Risk-sensitive Basel regulations and firms' access to credit: Direct and indirect effects *

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Abstract

This paper examines the impact of risk-sensitive Basel regulations on debt financing of firms around the world and investigates how firms cope with the impact through adjustments to their financing sources and capital investments. We find that the implementation of Basel II regulations is associated with reduced credit availability and higher cost of debt, particularly for lower-rated firms. Such firms mitigate the shortage in bank credit through increased reliance on accounts payables, lower payouts to shareholders, and reduction in their capital investments in the post-Basel II period. The results are robust to alternative estimations that control for credit supply shocks and the inclusion of loan-level information. The findings of this paper substantially contribute to the understanding of the real effects of risk-sensitive bank capital regulations.

Keywords: Basel regulations; Real effects; Credit risk; Trade credit; Credit rating

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1. Introduction

Credit risk-sensitive capital requirements are a key feature of bank capital regulations prescribed by the Basel norms. Unlike Basel I norms, where capital requirements were independent of credit risk for corporate lending, Basel II norms prescribed differential risk weights based on borrowers' credit risk (BCBS, 2006). The Basel III regulations, introduced to strengthen the Basel II norms (BCBS, 2011), retained the credit risk-sensitive approach framed under Basel II to determine the capital charges for banks (BCBS, 2006, 2011). The credit risk-sensitive approach introduced by Basel II required banks around the world to estimate their capital requirements for corporate lending based on borrower-specific credit risk. The risk-sensitive capital requirements for banks associated with corporate lending are determined with the help of either external credit ratings (standardized approach) or ratings assessed by an internal rating model (IRB approach).[1] The risk weights under the standardized approach have resulted in substantial changes in capital requirements across credit rating categories. In this study, we quantify the impact of the introduction of risk-sensitive Basel regulations on credit flows to the real sector and identify a range of firm-level responses across developed and emerging economies.

Anecdotal evidence suggests that banks have advised their clients to be prepared for the impact of risk-sensitive Basel norms on credit availability. An advisory issued by J.P. Morgan on Basel norms exhorted their clients to maintain a better risk profile to ensure greater access to bank products, including corporate loans.[2] Firms have also alerted their shareholders about the likely adverse impact of the risk-sensitive Basel norms on credit availability. For instance, an energy firm, Noble Energy, wrote in its 2013 Annual Report "As a result, traditional lending practices could change, resulting in more restricted access to funds or reduced availability of funds at rates and terms we consider to be economic. Increased regulation could also negatively impact the project finance market, even for investment grade companies such as we are, and

[1] Under the internal rating based approach, banks are allowed to compute risk weights based on internally generated credit risk parameters.

[2] The advisory issued by J.P. Morgan in February 2014 can be accessed from https://www.jpmorgan.com/global/jpmorgan/investbk/solutions/banking/cfa/pub

reduce our ability to obtain funding for the capital requirements of future major development projects . . . " (p. 42). In a survey of corporate finance professionals, the US Chamber of Commerce found that on account of the changes in banking regulations, most of the businesses that were surveyed faced difficulty in obtaining financing and nearly one-fifth of the firms delayed or cancelled planned investments.[3] The same survey also revealed that three-fourths of the respondents had a poor outlook about the firms' performance due to the new banking regulations. Underscoring the implications of Basel II regulations for firms, Kashyap and Stein (2004) argue that "if it is expensive for banks to raise and/or hold additional capital, a too-stringent capital requirement will lead to a reduction in bank lending, with the associated underinvestment on the part of those borrowers who are dependent on bank credit."

Research on the impact of Basel II regulations indicates a credit risk driven change in the loan and investment portfolios of banks (Acharya & Steffen, 2015; Demir, Michalski, & Ors, 2017; Gropp, Mosk, Ongena, & Wix, 2018; Hasan, Kim, & Wu, 2015). On bank behaviour, Acharya and Steffen (2015) find that in the period leading up to the Eurozone crisis, undercapitalized banks shifted investments to sovereign bonds with lower capital charges to comply with Basel II norms. Cross-border banking flows are found to be impacted by credit risk-sensitive capital norms. For instance, Hasan et al. (2015) find that bank flows from G-10 countries became more sensitive to rating changes of destination countries on account of Basel II. In Turkey, Basel II implementation led to a decrease in the issuance of letters of credit by banks for counterparties with higher risk (Demir et al., 2017). Gropp et al. (2018) find that European banks that were subjected to higher capital requirements, reduced lending to corporate customers. The studies cited above present evidence of a reallocation of assets by banks on account of risk-sensitive Basel regulations.

Several other interesting research questions emerge in the context of the introduction of risk-sensitive capital regulations for banks. Which kind of firms are the most adversely affected by way of changes in credit flow or interest costs? How have firms addressed the possible change in the credit supply from banks? Did they mitigate the credit shortfall by drawing

[3]The survey report can be accessed from https://www.uschamber.com/sites/default/files/documents/files/financing_growth_report_16_june_16.pdf

incremental trade credit or through increased reliance on internal funds, perhaps secured from lower payouts to shareholders? How do changes in credit flows to firms impact their capital investments in the post-Basel II period? Examining these questions can provide insights into the distributional impact of the implementation of risk-sensitive bank capital charges on firms.

We address the above questions through an analysis of firm-level panel data and contribute to the understanding of the impact of risk-sensitive Basel regulations in the following ways. First, we exploit the cross-sectional variation in firm-level credit ratings to investigate the difference brought about by Basel II implementation in the access to debt financing, especially for lower-rated firms. We also exploit the staggered nature of the implementation of Basel II norms across our sample of 52 countries (see Table A1) to reliably identify their effect on firms' debt financing. The wide cross-section of countries in our sample allows us to examine whether this impact holds after accounting for time-invariant differences in the market structure and institutional environment across countries. Second, we examine whether a possible reduction in access to bank credit is addressed by firms through alternative sources of financing, such as trade credit, especially in the case of the financially-constrained firms. Third, we investigate how changes in the availability of bank credit impact the payout choices of firms, as firms that are adversely affected may try to secure more funds through lower payouts to shareholders. Finally, we analyse whether firms adjust their capital investment intensity in response to the financing constraints arising from changes in bank lending behaviour. A significantly lower capital investment intensity by financially constrained firms in the post-Basel II period would imply that risk-sensitive capital requirements adversely affected investments by firms. To the best of our knowledge, our paper is the first to examine these aspects of firm behaviour as an outcome of the implementation of risk-sensitive bank capital regulations.

The findings of our study suggest that the implementation of risk-sensitive regulations have a significant adverse impact on the flow and the cost of bank credit, particularly for the lower-rated firms. The findings further suggest that firms attempt to counterbalance the changes in bank credit induced by the Basel II implementation through a combination of: (a) higher reliance on trade credit; (b) lower payouts to shareholders; and (c) a reduction in their capital investments. A summary of our key findings and their implications are as follows.

We find that an overall decline in debt financing following the implementation of Basel II regulations across countries masks significant changes in the cross-sectional variation in the flow of credit to firms. First, we employ a difference-in-differences approach to examine the effect of Basel II implementation on the difference in the debt financing between the higher-rated firms (BB- or higher) and lower-rated firms (B+ or lower). We find that while firms with lower credit ratings had no significant difference in their debt financing growth compared to the higher-rated firm in the pre-Basel II period, incremental borrowing by lower-rated firms declines by about 1.34 percent of their assets in the post-Basel II period. Further, we also observe a 34% increase in the impact of credit ratings on incremental borrowing in the post-Basel II period. These results suggest that debt financing by riskier firms, which invite higher capital charges, declined significantly after the implementation of Basel II norms. Second, a difference-in-differences approach reveals that lower-rated firms incur a 46 basis points higher cost of debt relative to the higher-rated firms in the post-Basel II period. We also find a nearly 25% increase in the impact of credit ratings on the interest cost of debt financing for firms in the post-Basel II period. Taken together, the above findings imply that debt financing became more restrictive and costlier for lower-rated firms.

The above findings on the impact of Basel II norms are based on the overall debt financing of firms. In order to better identify the impact of Basel II regulations, we re-examine our key findings with syndicated bank loans as the dependent variable for a subsample of firms that are covered in the Loan Pricing Corporation (LPC) database. The adverse impact on lower-rated firms observed for the LPC subsample is consistent with the findings for the overall sample. Our main findings on the impact of Basel II regulations on firms' debt financing and cost of debt are: (a) robust to inclusion of additional covariates; (b) consistent across subsamples of countries; and (c) significant with controls for banking crises episodes, used as proxies for country-specific credit supply shocks, and for the 2008-09 global financial crisis. Overall, the results on the impact on the debt financing of firms show that risk-sensitive bank capital requirements have adverse distributional consequences on firms as argued earlier (Allen, Chan, Milne, & Thomas, 2012; Diamond & Rajan, 2000).

Third, we find that lower-rated firms have significantly increased their reliance on accounts

payables as a source of credit in the post-Basel II period. Their increased reliance on trade credit could indicate a substitution of bank credit, which was in short supply or became costlier in the post-Basel II period. The results imply that firms with lower credit ratings addressed their shortage of credit from formal channels with trade credit, consistent with findings from earlier episodes of shocks to bank credit supply (Casey & O'Toole, 2014; Ferrando & Mulier, 2013).

Fourth, we find that firms with lower credit ratings, which face adverse distributional impacts of the implementation of Basel II norms, reduce their payouts to shareholders, possibly to maintain their liquidity and capital needs in the post-Basel II period. The findings are consistent with a reduction in payouts that has been documented during other episodes of financing constraints by Bliss, Cheng, and Denis (2015) and Campello, Graham, and Harvey (2010).

Finally, we find that the difference in capital investment intensity between higher-rated and lower-rated firms significantly widened in the post-Basel II period, possibly as a result of the reduced access to credit for lower-rated firms. The impact on capital investments is consistent with the findings of other studies that document a decline in capital expenditure by firms faced with increased financing constraints due to credit supply shocks (Aghion, Angeletos, Banerjee, & Manova, 2010; Chava & Purnanandam, 2011). The findings on the indirect impact of Basel II implementation suggest that firms that are adversely affected by the risk-sensitive Basel II regulations attempt to mitigate the consequence through a combination of increased supplier credit, greater reliance on internal capital, and lower capital investments.

The remainder of the paper is as follows. In the next section, we provide the conceptual background and formulate the hypotheses. Next, we describe the methodology and data employed for our empirical estimations. The subsequent sections discuss the findings and conclusions.

2. Conceptual background and hypotheses

2.1. Risk-sensitive capital requirements and credit supply

The changes in bank lending behaviour associated with capital regulations have been examined in the literature under three different approaches (VanHoose, 2007). In the first approach, banks strive to reach an optimal asset portfolio to meet risk-sensitive capital requirements. The second approach takes into account the attempt by banks to balance the costs of regulatory breach against the expected benefits of certain portfolio decisions. In the third approach, the influence of adverse selection and monitoring costs are accounted for in the asset portfolio decisions of the banks as a result of capital regulations.

The portfolio optimization approach concludes that a value-maximizing bank, facing stringent capital requirements, would reduce the risk of its asset portfolio (Flannery, 1989; Furlong & Keeley, 1989). Rochet (1992) and Kahane (1977) argue that capital regulations can potentially reduce asset risk if the risk weights in the proposed capital ratio are proportional to the market beta of the asset. The bank capital theory of Diamond and Rajan (2000) also emphasizes that binding capital requirements would have distributional consequences across borrowers depending on their creditworthiness. Calem and Rob (1999) suggest a U-shaped relationship between the level of capital and risk appetite of a bank over time. Whereas in the short run, banks would prefer a less risky portfolio so as to preserve capital under binding capital regulations, in the long run, as they accumulate more capital, banks would increase the riskiness of their asset portfolio. Substantiating the role of monitoring costs, Thakor (1996) suggests that more stringent capital requirements would lead to higher credit rationing to borrowers with greater monitoring needs. Cohen and Scatigna (2016) argue that banks could replace riskier loans with safe loans to meet risk-sensitive capital requirements. Overall, the literature on bank behaviour under risk-sensitive capital requirements suggests that minimum capital regulations could lead to a drop in exposure to higher-risk assets, create a preference for lower-risk assets, and increase lending rates for riskier borrowers.

Given the above arguments, the following outcomes are possible on account of Basel II implementation:

(i) Bank may decrease their loan exposure to firms with higher risk and reallocate capital to firms with lower risk to meet risk weighted capital requirements. Hence we hypothesize that:

Hypothesis 1 *Firms with higher (lower) credit risk would have lower (higher) access to debt financing in the post-Basel II period on account of their higher (lower) contribution to risk-weighted capital charge of banks.*

(ii) Banks may increase the pricing of their loans to firms with higher credit risk due to higher capital charges for such firms under Basel II, and may reduce their lending rates for higher-rated firms. Hence we hypothesize that:

Hypothesis 2 *Firms with higher (lower) credit risk would have higher (lower) cost of debt in the post-Basel II period on account of the higher (lower) risk weighted capital charge of banks.*

Given an expected reduction in supply of credit to firms in the post-Basel II period, firms with financing constraints are likely to seek alternative sources of credit. Trade credit is known to serve as a key short-term source of credit (Petersen & Rajan, 1997), especially in the less developed countries (Fisman & Love, 2003). Hence, we examine the possible spillover effects of Basel II implementation on the demand for trade credit.

