-	-	-
Cluster Time	YES	YES	YES	YES
Cluster Firm	YES	YES	YES	YES

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

Table A-3: Controlling for Stock Returns

This table reports the results from regressing the log changes in the corporate CDS spreads of company i in country j, $\Delta log\left(CDS^{c}_{i,j,t}\right)$, on log changes in the sovereign CDS spread of the same country j, $\Delta log\left(CDS^{s}_{j,t}\right)$. *Post* is a dummy variable that takes the value one after the event (April 11, 2010) and zero otherwise. $StockRet(\%)$ measures each company's stock return. The sample period goes from February 15, 2010 to June 25, 2010. Standard errors are double-clustered by firm (Cluster Firm) and time (Cluster Time). Each column indicates whether the regression contains time (Time FE) and firm fixed effects (Firm FE). Source: MARKIT.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Pre-Bailout	Pre-Bailout	Post-Bailout	Post-Bailout	Difference	Difference
Post*Sov CDS					0.093**	0.093**
					(0.037)	(0.038)
Sov CDS (%)	0.061***	0.060***	0.153***	0.150***	0.061***	0.058***
	(0.021)	(0.021)	(0.037)	(0.040)	(0.021)	(0.020)
Stock Ret (%)	-0.066***	-0.061**	-0.086	-0.078	-0.078*	-0.075*
	(0.023)	(0.025)	(0.066)	(0.061)	(0.043)	(0.041)
Observations	7,111	7,111	9,772	9,772	16,883	16,883
R-squared	0.4030	0.4164	0.6183	0.6280	0.5930	0.5987
-	-	-	-	-	-	-
Time FE	YES	YES	YES	YES	YES	YES
Firm FE	NO	YES	NO	YES	NO	YES
-	-	-	-	-	-	-
Cluster Time	YES	YES	YES	YES	YES	YES
Cluster Firm	YES	YES	YES	YES	YES	YES

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

Table A-4: Pre-bailout, Bailout and Post-Bailout Periods

This table reports the results from regressing the log changes in the corporate CDS spreads of company i in country j, $\Delta log\left(CDS^{c}_{i,j,t}\right)$, on log changes in the sovereign CDS spread of the same country $\Delta log\left(CDS^{s}_{j,t}\right)$. The first two columns include only observations before the event date (April 11, 2010), i.e. the pre-bailout period, whereas columns 3 and 4 only include observations after the event date. In Panel A, we define the bailout period by the three weeks in between the bailout announcement on April 11 and the official approval of the bailout on May 2. This period is marked with substantial policy uncertainty about the actual size of the support to Greece. In Panel B, we define the post-bailout period by the eight weeks after the official approval of the bailout on May 2. In The last two columns include all the observations and report the difference estimator for each specification, respectively. *Post* is a dummy variable that takes the value one after the event, and zero otherwise. The sample period goes from February 15, 2010 to June 25, 2010. Standard errors are double clustered by firm (Cluster Firm) and time (Cluster Time). Each column indicates whether the regression contains time (Time FE) and firm fixed effects (Firm FE). Source: CMA Datavision.

	(1) Pre-Bailout	(2) Pre-Bailout	(3) Post-Bailout	(4) Post-Bailout	(5) Difference	(6) Difference
Panel A: 3 weeks after bailout						
Post*Sov CDS					0.051	0.051
					(0.035)	(0.033)
Sovereign CDS (%)	0.016	0.014	0.068*	0.054**	0.016	0.012
	(0.014)	(0.014)	(0.036)	(0.026)	(0.014)	(0.014)
Observations	9,040	9,040	3,390	3,390	12,430	12,430
R-squared	0.3246	0.3431	0.3921	0.4430	0.3486	0.3640
Panel B: 4-11 weeks after bailout						
Post*Sov CDS					0.116***	0.120***
					(0.033)	(0.035)
Sovereign CDS (%)	0.016	0.014	0.132***	0.130***	0.016	0.011
	(0.014)	(0.014)	(0.035)	(0.038)	(0.014)	(0.015)
Observations	9,040	9,040	9,040	9,040	18,080	18,080
R-squared	0.3246	0.3431	0.5800	0.5909	0.5446	0.5512
-	-	-	-	-	-	-
Time FE	YES	YES	YES	YES	YES	YES
Firm FE	NO	YES	NO	YES	NO	YES
-	-	-	-	-	-	-
Cluster Time	YES	YES	YES	YES	YES	YES
Cluster Firm	YES	YES	YES	YES	YES	YES

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

Table A-5: Summary Statistics for Cross-sectional Sorting Variables

This table reports summary statistics for several cross-sectional sorting variables. *Bank loan/ Total liability* is the ratio of total bank loans to total liabilities as of 2009. The data on bank loans and total liabilities is sourced from Bureau van Dijk's Amadeus database. *Bank size/stock market* is the ratio of the aggregate value of all bank deposits extended by banks to the private sector in each country to the corresponding stock market capitalization. The data on countries' financial structure for the year 2010 is downloaded from the Financial Structure Database published by the World Bank. *Corp_sov_diff* is the distribution of the average difference between corporate and sovereign CDS spreads before the event date, after removing those companies whose average CDS spread before the bailout is lower than that of its sovereign. *Corp_sov_diff_rating* reports the distribution of the difference in credit ratings between sovereigns and corporate firms. We use the Standard & Poor's long-term issuer credit ratings for corporate companies from the ECB Centralised Securities Database. For sovereigns, we use the foreign currency long-term credit rating from Fitch Ratings.

	(1)	(2)	(3)	(4)	(5)
Variables	*Mean*	*Std*	*Min*	*Median*	*Max*
Bank Loan/ Total Liability	0.115	0.204	0.000	0.054	1.000
Bank size/stock market	1.783	0.938	0.674	1.550	3.804
Corp_sov_diff	110.468	164.552	0.035	65.324	955.010
Corp_sov_diff_rating	7.587	3.310	1.000	7.000	16.000