2.2. Impact on trade credit

Several studies have found that firms address the shortage of external finance, particularly in periods of financial crisis, with suppliers' credit (Casey & O'Toole, 2014; Coulibaly, Sapriza, & Zlate, 2013; Love, Preve, & Sarria-Allende, 2007). For instance, Casey and O'Toole (2014) find that trade credit was the main substitute for bank credit to finance the working capital needs of credit-rationed firms during the European sovereign debt crisis. Ferrando and Mulier (2013) find that firms that face difficulties in raising formal finance turn to trade credit. Coulibaly et al. (2013) show that firms with greater reliance on trade credit in emerging markets were able to better weather the financial crisis of 2008. Love et al. (2007) find that aggregate trade credit

in emerging economies increased immediately after the 2008 global financial crisis. (Shenoy & Williams, 2017) find that when a supplier firm has easier access to bank financing, it has a greater propensity to extend trade credit to its customers. It has been also documented that when a firm is able to obtain cheaper bank financing, the demand for expensive trade credit is lower (Ng, Smith, & Smith, 1999).

Given the evidence of substitution between trade credit and bank credit by firms, a shock to bank lending, such as the introduction of Basel II norms, is likely to impact the dependence on trade credit of firms. In a closely related study, Demir et al. (2017) show that since Basel II implementation, banks in Turkey reduced trade credit sanctioned through letters of credit to trading partners that are based in countries with higher sovereign risk. Hence, we hypothesize that:

Hypothesis 3 *Firms with higher (lower) credit risk would have higher (lower) reliance on trade credit in the post-Basel II period.*

2.3. Impact on payout choices

Firms are known to increase their precautionary cash holdings when faced with uncertainty in financial markets, in an attempt to mitigate an expected contraction of external funding (Bliss et al., 2015; Campello et al., 2010; Sun & Wang, 2015). Several empirical studies find that firms decrease payouts, particularly equity repurchases, in response to credit supply shocks. For instance, Bliss et al. (2015) find that firms that were more likely to encounter a reduction in formal credit supply reduced their payout during the 2008 global financial crisis. Similarly, a reduction in payouts has been observed by Campello et al. (2010) and Sun and Wang (2015) during the 2008 global financial crisis. Therefore, we conjecture that when faced with a credit supply shock, firms are likely to build up their liquidity through lower payouts.

The implementation of risk-sensitive Basel II norms is expected to impact the overall supply of credit and the cost of credit. However, the implementation of Basel II norms is likely to have a strong cross-sectional effect, wherein higher-rated firms would receive credit on more beneficial terms. On the contrary, lower-rated firms would face a more restricted supply of credit. Hence, there is a stronger incentive for financially constrained firms to lower their

payouts in order to maintain their liquidity and investment levels. Therefore, we hypothesize that:

Hypothesis 4 *Firms with higher (lower) credit risk would have a higher (lower) reduction in their payouts in the post-Basel II period.*

2.4. Impact on investment intensity

It is well documented that financial frictions impact the investment activities of firms (Aghion et al., 2010; Campello et al., 2010; Chava & Purnanandam, 2011; Duchin, Ozbas, & Sensoy, 2010; Heid, 2007). Aghion et al. (2010) show that the anticipation of a financing shock reduce firms' investment appetite, especially for long-term investments. Campello et al. (2010) find that credit-constrained firms scaled down their investments during the global financial crisis. Similarly, Duchin et al. (2010) find a decline in corporate investments following the financial crisis of 2008, mostly among firms with low liquidity and those from industries dependent on external finance. Chava and Purnanandam (2011) provide evidence that adverse shocks to banks in the United States during the 1998 Russian debt crisis negatively affected the investments of their borrowers.

The implementation of risk-sensitive Basel II regulations and their predicted impact on the supply of credit or its pricing (VanHoose, 2007), could impact capital investments of firms. Heid (2007) argues that the capital requirements of Basel regulations would negatively affect firms' investments.

If the debt financing options of lower-rated firms have been significantly affected by the implementation of risk-sensitive Basel II regulations, it would adversely impact the capital investments of these firms. Hence we hypothesize that:

Hypothesis 5 *Firms with higher (lower) credit risk would have lower (higher) investment intensity in the post-Basel II period owing to a decrease (increase) in credit supply.*

3. Methodology and Data

3.1. Methodology

We examine the firm-level impact of the implementation of Basel II regulations across both advanced and emerging economies. A cross-country study with firm-level data offers the following advantages. Firstly, as the timeline of Basel II implementation varies across countries, the cross-country data would control for any country-specific events which may coincide with the implementation. Secondly, it would allow us to account for the impact of country-level factors, such as the level of financial development, on firms. Finally, the estimation of the impact across multiple countries would ensure the robustness of our results. The sample includes all the countries that have agreed to implement the Basel II recommendations.

3.1.1. Distributional impact on debt financing and cost of debt

We examine Hypothesis 1 by modelling the annual net debt financing by firms. The dependent variable in the model is the annual net debt financing scaled by total assets of the firm at the beginning of the year. The dependent variable is similar to that used by Berger, Ofek, and Yermack (1997) to analyze the determinants of the debt structure of firms. Accordingly, the estimation equation is given below:

$$\begin{aligned} \Delta Debt\_Asset_{it} = \alpha_0 + \alpha_1 Rating_{it-1} + \alpha_2 Basel\_Dum_j \times Rating_{it-1} + \alpha_3 Basel\_Dum_j \\ + \sum_k X_{i,kt-1} \times \alpha_{4,k} + \sum_l Y_{j,lt-1} \times \alpha_{5,l} + \mu_i + \tau_t + \epsilon_{it} \end{aligned} \tag{1}$$

where $\Delta Debt\_Asset_{it}$ is the incremental debt raised by firm i in the year t scaled by total assets of the firm at the beginning of the year. $Rating_{it-1}$ of the firm i at the beginning of the year t is the issuer credit rating converted to an ordinal scale as described in Table 1. Credit rating is a widely used proxy for credit risk (Alp, 2013; Baghai, Servaes, & Tamayo, 2014). $Basel\_Dum$ is a dummy variable that takes the value 1 for the years after country j has implemented the standardized approach to credit risk specified under Basel II regulations,

and 0 otherwise.[4] X is a set of firm-level controls that can affect the debt financing of firms and Y is a set of country-specific factors that can potentially affect the credit supply to firms, as explained below. The firm fixed-effect μ_i represents time-invariant unobserved firm-specific heterogeneity, which also subsumes the industry and country fixed effects. The year-specific effect τ_t captures all unobserved time-varying common global shocks, including the global financial crisis. All the explanatory variables are lagged by one year to avoid potential endogeneity concerns. In an alternative estimation, we control for $Industry \times Year$ fixed effects, which would account for any industry-specific demand fluctuations over time. We also include an interaction of the financial crisis dummy (for the years 2008-09) with the firm-level credit ratings to account for any possible crisis-induced changes in the sensitivity of debt financing to credit ratings.

As debt financing needs are likely to be impacted by the demand growth faced by a firm, we control for this factor in the estimation. Lagged sales growth and the market-to-book (M/B) ratio are used as proxies for demand growth (see Table 1 for variable definitions). The need for external financing for firms with higher internal cash flows is likely to be lower, therefore, we control for both EBITDA ($EBITDA\_Asset$) and operating cash flows ($Op.CF\_Assets$). We also control for firm size (Log_Sales) as larger firms are known to have easier access to formal sources of financing. As a control for the debt overhang of a firm, we employ the debt to equity ratio ($Leverage$). Finally, we control for the capacity of firms to collateralize their borrowings by including the fixed assets to total assets ratio ($Tangibility$). The above variables are known to affect the capital structure decisions of firms and had been employed commonly in prior empirical research (Baghai et al., 2014; Berger et al., 1997). The vector of country-specific factors (Y) includes GDP growth, private credit to GDP and per capita GDP. The GDP growth rate is a proxy for the overall demand for credit in an economy, the private credit to GDP ratio is an indicator of the development of banking sector, and per capita GDP proxies for the overall economic development of a country (Demirguc-Kunt & Maksimovic, 2001).

While we have employed net debt financing by firms as the dependent variable to capture

[4] Hasan et al. (2015) construct a similar Basel II implementation dummy for their study on cross-border banking.

the impact of Basel II implementation in Equation 1, it is possible that the estimated effect could also reflect changes in financing from non-bank sources. Therefore, in an alternative estimation, we employ yearly syndicated bank loans taken by firms ($Loan\_Asset$) from the Loan Pricing Corporation (LPC) database to better identify the impact of Basel II regulations.

Banks may pass on their incremental capital charge brought about by the risk-sensitive capital requirements to their borrowers, particularly to the lower-rated firms (Hypothesis 2). We estimate the impact of the Basel II regulations on the interest cost of debt. The estimation is analogous to Equation 1 with interest cost of debt as the dependent variable ($Interest\_Cost$). $Interest\_Cost$ is calculated as a percent of the total interest expense incurred by a firm scaled by the total debt in that year.

3.1.2. Impact on trade credit

In order to test Hypothesis 3 on the reliance of firms on trade credit, we employ a model with trade credit (TC) as the dependent variable. TC is defined as either the total accounts payables scaled by assets ($AccPay\_Asset$) or the accounts receivables scaled by sales ($AccRec\_Sales$). These variables have been used in earlier empirical studies on trade credit (Fisman & Love, 2003; Petersen & Rajan, 1997).

We estimate the effects of Basel II regulations on changes in trade credit as follows:

$$\begin{aligned} TC_{it} = \gamma_0 + \gamma_1 Rating_{it-1} + \gamma_2 Basel\_Dum_j \times Rating_{it-1} + \gamma_3 Basel\_Dum_j \\ + \sum_s M_{i,st-1} \times \gamma_{4,s} + \sum_l Y_{j,lt-1} \times \gamma_{5,l} + \mu_i + \tau_t + \epsilon_{it} \end{aligned} \tag{2}$$

where TC_{it} is the scaled value of outstanding trade credit of the firm i in the year t. M includes a range of firm-specific factors that could influence the level of trade credit. Following Petersen and Rajan (1997), we control for firm size as small firms may rely more on trade credit, cash holdings to account for liquidity, sales growth to control for operational shocks faced by a firm, and profitability as a proxy for internal cash generation. We also control for the market share of the firm to account for its bargaining power (Wilner, 2000). In addition, we include Tobin's q to account for the trade credit relationships maintained with suppliers and

customers by firms with higher growth opportunities (Shenoy & Williams, 2017). Leverage is employed as a proxy for financing capacity. Y is a set of country-specific factors employed in the earlier model. Similar to earlier, we use a panel data fixed effects model to estimate the equation and control for year effects.

3.1.3. Impact on payout choices

We test the possible impact of Basel II regulations on the payout to shareholders in the form of dividends and repurchases (Hypothesis 4) with the following empirical approach:

$$\begin{aligned} Total\_Payout_{it} = \delta_0 + \delta_1 Rating_{it-1} + \delta_2 Basel\_Dum_j \times Rating_{it-1} + \delta_3 Basel\_Dum_j \\ + \sum_p N_{i,pt-1} \times \delta_{4,p} + \sum_l Y_{j,lt-1} \times \delta_{5,l} + \mu_i + \tau_t + \epsilon_{it} \end{aligned} \tag{3}$$

where $Total\_Payout_{it}$ refers to the total payout that includes repurchases and dividends of firm i in year t scaled by the net income in year t. N refers to a set of firm-level controls, which are considered as potential determinants of firms' payout policy. Specifically, we employ Tobin's q as a proxy for future growth opportunities (Fama & French, 2001), earnings volatility, leverage and size of the firm (Brav, Graham, Harvey, & Michaely, 2005; Chay & Suh, 2009). The macroeconomic control variables represented by Y are similar to those given in section 3.1.1. The estimation is carried out as a panel data fixed effects model with year fixed effects.

3.1.4. Impact on capital investments

We test the impact of risk-sensitive Basel II regulations on capital investments by firms (Hypothesis 5). The dependent variable that we employ is investment intensity, the total capital expenditure in year t as a percent of the total fixed assets as of the beginning of the year t. The estimation model is as follows:

$$Capex\_Intensity_{it} = \theta_0 + \theta_1 Rating_{it-1} + \theta_2 Basel\_Dum_j + \theta_3 Basel\_Dum_j \times Rating_{it-1} + \sum_r C_{i,rt-1} \times \theta_{4,r} + \sum_l Y_{j,lt-1} \times \theta_{5,l} + \mu_i + \tau_t + \epsilon_{it} \quad (4)$$

where $Capex\_Intensity_{it}$ is the investment intensity of firm i in the current year t. C is a set of firm-level controls that are considered as potential determinants of firm-level investments. The controls are marginal cost of capital (Modigliani & Miller, 1958), proxied by Tobin's q, leverage as a measure of debt overhang (Hennessy, 2004), and cash flows from operations as an indicator of credit constraints (Fazzari, Hubbard, Petersen, Blinder, & Poterba, 1988). We also include other variables that can influence capital expenditure such as firm size and cash holdings (Beck, Demirgüç-Kunt, Laeven, & Maksimovic, 2006; Campello et al., 2010). The macroeconomic control variables represented by Y are similar to those given in section 3.1.1. We use a panel data fixed effects model and control for year effects as earlier.

3.1.5. Difference-in-differences analysis

It is likely that risk-sensitive Basel II regulations may either adversely impact lower-rated firms, for which banks incur higher capital charges, or may favourably impact higher-rated firms, which attract lower capital charges. Hence, we examine the nature of the impact of Basel II implementation on firms with higher and lower ratings through a difference-in-differences analysis between the two groups of firms. A binary variable, HCC_Dum, is employed instead of the continuous variable $Rating$ in the interaction term in each of the specifications above (Equation 1 to Equation 4). The dummy variable HCC_Dum represents firms that incur higher capital charges in the post-Basel II period. Accordingly, the HCC_Dum takes a value of 1 if the credit rating of the firm is B+ or lower and 0 otherwise (BB- to AAA).

3.2. Data

The firm-specific data covers a 23-year period between 1995 and 2017. The sample period spans somewhat equally around the Basel II implementation period. The universe for the study is the set of non-financial firms covered in the Worldscope database across 116 countries.[5] The Worldscope data covers 56,646 unique firms in these countries. Firms are matched with issuer credit ratings obtained from the Thomson Reuters Eikon database, which provides information on Standard & Poor's issuer ratings since 1995. Firm-level credit ratings are available only for a subsample of the universe of firms. After excluding firms without any rating information, we are left with 34,132 firm-year observations representing 3,804 firms. We also exclude: (a) firms from seven countries with less than five firm-year observations; (b) firm-years with missing information on other variables required in the analysis; (c) firm-years with non-rated status; and (d) firm-years where a firm reports negative book value of equity. The final sample of unbalanced panel data has 25,524 firm-years, corresponding to 3,129 unique firms spread across 52 countries. The sample represents about 55% of the overall market capitalization and about 57% of the overall asset size (based on 2017 data) of the universe of non-financial firms covered in Worldscope. Our final sample is comparable to that employed by Almeida, Cunha, Ferreira, and Restrepo (2017) to study the firm-level impact of sovereign rating changes.

The timeline of Basel II implementation in each country is ascertained from the progress updates released by the Bank for International Settlements (BIS) on the implementation of the regulations. The year of the implementation of the standardized approach to credit risk in each of the 52 countries is given in Table A1. Out of the 52 countries, 27 implemented the Basel II regulations before the onset of the 2008 global financial crisis. The table also gives the number of firm-year observations covered in each country, the average credit ratings of the sample firms, and the standard deviation of the ratings. At the aggregate, about 41% of the firm-year observations represent ratings below the investment grade. As indicated by the standard deviation of the credit ratings, we observe a significant cross-sectional variation of ratings within each country, which makes the sample suitable to examine the distributional consequences of risk-sensitive banking regulations.

[5] We omit all the financial firms which are represented by the two-digit SIC code between 60 and 67.

The description of the variables and sources, and the item codes in the corresponding data sources are given in Table 1. The summary statistics of all the variables employed in the study are described in Table 2. The macroeconomic variables (GDP growth rate, private credit to GDP, per capita GDP and bank capital to assets ratio) are obtained from the World Development Indicators of the World Bank and the FRED database of the Federal Reserve Bank of St. Louis. The average real GDP growth rate across the sample countries is 2.42%. We winsorize all the firm-specific variables, except for credit ratings, at the 1^{st} percentile and 99^{th} percentile. The average firm size is $4.7 billion based on total assets and is $3.6 billion based on market capitalization. Across the sample period, the median firm had an annual sales growth of 5.86% and Market-to-Book (M/B) ratio of 2.01. The median firm's annual capital investment is 16% of fixed assets.

The median firm is profitable, cash flow positive and has a cash balance of 6% of assets. However, both on the growth and profitability characteristics, there is a significant variation across the sample, as suggested by the corresponding values at the 10^{th} and the 90^{th} percentile. Nearly a quarter of the earnings of the median firm is paid out as dividends to shareholders and the level of payout rises to nearly half of the earnings when repurchases are included along with the dividends. The sample firms appear to significantly rely on debt financing. The average firm has an annual net debt issuance of 3.2% of assets and a leverage ratio (debt:equity ratio) of 1.02. The average annual interest cost incurred on debt is about 6% per annum. The sample firms also rely on trade credit for financing their operations. For the median firm, accounts payables are about 6.5% of assets. The median firm also extends credit to its customers as indicated in the outstanding accounts receivables of about 15% of sales.

4. Findings and discussion

4.1. Impact on debt financing of firms

Univariate comparison of debt financing ($\Delta Debt\_Asset$) in the pre-and post-Basel II period indicates only a marginal decline (Table 3) in incremental debt financing by firms after Basel II implementation. However, a univariate comparison could mask significant cross-sectional

impact that risk-sensitive Basel II regulations may have on debt financing of firms. The cross-sectional impact of risk-sensitive Basel II regulations is estimated as specified in Equation 1. The baseline estimation results given in Table 4 (column 1) suggest that the dependence of debt financing on credit ratings increases significantly since Basel II implementation. In other words, the sensitivity of debt growth to credit ratings is significantly higher in the post-Basel II period compared to the pre-Basel II period. For instance, the results in column (1) show an increase in the sensitivity of debt financing to ratings of about 34%, from 0.872 (coefficient of $Rating_{t-1}$) to 1.172 (coefficient of $Basel\_Dum \times Rating_{t-1}$), in the post-Basel II period.

As our sample period partially coincides with the global financial crisis (GFC), which had a negative impact on the real sector, we control for the impact of GFC in the estimation of Equation 1 by interacting the global financial crisis dummy with the firm-level credit ratings. The results presented in column (3) account for the effect of GFC on debt financing for the years 2008 and 2009. We observe a 32% increase in the sensitivity of debt financing to credit ratings in the post-Basel II period, consistent with the earlier result even after controlling for the effect of GFC. The increase in the sensitivity of debt financing to credit ratings observed for the sample of 52 sample countries around the Basel II implementation period, even after controlling for other factors known to affect debt financing, suggests that Basel II implementation had a stronger impact on debt financing of firms with lower ratings, which attract higher capital charges for banks.

While we observe an increase in the sensitivity of debt financing to ratings in the post-Basel II period, it is possible that the impact of risk-sensitive regulations may either be adverse for the lower-rated firms or favourable for the higher-rated firms. The results of the difference-in-differences estimation on the impact of Basel II regulations with the HCC_Dum are presented in column (2) of Table 4. The results indicate that relative to the control group (higher-rated firms), firms that attract higher capital charges face significantly lower access to credit in the period following the implementation of Basel II. As indicated by the $HCC\_Dum \times Basel\_Dum$ interaction, debt financing is 1.34 percentage points lower (as a percent of assets) for the group of firms for which banks attract increased capital charges. At the same time, we observe almost no decline in debt financing for firms rated above B+ in the post-Basel II

period (Table 3). The lower growth in debt financing for firms rated below B+ and with the largely unaffected growth of the higher-rated firms imply that the increased sensitivity to ratings revealed by the baseline estimation is driven significantly by a decline in the supply of debt to lower-rated firms. We also re-estimate the above result with control for GFC. While the significant negative impact of GFC is as expected (3.4% lower growth in debt financing), the differential impact of the risk-sensitive regulations on firms that invite higher capital charge is largely unchanged (1.3 percentage points in column (4), similar to the 1.34 percentage points without GFC control). The relatively lower debt growth of the lower-rated cohort presented above is also valid if we re-group the firms according to the commonly employed definition of investment-grade (AAA to BBB-) and speculative-grade (BB+ to SD) in the debt markets.

Overall, the results indicate that the access to debt financing for firms deteriorated, particularly for lower-rated firms, on account of the risk-sensitive bank capital regulations. The findings as discussed above strongly support Hypothesis 1.

A possible concern with the baseline specification is potential endogeneity of the staggered implementation of Basel regulations, particularly for countries that implemented Basel II after the year 2008 (late adopters).[6] If a delay in Basel II implementation is driven by unobservable factors, this may bias our estimates of the effect of Basel regulations on incremental debt financing. In order to address this concern, we conduct placebo tests as employed in earlier studies (Acharya & Xu, 2017; Duchin et al., 2010; Rice & Strahan, 2010). We test the treatment effect on late adopters based on two different placebo implementation years (2007 and 2008). The estimation sample is truncated at the actual Basel II implementation by the late adopters to avoid any confounding effects of the actual implementation on the estimated effects.

The results of the placebo implementation years are given in Table A2. Column (1) shows the effect of actual implementation years on the late adopters of Basel II. In columns (2)-(3), we show the results for the placebo implementation years. We do not observe any significant impact of the treatment effect in the post-implementation period for any of the placebo years.

In addition, we also test the change in sensitivity observed in the post-Basel II period for a placebo treatment, which includes the dot-com bust in 2001, prior to the actual Basel II

[6]The late adopters group comprises 12 countries, including the United States and China.

implementation. The results of the treatment effects for the placebo treatment year (2001) for the sample period 1995-2004 is shown in column (4). Again, we do not observe a significant increase in the sensitivity of debt financing to credit ratings in the post-treatment period.

The results presented so far on the impact of Basel II implementation employs the annual change in debt financing as the dependent variable. However, it is possible that for firms with issuer ratings, bank loans form one of their several sources of debt. For instance, Rauh and Sufi (2010) and Denis and Mihov (2003) show that the most creditworthy firms prefer public debt, the least creditworthy firms prefer non-bank private debt and it is the intermediate group that prefer bank credit. In the following section, we focus exclusively on a subsample of firms that rely on bank debt to improve the identification of the distributional impact of the Basel II implementation.

4.2. Evidence from syndicated bank loans

We identify a subset of firms that have borrowed from banks during the sample period from the data on syndicated loans available from the Loan Pricing Corporation Dealscan database (LPC). We construct a sample of firms that avails syndicated loans (LPC sample) and overlaps with the baseline sample by matching the loan information from the LPC database with firm-level information from the Worldscope database.

The LPC matched sample has 1,844 unique firms across 45 countries. We estimate the total amount of annual borrowings for each firm by adding up the tranches of loans taken by a firm in a year. The average firm in the LPC sample is relatively larger with $4.5 billion in net sales as compared to $3.6 billion for the baseline sample. As compared to the average firm in the baseline sample, the average firm in the LPC sample has higher sales growth, higher investment intensity, better profitability, and higher operating cashflows. These firms also have higher leverage and M/B ratios. However, the average firm in the LPC sample has a similar risk profile compared to the baseline sample, with the average credit rating of 13.32 for the LPC sample to 13.17 of the baseline sample. The LPC sample has higher growth in debt financing during the sample period compared to the baseline sample. The average annual change in debt financing as a percent of the prior year assets ($\Delta Debt_Asset$) for the LPC sample is 5.5% as

against 3.2% for the baseline sample. Similar to the trend observed for the baseline sample, there is a decline in the average $\Delta Debt\_Asset$ in the post-Basel II period as compared to the pre-Basel II period in the LPC sample, especially for the lower-rated firms.

We re-estimate the baseline estimation in Equation 1 with the LPC sample, where the dependent variable is the loans taken in a year scaled by the assets at the beginning of the year ($Loan\_Asset$). The key explanatory variable is the Avg_Rating, estimated as the annual loan-weighted average (with corresponding loan amounts used as weights) of the issuer credit ratings assigned by three major credit rating agencies.[7]

The results shown in Table 5 column (1) suggest that the sensitivity of loans to credit ratings increased significantly in the post-Basel II period for the LPC sample, similar to that observed for the baseline sample. This result is robust to additional control for the effect of GFC. These results lend support to the findings reported in section 4.1 for the baseline sample. For the LPC sample, we also extend the approach used in the baseline estimation with bank-level controls, which could alter the response of a bank to the introduction of risk-sensitive regulations (Gropp et al., 2018). The bank-level control variables employed are the equity to assets ratio to capture capital adequacy; net interest margin to proxy for profitability; the cost to income ratio as a proxy for efficiency; and loan loss reserves to total loans as a proxy for loan asset quality. All of the above control variables are commonly employed in banking studies. The bank-level controls employed correspond to those of the lead arranger banks in syndications.[8] The results, shown in columns (4) and (6) of Table 5, support the finding of increased sensitivity of lending to credit ratings in the post-Basel II period as obtained for the baseline sample and the LPC sample without the bank-level controls.

[7]First, we take the average rating across the three rating agencies, Standard & Poor's, Moody's and Fitch, as available for each deal. Then we compute the loan-weighted rating for each firm-year.

[8]The control variables for the lead arranger banks are taken from the Orbis Bank Focus (OBF) database by a combination of matching the *ISIN* and the names of the lead banks from the LPC database. Where there are multiple lead arrangers for a syndicated deal, the control variables are averaged across the banks. We are able to obtain the control variables for 1,652 unique lead arranger banks, representing about 55% of the LPC sample. The subsample with bank-level controls consists of 4,925 firm-year-bank observations across 44 countries for 1,430 unique firms.

Syndicated loan issuances are only observed for a third of our baseline sample. Hence, in order to correct for any possible selectivity bias of firms in loan issuance, we employ a Heckman selection model. In unreported results, we find that the above findings for the LPC sample are robust to the correction for selectivity bias. The analysis of the baseline sample along with that of the LPC sample suggest that lower-rated firms faced a negative shock to their debt financing in the post-Basel II period across our sample of countries.

4.3. Impact on interest cost of debt

While we observe reduced debt growth in the post-Basel II period for lower-rated firms, it is possible that banks also increase the interest rate for lending to such firms. We examine the cross-sectional variation in the extent of interest rate changes for firms in different risk categories.

The results of the estimation given in Table 6 suggest that higher-rated firms received relatively lower loan pricing in the post-Basel II period. The significant and negative value of the coefficient of the rating sensitivity ($Basel\_Dum \times Rating_{t-1}$) (see columns (1) Table 6)) suggests an increase of about 27% in the sensitivity of interest rates to credit ratings in the post-Basel II period. The increase implies that banks charge higher interest rates on lower-rated firms to adjust for the incremental capital that they need to set aside, as per the Basel II regulations. The increase in interest costs for lower-rated firms observed here is robust to additional controls to capture the changes in the borrowing cost that could have been brought about by the global financial crisis of 2008-09 (column (3)). The results in columns (2) and (4) suggest that on average, lower-rated firms as a group faced a relatively higher cost of debt. The cost is higher by about 46.5 basis points ($Basel\_Dum \times HCC\_Dum$), in the period following risk-sensitive Basel II regulations as compared to the remaining firms.[9] The findings on the estimation of the interest rate sensitivity to credit ratings support Hypothesis 2.

Analogous to the estimation of the impact of Basel II on debt financing, we re-estimate the impact on interest costs, with the LPC sample. The estimation helps us to reliably examine

[9]While we observe that interest rates declined on average for all firms in the post-Basel II period, the decline is greater for higher-rated firms, as compared to lower-rated firms (Table 3).

the impact of risk-sensitive regulations on the interest cost of firms which have borrowed from banks. The results, shown in columns (5) and (6, support the findings reported for the baseline sample. The increase in the sensitivity of interest cost to credit ratings is close to 35% for the LPC matched sample of firms, higher than the 27% found for the baseline sample. The lower-rated firms in the LPC matched sample have an incremental interest cost of 56 basis points relative to the higher-rated counterparts in the post-Basel II period.

4.4. Firm-level responses to changes in bank lending behaviour

As the analysis in section 4.1 suggests a sharp decline in credit supply to lower-rated firms as an outcome of Basel II implementation, in this section we examine whether firms mitigated the fall in bank credit with alternatives, such as trade credit and internal funds. We also examine the spillover effects of the fall in credit supply on the capital investment intensity of firms, especially for lower-rated firms.

4.4.1. Impact on trade credit

We examine the impact of Basel II implementation on trade credit by estimating the extent to which credit ratings determine the reliance of a firm on trade credit. If the Basel II implementation adversely impacted the flow of bank credit to lower-rated firms, we would expect an increase in their dependence on trade credit relative to their higher-rated counterparts. Alternatively, if the Basel II implementation favoured higher-rated firms, they would have a lower dependence on trade credit in the post-Basel II period. The results based on the estimation of Equation 2, presented in Table 7, are as follows.

First, higher-rated firms show a lower degree of reliance on supplier's credit after the implementation of Basel II, relative to lower-rated firms. It suggests that the relatively easier access to bank credit available to higher-rated firms, allow them to lower their reliance on the expensive trade credit.[10] In the pre-Basel II period, the difference in the reliance on accounts payable is insignificant, the difference increases by 10 basis points in the post-Basel period (indicated

[10]Based on a survey in the US, Ng et al. (1999) document an effective interest rate of 43.9% for supplier credit.

by the coefficient of $Basel\_Dum \times Rating_{t-1}$ in column (1) of Table 7). A one standard deviation decline in a firm's credit rating in the post-Basel II period translates into a 34 basis points higher accounts payables (equivalent to 5% of the accounts payable of the median firm). As it has been documented that accounts payables tend to increase during crisis periods (Casey & O'Toole, 2014), we control for the effects of the GFC in the estimation. The results given in column (3) of Table 7 suggest an overall increase in accounts payables during the crisis period as argued in the literature. However, the lower reliance on accounts payable by higher-rated firms remains true even after accounting for the possible rise in accounts payables during the financial crisis. We also observe that firms that incur higher capital charge (HCC_Dum) significantly increased their payables by 99 basis points compared to firms with higher ratings (column (2) in Table 7).

Second, we find that accounts receivables were impacted by the implementation of Basel II in a manner which is complementary to the results observed for accounts payables. We observe an increase in accounts receivables in the post-Basel II period, primarily for higher-rated firms. In the estimation of the sensitivity of credit ratings to receivables (coefficient of $Basel\_Dum \times Rating_{t-1}$ in column (4) of Table 7), we find that the influence of credit ratings is positive and significant in the post-Basel II period. The increased sensitivity of ratings to receivables prevails even after controlling for the possible impact of the GFC. These results suggest that higher-rated firms offer a higher amount of credit to their customers in the post-Basel II period. Most likely, the relatively greater demand for credit from their customers combined with their improved access to bank credit led to a greater flow of trade credit from these firms to their customers. Notably, we observe that lower-rated firms which face the unfavourable impact of Basel II implementation do not lower their accounts receivables. The stickiness of accounts receivables could be the outcome of the competition in the product markets.

In summary, we observe that as an outcome of Basel II implementation, the higher-rated firms reduce their reliance on trade credit, but at the same time, extend greater trade credit to cater to the needs of their customers. Lower-rated firms, which are adversely impacted by changes in banking regulations, on the other hand, depend more on trade credit as indicated by their greater reliance on accounts payables. These findings on the impact of Basel II imple-

mentation on trade credit support our Hypothesis 3.

4.4.2. Impact on payout choices

We examine the possible changes in payouts by firms to their shareholders in the post-Basel II period by estimating Equation 3. We calculate payouts from the total payout ratio and the dividend payout ratio. The former is more relevant on account of the prevalence of share repurchases (Skinner, 2008). The results of the estimations are given in Table 8.

Our key result is that the impact of ratings on firms' payouts increased significantly in the post-Basel II period. In other words, the payout to shareholders became more sensitive to credit ratings of firms in the post-Basel II period. The coefficient of the interaction term, $Basel\_Dum \times Rating$ (see column (4)), which indicates the sensitivity of payout to credit ratings, increases by about 17% in the post-Basel II period. Possibly, the lower-rated firms attempt to compensate for the lower supply of bank credit by lowering their payout to shareholders. Alternatively, we also estimate payouts using the dividend payout ratio. The corresponding results for the increase in sensitivity of ratings, about 55% (see column (1)), is much higher than that for total payouts. The difference between the dividend payouts of the lower-rated firms relative to higher-rated firms (see column (2)) is about 8.8%.

Our findings on the decline in payouts by lower-rated firms following Basel II implementation are in line with the literature on the adverse impact of financial shocks on the payout of firms. For instance, Bliss et al. (2015) reported that during the 2008 financial crisis, firms increased their cash holdings to mitigate the heightened uncertainties in the environment through lower payouts. Our results indicate an incremental adverse impact of the Basel II implementation after controlling for the impact of the financial crisis on payout policy (columns (3) and (6)). Overall the results suggest that firms faced with a restricted supply or higher cost of credit attempt to maintain liquidity and investments by tapping a greater amount of internal capital through lower payouts. The increased use of trade credit, reported in section 4.4.1 of the paper, along with lower payouts, appears to help lower-rated firms mitigate the adverse distributional consequences of Basel II regulations.

4.4.3. *Impact on capital investment intensity*

In this section, we examine whether the decline in the credit availability for the relatively low rated firms adversely impacts the investment activity of these firms.

In line with the univariate comparison of the capital investment intensity, the results of the estimation based on Equation 4 show that the decline in credit flows to lower-rated firms adversely impacted their capital investment intensity. The results given in Table 9 show that both the sign and magnitude of the coefficient of the interaction term between credit ratings and Basel dummy ($Basel\_Dum \times Rating$ in column (1)) indicate a relative decline in the capital spending of lower-rated firms due to the risk-sensitive regulations. The extent to which credit ratings influence capital investments of firms increased by about 31% in the post-Basel II period. Analogous to the approach adopted for identifying the other dimensions of the impact of Basel II implementation, we employ a HCC_Dum to investigate whether lower-rated firms are impacted to a greater degree. The results indicate that firms with lower ratings reduced their capital investments by about 1.71 percent points in the period following Basel II implementation, relative to their higher-rated counterparts. When viewed in conjunction with the decline in the investment intensity of lower-rated firms in the post-Basel II implementation (see Table 3) we can infer that the increase in sensitivity observed here (column (1)) is driven by the decline in the investment intensity of lower-rated firms. The findings of the estimations support Hypothesis 5. They are also consistent with the concerns raised by various quarters on the impact of Basel II implementation on capital investments (Kashyap & Stein, 2004).

5. Robustness

We examine the robustness of our results on the impact of Basel II implementation on debt financing by firms with several additional tests.

5.1. Additional covariates

We examine the robustness of our main results by controlling for the sovereign rating of the country where the firm is headquartered, as the spillover effects of sovereign rating changes

could affect the financing ability of firms (Almeida et al., 2017). The sovereign ratings issued by S&P for long-term debt securities, available since the year 2000, were collected from the Bloomberg database. The results of the estimations are shown in Table 10 (columns (1) and (3)). The baseline results presented in Table 4 are mostly unaffected by the additional control variable.

Further, we re-estimate the baseline results with a country-level banking indicator, proxied by the ratio of bank capital to assets of the country. For instance, if the majority of the banks in a country are adequately capitalized, then the distributional impact might be lower as the banks can afford to lend to riskier firms. Whereas, in a country with under-capitalized banks, the response could be to move away from riskier firms to shore up the banks' capital base. The country-level bank capital ratio controls for the overall risk-taking ability of banks. This indicator is calculated from the data available from the FRED database. The baseline results on the impact of Basel II regulations on lending behaviour remain intact after including this indicator (see estimations in columns (2) and (4)). We observe that the net debt issuance by firms in countries with higher bank capital to assets is significantly higher, which is in line with the expectation that a well-capitalized banking system would be able to take on higher risk as compared to an under-capitalized one.

5.2. Controlling for the effect of banking crises

Bank lending behaviour is expected to change significantly during periods of banking crises in the sample period. We have only accounted for the 2008-09 global financial crisis in our main analysis. Here, we take into account the impact of a range of banking crises by controlling for the effects of all the documented banking crises during the sample period.

Banking crises are identified by a country-specific dummy variable ($Bank\_Crisis$), which takes the value 1 for the years in which there was a banking crisis, as per the Laeven and Valencia (2013) database on systemic banking crises and 0 otherwise. We limit the estimation sample to the period between 1995 and 2011 as the database on banking crises is available only until 2011. The results of the estimations after controlling for banking crises (Table 11) are consistent with the findings reported earlier for the baseline model on the post-Basel II increase

in the sensitivity of debt financing and interest cost to credit ratings.

5.3. Lags and leads in effects of regulations

It is possible that banks may have taken into account the future implications of rating contingent Basel regulations in the years prior to the official implementation date. For instance, the exposure to lower-rated firms could have been restricted in the pre-Basel period itself to adjust to the anticipated changes in banks' capital charges.

To account for the lagged effects of Basel II implementation, we re-estimate the baseline results with $Basel\_Leadlag$ set in years prior to the actual year of implementation (t-1, t-2 and t-3). The impact on incremental debt to assets, shown in Table 12, indicates that there is a significant effect of anticipated Basel II implementation in the prior years. For example, the sensitivity to credit ratings increases by about 31% in three years prior to the actual Basel II implementation time period. The corresponding increase in the year immediately prior to Basel II implementation (t-1) is 37%. We also account for the delay in the response of banks, if any, to the regulations in an analogous approach. The change in the sensitivity is insignificant for the lead years, except for year t+1.

Overall, the results suggest an 'inverted-U' shaped trend in the sensitivity of debt funding to ratings in the years around the implementation time as given in Figure 1. This 'inverted-U' pattern is likely to be driven by the nature of banks' response to risk-sensitive regulations over time. In the initial years, banks may attempt to reduce their risk exposure as a response to the increased capital, resulting in higher sensitivity in the earlier years. In later years, as banks accumulate sufficient capital buffers, the risk appetite of banks could increase, leading to a decline in the sensitivity. The inverted 'U-pattern' also corroborates the arguments of Calem and Rob (1999) and Diamond and Rajan (2000) that banks in the short-run would attempt to reduce the risk of their asset portfolio, followed by an increase in the portfolio risk as they build up the requisite capital buffers.

5.4. *Is the impact on debt financing driven by the US?*

As US firms account for 61% of our baseline sample, it is possible that the effects discussed earlier are driven only by US firms and the impact is not a pervasive phenomenon. In order to verify whether our results hold for non-US firms, we exclude US firms and re-estimate our baseline model related to debt financing (Table 13 columns (1)-(3)) and interest cost (columns (4)-(6)). The sensitivity of debt financing and interest costs to credit ratings for the non-US sample is consistent with our baseline results.

5.5. *Exclusion of speculative grade firms*

As the nature of risk and monitoring required for speculative-grade firms is higher as compared to investment-grade firms, it is possible that our main results are influenced by such firms. Hence, we re-estimate our baseline model after excluding all speculative grade firms, which constitute roughly 45% of our baseline sample. The results, shown in Table A3 are broadly consistent with our baseline results discussed in section 4. For the subsample excluding speculative grade firms, the increase in sensitivity in the post-Basel II period is lower for debt financing but is significantly higher for the interest cost of debt. It is possible that banks may be more willing to adjust their loan pricing based on credit risk than to adjust the quantity of credit for the investment-grade firms.

5.6. *Are the effects driven by rating changes?*

Is the shock to the supply of bank credit documented here affected by a decline in average ratings across firms? Both Hasan et al. (2015) and Almeida et al. (2017) show that debt financing is sensitive to rating changes (downgrades or upgrades). It is possible that the increased sensitivity of debt issuance to credit ratings observed may be due to a decline in credit ratings in the post-Basel II implementation period. The results of the analysis, which controls for rating changes at the firm-level, is similar to that observed in the baseline estimations (see Table 14).

5.7. Standardized vs. Internal Ratings Based (IRB) approaches

The credit risk assessment of a borrower could vary from the standardized approach when a bank employs the IRB approach, as the expected loss and the risk weights would be based on the historical loss distribution and the probability of default. We have not differentiated between the IRB approach and the standardized approach, partly due to a lack of publicly available information on the IRB approach. Moreover, it is not possible to classify countries based on adoption of the two approaches as there is likely to be variation across banks in a country.[11] However, even if a bank chooses to implement the IRB approach, the ratings are still scrutinized under the Pillar II by a supervisory review process. Hence, the variation between the internal and external ratings is likely to be minimal, especially for firms that are close to the speculative grade. To the extent that internal risk assessments and the ratings assigned by external credit rating agencies are consistent, our results, which use ratings as a proxy for credit risk, are likely to hold for firms irrespective of whether banks lending to these firms follow an IRB or standardized approach.

6. Conclusion

Risk-sensitive capital regulations, implemented ever since Basel II regulations, have impacted banks and their borrowers in multiple ways. In this study, we examine the impact of changes in bank capital regulations on firms. In particular, we attempt to measure the impact on the debt financing and interest costs, especially for the lower-rated firms. We also examine how firms have addressed the changes in debt financing through alternative channels such as trade credit or internal funds secured from lower payouts. Finally, we examine how the changes in debt financing impacts the capital investment intensity of firms in the post-Basel II period. We employ a cross-country firm-level dataset that spans both advanced and developing economies

[11] For instance, a report tabled in the European Parliament reports that the proportion of risk-weighted capital based on internal models ranges from 0% in Cyprus to 81.5% in Denmark; the weighted average is 48.4% for the European Union countries. The report can be accessed from http://www.europarl.europa.eu/RegData/etudes/IDAN/2016/587366/IPOL_IDA(2016)587366_EN.pdf.

over a 23-year period to identify the impact of the changes in banking regulations.

The findings suggest that the influence of firm-level credit ratings on debt financing substantially increased in the period following the implementation of the risk-sensitive Basel regulations. The results indicate that lower-rated firms faced more restricted access to debt financing during this period. We also find that lower-rated firms incur a higher cost of debt in the post-Basel II period. These findings imply that the implementation of Basel II regulations had a significant cross-sectional impact on the availability of credit for firms.

We also find that lower-rated firms rely more on internal sources of funding in the post-Basel II period. Accordingly, lower-rated firms decreased their payout to shareholders and at the same time, such firms increased their reliance on trade credit from suppliers. The increased reliance on internal funds and trade credit suggests that firms attempt to address the shortage in bank credit supply through alternatives sources of financing. Finally, we observe a negative spillover effect of lower credit supply on capital investments, particularly for lower-rated firms. Our findings are robust to alternative estimation approaches and hold across various subsamples.

Concerns have been raised by various quarters, including policy makers as well as the private sector, on the impact of the changes in bank capital regulations on the real sector. The evidence suggests that while risk-sensitive bank capital regulations could help to achieve the desired objective of reducing the riskiness of banks, they could adversely impact the access to credit, especially for weaker firms.

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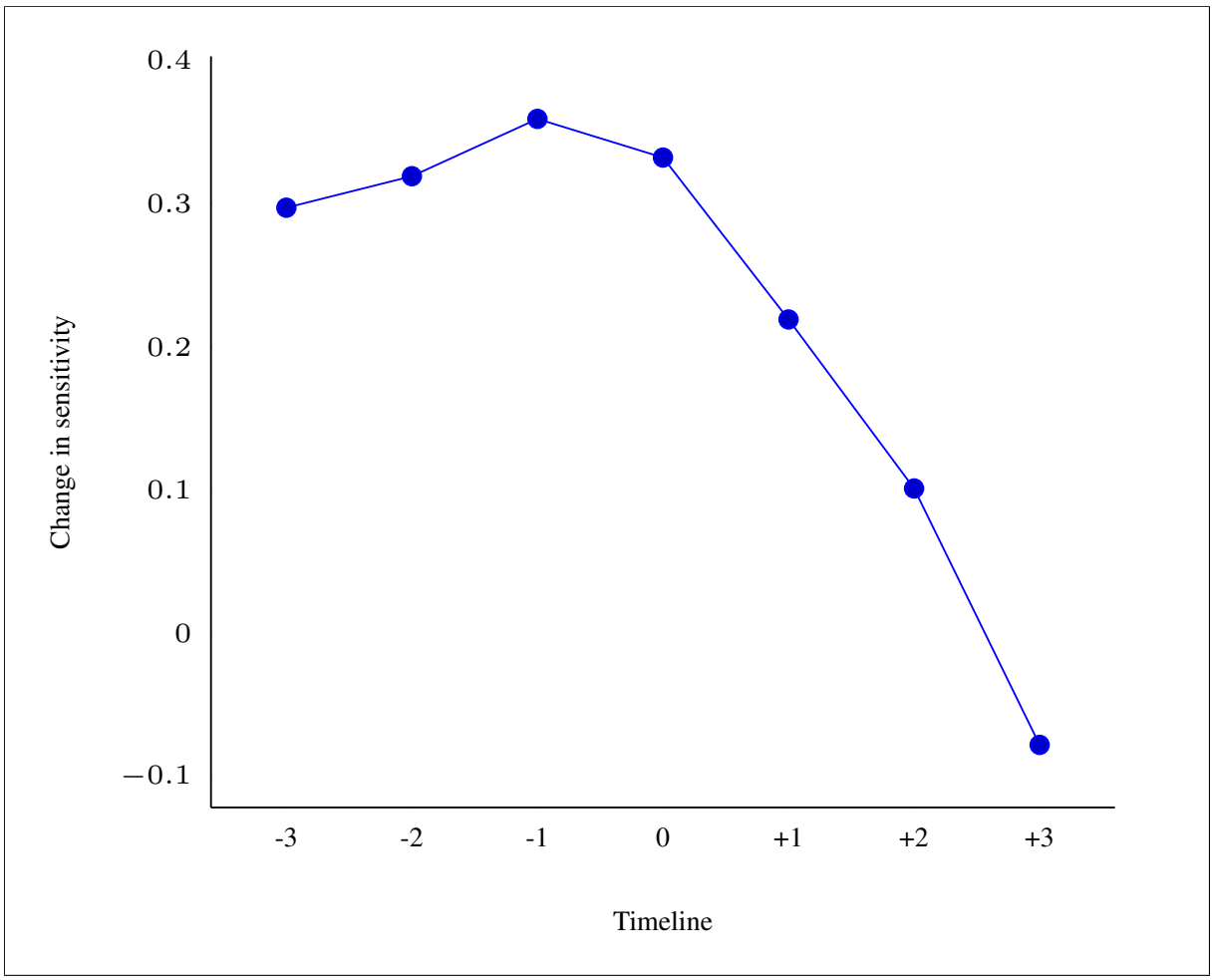
Figure 1: **Change in sensitivity of debt financing to credit ratings around Basel II implementation**



The figure shows the change in sensitivity of debt financing ($\Delta Debt\_asset$) to credit rating for a 3-year window around Basel II implementation. The sensitivity values (coefficient of $Basel\_Dum \times Rating_{t-1}$) shown are taken from the estimation results shown in Table 12.

Table 1: **Variable description & data source**

Variable	Definition and construction	Data source
$\Delta Debt\_Asset$ (%)	Change in total debt of the firm in a year scaled by the total assets of the firm in the beginning of the year (Δ*(WC03251 + WC03051)/Lag.WC02999*).	Worldscope
$Loan\_Asset$ (%)	Sum of all tranches of the syndicated loans (in USD) obtained by a firm in a year scaled by the total assets of the firm in the beginning of the year	Loan Pricing Corporation Dealscan
$Basel\_Dum$	A dummy variable which takes the value 0 for the years preceding the implementation of the standardized (risk-sensitive) approach to credit risk and 1 otherwise.	BIS
$Interest\_Cost$ (%)	Interest expense on debt in a year divided by the total debt of the firm	Worldscope
$Total\_Payout$ (%)	Total payout of a firm including share repurchases and cash dividends divided by the net income. The annual repurchase amount is the cash outflow for the purchase of common and preferred stock (*WC04781*). The same variable had been employed by Manconi, Peyer, and Vermaelen (2014) in a study of the equity repurchases around the world. *((WC04781+WC04551)/WC01551)*.	Worldscope
$Dividend\_Payout$ (%)	Total cash dividends paid by a firm in a year divided by the net income *(WC04551/WC01551)*.	Worldscope
$Capex\_Intensity$ (%)	Capital expenditure in a year scaled by the total fixed assets of the firm in the beginning of the year *(WC04601/Lag.WC02501)*	Worldscope
$Rating$	Issuer credit ratings of a firm disclosed by Standard & Poor's converted to ordinal scale. The ratings are coded from 1 to 22 with 1 (denotes default) and 22 (denotes AAA).	Thomson Reuters Eikon
Avg_Rating	Annual loan-weighted average (with corresponding loan amounts used as weights) of issuer credit rating assigned by three major credit rating agencies, Standard & Poor's, Moody's and Fitch.	Loan Pricing Corporation Dealscan
Log_Sales	Natural logarithm of the total sales in USD (*WC07240*) of the firm	Worldscope
Log_Asset	Natural logarithm of total assets in USD (*WC07230*) of the firm	Worldscope
$Leverage$	Ratio of total liabilities to book value of equity (*WC03351/WC03998*)	Worldscope
$Op.CF\_Asset$	Operational cash flow divided by the total assets at the end of the year of a firm (*WC04201/WC02999*)	Worldscope
$Op.CF\_Fixedasset$	Operational cash flow divided by the net property plant and equipment in the beginning of the year of a firm (*WC04201/Lag.WC02501*)	Worldscope

Continued on next page

Table 1 – *Continued from previous page*

Variables	Definition and Construction	Data Source
M/B	Ratio of market value of the equity to book value of equity (*WC07210/WC07220*)	Worldscope
$Tangibility$ (%)	Fixed assets to total assets of a firm (*WC02501/WC02999*).	Worldscope
$EBITDA\_Asset$	EBITDA to total assets of a firm (*WC01250/WC02999*).	Worldscope
$Earnings\_Volatility$	Standard deviation of EBITDA to total assets for a 5 year period.	Worldscope
$AccPay\_Asset$ (%)	Accounts payable scaled by the total assets of a firm (*WC03040/WC02999*).	Worldscope
$AccRec\_Sales$ (%)	Receivables scaled by the total sales of a firm (*WC02051/WC01001*).	Worldscope
$Cash\_Asset$	Cash and short-term investments scaled by the total assets of a firm(*WC02001/WC02999*).	Worldscope
$Gross\_Margin$	Gross income scaled by the total sales of a firm (*WC01100/WC01001*).	Worldscope
$Market\_Share$	Net sales of a firm to the total sales of the industry (2digit SIC codes) at the country-level	Worldscope
Sov_Rating	Sovereign credit rating of the country. The ratings are coded from 1 to 22 with 1 (denotes default) and 22 (denotes AAA).	Bloomberg
GDP_Growth (%)	GDP growth of the country where the firm is headquartered.	World Bank WDI
$Pvtcredit\_GDP$ (%)	Ratio of private credit to the GDP of the country where the firm is headquartered.	World Bank WDI
$Log\_Percapita\_GDP$	Log of the annual GDP per capita of a country where the firm is headquartered.	World Bank WDI
$Bank\_Capital\_Asset$ (%)	Aggregate bank capital to total bank assets for each country	World Bank WDI & FRED St. Louis Fed
$Net\_Interest\_Margin$	Net interest income of the bank scaled by the interest earning assets, averaged across all the lead banks in the syndicated loans.	Orbis Bank Focus
LLR_Loans	Total loan loss reserves of a bank scaled by the aggregate loans, averaged over all the lead banks in the syndicated loans.	Orbis Bank Focus
$Cost\_Income$	Operating costs of a bank to the operating income, averaged over all the lead banks in the syndicated loans.	Orbis Bank Focus
$Equity\_Asset$	Book value of equity to the total assets of a bank, averaged over all the lead banks in the syndicated loans.	Orbis Bank Focus

Table 2: **Summary statistics**

Variable	Obs.	Mean	Std. Dev.	Median	Min.	Max.	P10	P90
Firm-Level Variables								
Growth characteristics								
$Sales\_Growth$	25,524	7.45	19.86	5.86	-56.12	87.70	-10.99	28.48
M/B	25,524	2.94	3.19	2.01	0.00	20.40	0.86	5.45
Size characteristics								
Log_Sales	25,524	15.11	1.51	15.07	11.11	18.53	13.19	17.13
Log_Asset	25,524	15.47	1.47	15.37	12.20	20.36	13.60	17.44
Cashflow characteristics								
$Op.CF\_Fixedasset$	25,503	60.88	153.59	27.60	-114.41	1869.82	8.15	112.50
$Cash\_Asset$	25,428	8.89	9.13	6.05	0.03	50.62	0.79	20.78
$Op.CF\_Asset$	25,524	9.76	5.89	9.03	-6.63	29.14	3.50	17.31
Profitability								
$EBITDA\_Asset$	25,524	8.31	6.19	7.60	-9.66	28.74	1.84	16.09
$Gross\_Margin$	25,401	32.30	18.16	29.59	-3.35	92.45	11.12	57.14
$Earnings\_Volatility$	25,524	2.81	2.58	2.02	0.06	15.16	0.65	5.88
Financing								
$\Delta Debt\_Asset$	25,524	3.20	12.19	0.38	-21.97	80.31	-5.93	13.60
$Interest\_Cost$	25,430	6.30	3.20	5.99	0.12	25.80	2.71	9.83
$Loan\_Asset$	8,905	13.11	16.13	8.28	0.00	366.56	1.69	29.82
$AccPay\_Asset$	24,860	8.19	6.77	6.47	0.33	36.73	1.78	16.80
$AccRec\_Sales$	24,925	16.76	11.86	14.95	0.83	82.24	5.33	27.88
$Leverage$ (times)	25,524	1.02	0.62	0.92	0.19	14.97	0.53	1.55
Payout								
$Total\_Payout$	22,982	74.76	114.22	46.20	0.00	2440.10	0.00	156.73
$Dividend\_Payout$	23,528	42.01	72.21	24.34	0.00	546.50	0.00	87.89
Capital Investment								
$Capex\_Intensity$	25,417	20.37	16.79	16.42	0.00	143.98	6.48	37.24
$Tangibility$	25,524	38.11	24.92	33.91	0.07	93.88	7.69	74.94
Country-Level Variables								
$Pvtcredit\_GDP$	25,524	192.65	61.53	201.26	-12.75	363.25	104.87	247.46
GDP_Growth	25,524	2.42	2.27	2.46	-21.54	25.56	0.00	4.49
$Log\_Percapita\_GDP$	25,524	10.44	0.66	10.61	6.01	11.69	9.88	10.91

All the variables are shown in percent and P(x) refers to the x^{th}percentile of the distribution. The definition of each of the variables is given in Table 1.

Table 3: **Summary of dependent variables - Pre- & Post-Basel II periods**

Variable	Period	All firms			Non-US firms			US firms		
		High Rating	Low Rating	All Firms	High Rating	Low Rating	All Firms	High Rating	Low Rating	All Firms
$\Delta Debt\_Asset$	Pre-Basel II	3.19	4.07	3.31	2.11	3.53	2.27	3.71	4.25	3.80
	Post-Basel II	3.07	3.11	3.08	2.82	3.59	2.91	3.30	2.86	3.21
	Overall	3.13	3.58	3.20	2.52	3.57	2.64	3.54	3.59	3.55
$Interest\_Cost$	Pre-Basel II	6.64	9.29	7.02	6.08	10.09	6.54	6.92	9.02	7.25
	Post-Basel II	5.07	7.91	5.52	4.88	8.30	5.28	5.24	7.71	5.72
	Overall	5.89	8.59	6.30	5.40	9.06	5.82	6.22	8.39	6.60
$AccPay\_Asset$	Pre-Basel II	8.63	7.57	8.48	9.45	8.26	9.32	8.23	7.34	8.09
	Post-Basel II	7.96	7.61	7.90	8.88	9.38	8.94	7.12	6.73	7.04
	Overall	8.31	7.59	8.20	9.13	8.91	9.10	7.77	7.05	7.64
$AccRec\_Sales$	Pre-Basel II	16.27	15.49	16.16	19.27	20.02	19.36	14.77	13.94	14.64
	Post-Basel II	17.47	17.12	17.41	20.54	24.41	20.99	14.64	13.44	14.41
	Overall	16.84	16.42	16.76	19.99	22.54	20.29	14.72	13.70	14.54
$Total\_Payout$	Pre-Basel II	75.85	35.08	70.33	65.89	34.44	62.37	80.79	35.33	74.12
	Post-Basel II	85.83	42.05	79.59	76.28	31.96	71.43	94.67	47.62	86.62
	Overall	80.60	38.51	74.76	71.80	33.04	67.51	86.55	40.97	79.39
$Capex\_Intensity$	Pre-Basel II	20.37	23.69	20.85	18.61	16.91	18.42	21.23	25.95	21.97
	Post-Basel II	19.89	19.70	19.86	19.90	17.97	19.67	19.88	20.56	20.01
	Overall	20.14	21.67	20.37	19.35	17.52	19.14	20.67	23.38	21.14

All the variables in column (1) are defined in Table 1. Post-Basel II (Pre-Basel II) refers to the period after (before) the implementation of Basel II regulations in the country of domicile of a firm. High rating (low rating) refers to the firms with a rating BB- or higher (B+ or lower) that invites lower (higher) capital charge for banks. Each of the figures given represents the average of the variable for the sub-periods and samples indicated in the table.

Table 4: **Effect of risk-sensitive Basel II regulations on debt financing**

	(1)	(2)	(3)	(4)	(5)	(6)
$Rating_{t-1}$	0.872***	1.032***	0.859***	1.043***	0.812***	0.962***
	(0.096)	(0.096)	(0.096)	(0.096)	(0.100)	(0.100)
$Basel\_Dum$	-2.302**	1.853***	-2.215**	1.624***	-2.329**	2.026***
	(0.968)	(0.512)	(0.970)	(0.512)	(1.068)	(0.541)
$Basel\_Dum \times Rating_{t-1}$	0.300***		0.272***		0.312***	
	(0.063)		(0.064)		(0.069)	
HCC_Dum		1.052		1.444**		0.911
		(0.642)		(0.647)		(0.653)
$HCC\_Dum \times Basel\_Dum$		-1.335**		-1.297**		-1.405**
		(0.627)		(0.623)		(0.655)
$Crisis\_Dum$			-7.060***	-2.659**		
			(1.442)	(1.065)		
$Crisis\_Dum \times Rating_{t-1}$			0.271***			
			(0.070)			
$HCC\_Dum \times Crisis\_Dum$				-3.198***		
				(0.699)		
$Sales\_Growth_{t-1}$	11.321	10.981	11.811	11.371	12.489	13.095
	(8.411)	(8.487)	(8.405)	(8.462)	(9.638)	(9.715)
Log_Sales_{t-1}	0.006	0.007	0.006	0.007	-0.003	-0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$Leverage_{t-1}$	-6.246***	-6.273***	-6.238***	-6.281***	-6.449***	-6.479***
	(0.419)	(0.423)	(0.419)	(0.422)	(0.453)	(0.457)
$Op.CF\_Asset_{t-1}$	-1.118***	-1.131***	-1.130***	-1.132***	-1.041***	-1.046***
	(0.276)	(0.280)	(0.275)	(0.279)	(0.281)	(0.285)
M/B_{t-1}	21.461***	21.199***	21.463***	21.271***	23.954***	23.646***
	(4.098)	(4.085)	(4.099)	(4.089)	(4.090)	(4.076)
$Tangibility_{t-1}$	0.156**	0.151**	0.156**	0.147**	0.139**	0.135**
	(0.061)	(0.061)	(0.061)	(0.061)	(0.063)	(0.063)
$EBITDA\_Asset_{t-1}$	2.362	2.104	2.396	2.159	2.973*	2.716*
	(1.503)	(1.507)	(1.505)	(1.508)	(1.557)	(1.561)
$Pvtcredit\_GDP_{t-1}$	27.460***	27.728***	27.290***	27.534***	26.805***	26.903***
	(3.786)	(3.787)	(3.794)	(3.792)	(4.000)	(3.994)
GDP_Growth_{t-1}	0.007	0.01	0.008	0.009	0.01	0.012*
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$Log\_Percapita\_GDP_{t-1}$	0.003	0.028	0.007	0.025	-0.018	0.005
	(0.074)	(0.073)	(0.073)	(0.073)	(0.076)	(0.075)
$Constant$	6.543***	6.338***	6.499***	6.304***	6.681***	6.429***
	(0.867)	(0.863)	(0.866)	(0.859)	(0.914)	(0.905)
Firm-year obs.	25,524	25,524	25,524	25,524	25,089	25,089
Fixed effects	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr Ind-Yr	Firm, Yr Ind-Yr
R^2	0.086	0.085	0.086	0.086	0.135	0.135

The dependent variable in the estimations is the incremental debt in the year t scaled by prior period total assets of the firm (in percent). $Rating$ takes values from 1 to 22 depending on the credit rating of the firm, 1 indicates default and 22 indicates AAA rating. $Basel\_Dum$ is a dummy variable which takes value of 1 if the country of domicile of a firm has implemented Basel II regulations and 0 otherwise. HCC_Dum takes value of 1 if the rating is B+ or lower that invites higher capital charge for banks, and 0 if the rating is BB- or higher. $Crisis\_Dum$ takes value of 1 for the years 2008 and 2009, and 0 for all other years. Robust standard errors clustered at firm-level are presented in the brackets. ***, ** and * indicate p-values at the 1%, 5% and 10% significance levels. The definition of the variables are given in Table 1.

Table 5: **Effect of risk-sensitive Basel II regulations on syndicated bank loans**

	(1)	(2)	(3)	(4)	(5)	(6)
Avg_Rating_t	-0.309	-0.378*	-0.321*	-0.342*	-0.335	-0.346*
	(0.201)	(0.213)	(0.202)	(0.205)	(0.217)	(0.205)
$Basel\_Dum$	-3.098	0.881	-2.748	-3.395	0.921	-3.51
	(2.253)	(1.185)	(2.253)	(2.858)	(1.293)	(2.855)
$Basel\_Dum \times Avg\_Rating_t$	0.272**		0.227*	0.290*		0.285*
	(0.136)		(0.137)	(0.166)		(0.166)
HCC_Dum		-1.025			-0.295	
		(1.113)			(1.670)	
$HCC\_Dum \times Basel\_Dum$		-2.474*			-2.509	
		(1.481)			(1.641)	
$Crisis\_Dum$			-6.427			-0.78
			(3.958)			(4.992)
$Crisis\_Dum \times Avg\_Rating_t$			0.409**			0.165
			(0.201)			(0.219)
$Collateral_t$	0.337	0.387	0.369	1.18	1.204*	1.192
	(0.628)	(0.621)	(0.624)	(0.725)	(0.723)	(0.725)
$Sales\_Growth_{t-1}$	-0.014	-0.014	-0.014	-0.006	-0.006	-0.006
	(0.009)	(0.008)	(0.009)	(0.013)	(0.013)	(0.013)
Log_Sales_{t-1}	-6.336***	-6.392***	-6.319***	-5.797***	-5.866***	-5.782***
	(0.929)	(0.928)	(0.930)	(0.886)	(0.890)	(0.887)
$Leverage_{t-1}$	-0.779*	-0.771*	-0.783*	-0.183	-0.183	-0.185
	(0.453)	(0.443)	(0.453)	(0.517)	(0.505)	(0.517)
$Op.CF\_Asset_{t-1}$	39.726***	38.914***	39.697***	18.532	18.009	18.642
	(11.228)	(11.172)	(11.227)	(12.351)	(12.097)	(12.372)
M/B_{t-1}	0.573***	0.579***	0.573***	0.275**	0.283**	0.275**
	(0.152)	(0.153)	(0.152)	(0.128)	(0.129)	(0.128)
$Tangibility_{t-1}$	3.184	3.226	3.195	-0.123	-0.249	-0.108
	(4.397)	(4.434)	(4.399)	(3.547)	(3.589)	(3.549)
$EBITDA\_Asset_{t-1}$	29.885***	30.392***	29.829***	36.032***	36.219***	35.822***
	(8.696)	(8.757)	(8.698)	(10.796)	(10.687)	(10.834)
$Equity\_Asset_{t-1}$				-0.039	-0.023	-0.036
				(0.136)	(0.135)	(0.136)
LLR_Loans_{t-1}				0.169	0.122	0.168
				(0.403)	(0.406)	(0.403)
$Net\_Interest\_Margin_{t-1}$				0.021	0.017	0.025
				(0.391)	(0.395)	(0.392)
$Cost\_Income_{t-1}$				-0.039**	-0.036*	-0.039**
				(0.019)	(0.019)	(0.019)
Firm-year obs.	8,905	8,905	8,905	4,925	4,925	4,925
Fixed effects	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr
R^2	0.121	0.121	0.121	0.106	0.106	0.106

The dependent variable in the estimations is the total loans in year t (aggregate tranche amount in U.S. dollars) scaled by assets at the beginning of the year t for a firm. $Rating$ takes values from 1 to 22 depending on the credit rating of the firm, 1 indicates default and 22 indicates AAA rating. $Basel\_Dum$ is a dummy variable which takes value of 1 if the country of domicile of a firm has implemented Basel II regulations and 0 otherwise. HCC_Dum takes value of 1 if the rating is B+ or lower that invites higher capital charge for banks, and 0 if the rating is BB- or higher. $Collateral$ takes value of 1 if the loan is a secured loan and 0 otherwise. $Crisis\_Dum$ takes value of 1 for the years 2008 and 2009, and 0 for all other years. Robust standard errors clustered at firm-level are presented in the brackets. ***, ** and * indicate p-values at the 1%, 5% and 10% significance levels. We do not present the country-specific variables and constant term for brevity. The definition of the variables are given in Table 1.

Table 6: **Effect of risk-sensitive Basel II regulations on interest cost**

	(1)	(2)	(3)	(4)	(5)	(6)
$Rating_{t-1}$	-0.272***	-0.275***	-0.273***	-0.276***	-0.322***	-0.342***
	(0.025)	(0.025)	(0.025)	(0.025)	(0.035)	(0.031)
$Basel\_Dum$	1.360***	0.336***	1.365***	0.342***	1.898***	0.247
	(0.285)	(0.127)	(0.286)	(0.127)	(0.510)	(0.217)
$Basel\_Dum \times Rating_{t-1}$	-0.073***		-0.074***		-0.115***	
	(0.020)		(0.020)		(0.035)	
HCC_Dum		0.126		0.115		0.141
		(0.152)		(0.153)		(0.247)
$HCC\_Dum \times Basel\_Dum$		0.465***		0.464***		0.564*
		(0.170)		(0.170)		(0.303)
$Crisis\_Dum$			-2.528***	-2.434***		
			(0.365)	(0.264)		
$Crisis\_Dum \times Rating_{t-1}$			0.016			
			(0.017)			
$HCC\_Dum \times Crisis\_Dum$				0.085		
				(0.170)		
$Sales\_Growth_{t-1}$	-0.003***	-0.003***	-0.003***	-0.003***	-0.004**	-0.004**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Log_Sales_{t-1}	0.161**	0.172***	0.162**	0.173***	0.171*	0.198**
	(0.063)	(0.063)	(0.063)	(0.063)	(0.093)	(0.092)
$Leverage_{t-1}$	0.250***	0.245***	0.249***	0.245***	0.254*	0.245*
	(0.080)	(0.080)	(0.080)	(0.080)	(0.133)	(0.135)
$Op.CF\_Asset_{t-1}$	-2.521***	-2.355***	-2.521***	-2.357***	-2.429*	-2.176
	(0.847)	(0.844)	(0.848)	(0.843)	(1.374)	(1.376)
M/B_{t-1}	-0.028***	-0.028***	-0.028***	-0.028***	-0.039**	-0.039**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.016)	(0.016)
$Tangibility_{t-1}$	0.378	0.398	0.38	0.396	0.383	0.45
	(0.385)	(0.381)	(0.385)	(0.381)	(0.513)	(0.515)
$EBITDA\_Asset_{t-1}$	-0.656	-0.684	-0.666	-0.679	-1.787	-1.995
	(0.798)	(0.794)	(0.798)	(0.792)	(1.371)	(1.370)
$Pvtcredit\_GDP_{t-1}$	0.001	0.001	0.001	0.001	0.005*	0.005*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
GDP_Growth_{t-1}	-0.034**	-0.039**	-0.034**	-0.039**	-0.009	-0.017
	(0.016)	(0.016)	(0.016)	(0.016)	(0.026)	(0.026)
$Log\_Percapita\_GDP_{t-1}$	-0.577*	-0.523*	-0.580*	-0.522*	-0.986***	-0.979***
	(0.306)	(0.310)	(0.306)	(0.310)	(0.370)	(0.376)
$Constant$	15.312***	14.696***	15.341***	14.686***	19.232***	19.063***
	(2.943)	(2.977)	(2.943)	(2.974)	(3.666)	(3.727)
Firm-year obs.	25,430	25,430	25,430	25,430	8,318	8,318
Fixed effects	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr
R^2	0.147	0.147	0.147	0.147	0.197	0.194

The dependent variable is the total interest expense in the year t scaled by the total debt(in percent). $Rating$ takes values from 1 to 22 depending on the credit rating of the firm, 1 indicates default and 22 indicates AAA rating. $Basel\_Dum$ is a dummy variable which takes value of 1 if the country of domicile of a firm has implemented Basel II regulations and 0 otherwise. HCC_Dum takes value of 1 if the rating is B+ or lower that invites higher capital charge for banks, and 0 if the rating is BB- or higher. $Crisis\_Dum$ takes value of 1 for the years 2008 and 2009, and 0 for all other years. Robust standard errors clustered at firm-level are presented in the brackets. ***, ** and * indicate p-values at the 1%, 5% and 10% significance levels. The definition of the variables are given in Table 1.

Table 7: **Effect of risk-sensitive Basel II regulations on the reliance on trade credit**

	Payables			Receivables		
	(1)	(2)	(3)	(4)	(5)	(6)
$Rating_{t-1}$	-0.041	-0.093***	-0.044	-0.016	0.047	-0.017
	(0.036)	(0.035)	(0.036)	(0.068)	(0.074)	(0.068)
$Basel\_Dum$	1.185**	-0.226	1.204**	-0.468	1.033***	-0.463
	(0.482)	(0.162)	(0.483)	(0.889)	(0.350)	(0.893)
$Basel\_Dum \times Rating_{t-1}$	-0.096***		-0.101***	0.111*		0.109*
	(0.031)		(0.032)	(0.059)		(0.060)
HCC_Dum		-0.653***			0.376	
		(0.223)			(0.382)	
$HCC\_Dum \times Basel\_Dum$		0.991***			-0.263	
		(0.284)			(0.438)	
$Crisis\_Dum$			-2.315***			-3.095***
			(0.545)			(1.138)
$Crisis\_Dum \times Rating_{t-1}$			0.054***			0.015
			(0.020)			(0.050)
Log_Sales_{t-1}	0.243*	0.244*	0.245*			
	(0.142)	(0.141)	(0.142)			
Log_Asset_{t-1}				0.076	0.105	0.076
				(0.295)	(0.292)	(0.295)
$Market\_Share_{t-1}$	-1.122	-1.098	-1.117	-4.170**	-4.222**	-4.169**
	(0.785)	(0.777)	(0.785)	(1.947)	(1.952)	(1.947)
$Sales\_Growth_{t-1}$	0.009***	0.009***	0.009***	-0.023***	-0.023***	-0.023***
	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)
$Cash\_Asset_{t-1}$	-0.748	-0.74	-0.731	-1.234	-1.257	-1.229
	(0.660)	(0.656)	(0.660)	(1.224)	(1.227)	(1.225)
$Gross\_Margin_{t-1}$	-1.755***	-1.775***	-1.750***	1.790*	1.831*	1.791*
	(0.385)	(0.386)	(0.385)	(1.085)	(1.090)	(1.086)
$Leverage_{t-1}$	0.568***	0.570***	0.567***	-0.161	-0.17	-0.162
	(0.154)	(0.156)	(0.154)	(0.206)	(0.208)	(0.206)
M/B_{t-1}	0.099***	0.100***	0.099***	-0.009	-0.01	-0.009
	(0.017)	(0.017)	(0.017)	(0.024)	(0.024)	(0.024)
$Pvtcredit\_GDP_{t-1}$	-0.008***	-0.008***	-0.008***	0.004	0.005	0.004
	(0.003)	(0.003)	(0.003)	(0.008)	(0.008)	(0.008)
GDP_Growth_{t-1}	-0.014	-0.019	-0.013	-0.039	-0.028	-0.038
	(0.019)	(0.019)	(0.019)	(0.048)	(0.047)	(0.048)
$Log\_Percapita\_GDP_{t-1}$	1.205***	1.224***	1.198***	-0.143	-0.255	-0.145
	(0.367)	(0.367)	(0.366)	(0.815)	(0.817)	(0.815)
$Constant$	-5.328	-4.639	-5.25	18.626**	18.156**	18.648**
	(3.850)	(3.830)	(3.839)	(8.967)	(9.065)	(8.967)
Firm-year obs.	24,860	24,860	24,860	24,925	24,925	24,925
Fixed effects	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr
R^2	0.049	0.049	0.049	0.020	0.019	0.020

The dependent variable is the accounts payable scaled by total assets in the year t, in columns (1)-(3) and accounts receivable scaled by total sales in the year t, in columns (4)-(6). $Rating$ takes values from 1 to 22 depending on the credit rating of the firm, 1 indicates default and 22 indicates AAA rating. $Basel\_Dum$ is a dummy variable which takes value of 1 if the country of domicile of a firm has implemented Basel II regulations and 0 otherwise. HCC_Dum takes value of 1 if the rating is B+ or lower that invites higher capital charge for banks, and 0 if the rating is BB- or higher. $Crisis\_Dum$ takes value of 1 for the years 2008 and 2009, and 0 for all other years. Robust standard errors clustered at firm-level are presented in the brackets. ***, ** and * indicate p-values at the 1%, 5% and 10% significance levels. The definition of the variables are given in Table 1.

Table 8: **Effect of risk-sensitive Basel II regulations on payout choices**

	(1)	(2)	(3)	(4)	(5)	(6)
$Rating_{t-1}$	2.798***	2.941***	2.776***	6.053***	5.554***	6.020***
	(0.583)	(0.621)	(0.584)	(0.916)	(0.957)	(0.916)
$Basel\_Dum$	-18.633***	3.588	-18.522***	-12.167	1.858	-11.939
	(5.853)	(3.455)	(5.875)	(9.198)	(4.888)	(9.252)
$Basel\_Dum \times Rating_{t-1}$	1.579***		1.531***	1.003*		0.925
	(0.333)		(0.342)	(0.558)		(0.575)
HCC_Dum		-2.615			-10.121	
		(3.489)			(6.689)	
$HCC\_Dum \times Basel\_Dum$		-8.883***			-5.231	
		(3.345)			(5.939)	
$Crisis\_Dum$			-12.942			-7.481
			(8.862)			(13.693)
$Crisis\_Dum \times Rating_{t-1}$			0.518			0.821
			(0.415)			(0.710)
$Earnings\_Volatility_{t-1}$	14.434	16.583	14.482	32.096	33.754	32.356
	(27.693)	(27.732)	(27.710)	(53.710)	(53.831)	(53.734)
Log_Sales_{t-1}	5.244***	4.993***	5.264***	5.742**	5.463*	5.782**
	(1.876)	(1.865)	(1.877)	(2.926)	(2.897)	(2.928)
$Leverage_{t-1}$	-0.742	-0.645	-0.769	-5.932**	-5.773**	-5.978**
	(1.430)	(1.439)	(1.429)	(2.567)	(2.570)	(2.565)
$Op.CF\_Asset_{t-1}$	29.639	25.835	29.657	124.700***	120.561***	124.679***
	(19.140)	(19.133)	(19.157)	(35.608)	(35.483)	(35.641)
M/B_{t-1}	-1.032***	-1.028***	-1.029***	-2.559***	-2.529***	-2.552***
	(0.234)	(0.234)	(0.234)	(0.432)	(0.433)	(0.432)
$EBITDA\_Asset_{t-1}$	-81.562***	-80.503***	-81.916***	-107.788***	-108.375***	-108.265***
	(18.668)	(18.708)	(18.698)	(33.673)	(33.668)	(33.707)
$Pvtcredit\_GDP_{t-1}$	-0.031	-0.023	-0.03	0.026	0.027	0.027
	(0.051)	(0.051)	(0.052)	(0.072)	(0.072)	(0.072)
GDP_Growth_{t-1}	0.514	0.623*	0.522	1.056*	1.119*	1.073*
	(0.372)	(0.373)	(0.373)	(0.577)	(0.574)	(0.578)
$Log\_Percapita\_GDP_{t-1}$	16.472***	15.237**	16.365***	5.073	3.947	4.901
	(5.901)	(5.942)	(5.899)	(7.669)	(7.705)	(7.667)
$Constant$	-227.598***	-215.098***	-226.493***	-157.026**	-133.872*	-155.406**
	(57.714)	(58.304)	(57.687)	(75.952)	(76.862)	(75.949)
Firm-year obs.	23,528	23,528	23,528	22,982	22,982	22,982
Fixed effects	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr
R^2	0.022	0.021	0.022	0.024	0.024	0.024

The dependent variable in columns (1)-(3) is the dividend payout (%) in the year t and in columns (4)-(6) is the total payout ratio (including repurchases). $Rating$ takes values from 1 to 22 depending on the credit rating of the firm, 1 indicates default and 22 indicates AAA rating. $Basel\_Dum$ is a dummy variable which takes value of 1 if the country of domicile of a firm has implemented Basel II regulations and 0 otherwise. HCC_Dum takes value of 1 if the rating is B+ or lower that invites higher capital charge for banks, and 0 if the rating is BB- or higher. $Crisis\_Dum$ takes value of 1 for the years 2008 and 2009, and 0 for all other years. Robust standard errors clustered at firm-level are presented in the brackets. ***, ** and * indicate p-values at the 1%, 5% and 10% significance levels. The definition of the variables are given in Table 1.

Table 9: **Effect of risk-sensitive Basel II regulations on capital investment**

	(1)	(2)	(3)	(4)
$Rating_{t-1}$	0.309**	0.349***	0.298**	0.357***
	(0.121)	(0.117)	(0.120)	(0.117)
$Basel\_Dum$	-2.414*	0.818	-2.342	0.636
	(1.438)	(0.699)	(1.441)	(0.700)
$Basel\_Dum \times Rating_{t-1}$	0.226***		0.205**	
	(0.085)		(0.086)	
HCC_Dum		0.151		0.46
		(0.822)		(0.820)
$HCC\_Dum \times Basel\_Dum$		-1.705*		-1.674*
		(0.874)		(0.874)
$Crisis\_Dum$			-9.144***	-5.780***
			(1.981)	(1.529)
$Crisis\_Dum \times Rating_{t-1}$			0.210**	
			(0.092)	
$HCC\_Dum \times Crisis\_Dum$				-2.517**
				(1.020)
$Cash\_Asset_{t-1}$	23.961***	23.834***	24.038***	23.898***
	(3.118)	(3.122)	(3.117)	(3.124)
Log_Sales_{t-1}	-1.865**	-1.894**	-1.860**	-1.901**
	(0.758)	(0.760)	(0.758)	(0.760)
$Leverage_{t-1}$	-1.719***	-1.708***	-1.726***	-1.708***
	(0.289)	(0.290)	(0.288)	(0.287)
$Op.CF\_Fixedasset_{t-1}$	2.899***	2.898***	2.900***	2.898***
	(0.568)	(0.569)	(0.568)	(0.569)
M/B_{t-1}	0.701***	0.700***	0.700***	0.697***
	(0.065)	(0.064)	(0.065)	(0.064)
$Pvtcredit\_GDP_{t-1}$	0.001	0.002	0.001	0.001
	(0.010)	(0.010)	(0.010)	(0.010)
GDP_Growth_{t-1}	0.194**	0.209**	0.198**	0.207**
	(0.089)	(0.091)	(0.089)	(0.091)
$Log\_Percapita\_GDP_{t-1}$	0.121	-0.01	0.09	-0.035
	(1.369)	(1.378)	(1.368)	(1.376)
$Constant$	42.418***	43.367***	42.783***	43.677***
	(12.813)	(12.973)	(12.817)	(12.954)
Firm-year obs.	25,322	25,322	25,322	25,322
Fixed effects	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr
R^2	0.123	0.123	0.123	0.123

The dependent variable in all the estimations is the capital expenditure in the year t scaled by the prior period fixed assets (in percent). $Rating$ takes values from 1 to 22 depending on the credit rating of the firm, 1 indicates default and 22 indicates AAA rating. $Basel\_Dum$ is a dummy variable which takes value of 1 if the country of domicile of a firm has implemented Basel II regulations and 0 otherwise. HCC_Dum takes value of 1 if the rating is B+ or lower that invites higher capital charge for banks, and 0 if the rating is BB- or higher. $Crisis\_Dum$ takes value of 1 for the years 2008 and 2009, and 0 for all other years. Robust standard errors clustered at firm-level are presented in the brackets. ***, ** and * indicate p-values at the 1%, 5% and 10% significance levels. The definition of the variables are given in Table 1.

Table 10: **Baseline estimations with additional covariates for debt financing and interest cost**

	$\Delta Debt\_Asset$		$Interest\_Cost$	
	(1)	(2)	(3)	(4)
$Rating_{t-1}$	0.839***	0.759***	-0.264***	-0.269***
	(0.104)	(0.105)	(0.030)	(0.029)
$Basel\_Dum$	-1.834*	-2.307**	1.282***	1.468***
	(0.963)	(0.994)	(0.321)	(0.315)
$Basel\_Dum \times Rating_{t-1}$	0.288***	0.321***	-0.072***	-0.078***
	(0.062)	(0.064)	(0.023)	(0.022)
Sov_Rating_{t-1}	-0.525***		-0.011	
	(0.196)		(0.038)	
$Bank\_Capital\_Asset_{t-1}$		0.701***		-0.017
		(0.119)		(0.031)
$Sales\_Growth_{t-1}$	-0.009	-0.004	-0.002*	-0.002*
	(0.006)	(0.006)	(0.001)	(0.001)
Log_Sales_{t-1}	-6.096***	-6.166***	0.138*	0.119
	(0.429)	(0.435)	(0.075)	(0.075)
$Leverage_{t-1}$	-1.130***	-0.923***	0.114	0.131
	(0.337)	(0.289)	(0.098)	(0.086)
$Op.CF\_Asset_{t-1}$	19.629***	23.035***	-2.180**	-2.459***
	(4.271)	(4.157)	(0.980)	(0.951)
M/B_{t-1}	0.084	0.072	-0.026**	-0.023**
	(0.067)	(0.063)	(0.011)	(0.011)
$Tangibility_{t-1}$	3.857**	2.234	-0.107	0.076
	(1.586)	(1.659)	(0.499)	(0.479)
$EBITDA\_Asset_{t-1}$	29.887***	29.398***	-0.708	-0.52
	(3.958)	(3.956)	(0.909)	(0.899)
$Pvtcredit\_GDP_{t-1}$	0.014*	0.018**	-0.001	0.002
	(0.007)	(0.008)	(0.002)	(0.002)
GDP_Growth_{t-1}	-0.026	-0.194**	-0.030*	-0.019
	(0.081)	(0.088)	(0.016)	(0.018)
$Log\_Percapita\_GDP_{t-1}$	8.887***	8.902***	-0.503	-0.451
	(1.267)	(1.060)	(0.330)	(0.351)
$Constant$	-4.943	-18.133	14.226***	14.142***
	(10.750)	(11.372)	(3.142)	(3.453)
Firm-year obs.	20,761	20,824	20,682	20,749
Fixed effects	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr
R^2	0.078	0.081	0.118	0.125

The dependent variable is the incremental debt to assets in the year t in columns (1), and (2), and interest cost of debt in the year t in columns (3) and (4). $Rating$ takes values from 1 to 22 depending on the credit rating of the firm, 1 indicates default and 22 indicates AAA rating. $Basel\_Dum$ is a dummy variable which takes value of 1 if the country of domicile of a firm has implemented Basel II regulations and 0 otherwise. Robust standard errors clustered at firm-level are presented in the brackets. ***, ** and * indicate p-values at the 1%, 5% and 10% significance levels. The definition of the variables are given in Table 1.

Table 11: **Control for global financial crisis & banking crises**

	$\Delta Debt\_Asset$		$Interest\_Cost$	
	(1)	(2)	(3)	(4)
$Rating_{t-1}$	1.127***	1.271***	-0.299***	-0.292***
	(0.128)	(0.131)	(0.029)	(0.030)
$Basel\_Dum$	-3.423***	1.524**	1.316***	0.373**
	(1.225)	(0.621)	(0.324)	(0.153)
$Basel\_Dum \times Rating_{t-1}$	0.340***		-0.069***	
	(0.078)		(0.021)	
$Crisis\_Dum$	-7.023***	-2.528*	-2.564***	-2.436***
	(1.831)	(1.487)	(0.420)	(0.333)
$Crisis\_Dum \times Rating_{t-1}$	0.282***		0.017	
	(0.073)		(0.017)	
$Bank\_Crisis$	1.435	1.400**	-0.391	-0.06
	(2.021)	(0.633)	(0.296)	(0.093)
$Bank\_Crisis \times Rating_{t-1}$	-0.031		0.025	
	(0.134)		(0.020)	
HCC_Dum		1.697**		0.143
		(0.752)		(0.165)
$HCC\_Dum \times Basel\_Dum$		-2.616***		0.324*
		(0.755)		(0.196)
$HCC\_Dum \times Crisis\_Dum$		-3.318***		0.143
		(0.752)		(0.173)
$HCC\_Dum \times Bank\_Crisis$		-3.275**		0.141
		(1.321)		(0.204)
$Sales\_Growth_{t-1}$	0.001	0.002	-0.002*	-0.002*
	(0.007)	(0.007)	(0.001)	(0.001)
Log_Sales_{t-1}	-7.403***	-7.474***	0.249***	0.263***
	(0.595)	(0.599)	(0.081)	(0.081)
$Leverage_{t-1}$	-1.217***	-1.215***	0.267**	0.265**
	(0.340)	(0.342)	(0.113)	(0.113)
$Op.CF\_Asset_{t-1}$	26.288***	26.091***	-2.355**	-2.241**
	(5.398)	(5.373)	(0.995)	(0.992)
M/B_{t-1}	0.144*	0.134	-0.023*	-0.023*
	(0.082)	(0.082)	(0.013)	(0.013)
$Tangibility_{t-1}$	3.129	2.796	0.601	0.648
	(2.241)	(2.240)	(0.402)	(0.401)
$EBITDA\_Asset_{t-1}$	28.173***	28.474***	-1.471	-1.515
	(4.980)	(4.971)	(0.952)	(0.948)
Firm-year obs.	17,529	17,529	17,485	17,485
Fixed effects	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr
R^2	0.103	0.103	0.09	0.089

The dependent variable is the incremental debt to assets in the year t in columns (1), and (2), and interest cost of debt in the year t in columns (3) and (4). $Rating$ takes values from 1 to 22 depending on the credit rating of the firm, 1 indicates default and 22 indicates AAA rating. $Basel\_Dum$ is a dummy variable which takes value of 1 if the country of domicile of a firm has implemented Basel II regulations and 0 otherwise. HCC_Dum takes value of 1 if the rating is B+ or lower that invites higher capital charge for banks, and 0 if the rating is BB- or higher. $Crisis\_Dum$ is a dummy variable which takes the value 1 for the years 2008-2009 and 0 otherwise. $Bank\_Crisis$ is a country-specific dummy variable which takes the value 1 for all the years where a banking crisis had been identified in the database maintained by Laeven and Valencia (2013) on systemic banking crises and 0 otherwise. We truncate the sample at year 2011 as the database on banking crises is available only until 2011. Robust standard errors clustered at firm-level are presented in the brackets. ***, ** and * indicate p-values at the 1%, 5% and 10% significance levels. We do not present the country-specific variables and constant term for brevity. The definition of the variables are given in Table 1.

Table 12: **Lead and lag effects in the implementation of Basel II regulations**

	t-3	t-2	t-1	t	t+1	t+2	t+3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Rating_{t-1}$	0.968***	0.974***	0.976***	1.010***	1.064***	1.109***	1.148***
	(0.119)	(0.116)	(0.114)	(0.112)	(0.110)	(0.109)	(0.110)
$Basel\_Leadlag$	-3.855***	-4.049***	-5.415***	-2.775***	-0.298	-0.287	1.616
	(1.120)	(1.101)	(1.116)	(1.076)	(1.059)	(1.126)	(1.253)
$Basel\_Leadlag \times Rating_{t-1}$	0.295***	0.318***	0.360***	0.331***	0.219***	0.101	-0.079
	(0.072)	(0.071)	(0.071)	(0.070)	(0.068)	(0.072)	(0.077)
$Sales\_Growth_{t-1}$	0.000	-0.001	-0.001	-0.001	0.000	0.000	-0.004
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Log_Sales_{t-1}	-6.492***	-6.499***	-6.508***	-6.520***	-6.522***	-6.561***	-6.219***
	(0.527)	(0.529)	(0.530)	(0.527)	(0.528)	(0.531)	(0.529)
$Leverage_{t-1}$	-1.332***	-1.317***	-1.296***	-1.317***	-1.310***	-1.307***	-1.250***
	(0.323)	(0.323)	(0.322)	(0.322)	(0.321)	(0.326)	(0.318)
$Op.CF\_Asset_{t-1}$	22.189***	22.416***	22.845***	22.278***	22.229***	22.051***	20.617***
	(4.822)	(4.840)	(4.826)	(4.801)	(4.810)	(4.807)	(4.846)
M/B_{t-1}	0.225***	0.222***	0.220***	0.218***	0.210***	0.209***	0.228***
	(0.081)	(0.081)	(0.081)	(0.080)	(0.080)	(0.080)	(0.081)
$Tangibility_{t-1}$	2.422	2.391	2.643	2.67	2.467	2.21	2.335
	(1.843)	(1.846)	(1.848)	(1.840)	(1.836)	(1.842)	(1.884)
$EBITDA\_Asset_{t-1}$	27.456***	27.483***	26.869***	27.346***	27.553***	27.821***	28.234***
	(4.542)	(4.568)	(4.556)	(4.529)	(4.549)	(4.551)	(4.562)
$Pvtcredit\_GDP_{t-1}$	0.001	0.001	-0.001	0.005	-0.004	-0.002	-0.001
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
GDP_Growth_{t-1}	-0.089	-0.096	-0.119	-0.128	-0.149	-0.091	-0.084
	(0.092)	(0.091)	(0.092)	(0.092)	(0.092)	(0.092)	(0.090)
$Log\_Percapita\_GDP_{t-1}$	6.804***	6.868***	6.926***	6.823***	6.367***	6.519***	5.743***
	(0.991)	(1.002)	(1.001)	(0.988)	(0.976)	(0.982)	(0.988)
$Constant$	11.762	11.142	10.928	10.824	15.994	14.013	16.027
	(9.906)	(10.020)	(10.050)	(9.947)	(9.823)	(9.878)	(10.017)
Firm-year obs.	18,945	18,880	18,878	18,945	18,945	18,945	18,466
Fixed effects	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr
R^2	0.092	0.093	0.094	0.093	0.093	0.092	0.089

The dependent variable in the estimations is the incremental debt in the year t scaled by prior period total assets of the firm in percent. $Rating$ takes values from 1 to 22 depending on the credit rating of the firm, 1 indicates default and 22 indicates AAA rating. $Basel\_Leadlag$ is a dummy variable to indicate the lead and lag years around the Basel II implementation as shown in the column headings. For instance, estimations given in t-1 (t-2), the dummy takes value 1 for all years in the post-Basel II period and the immediately preceding year (two years). Robust standard errors clustered at firm-level are presented in the brackets. ***, ** and * indicate p-values at the 1%, 5% and 10% significance levels. The definition of the variables are given in Table 1.

Table 13: **Baseline estimations excluding US firms**

	$\Delta Debt\_Asset$			$Interest\_Cost$		
	(1)	(2)	(3)	(4)	(5)	(6)
$Rating_{t-1}$	0.752***	1.028***	0.758***	-0.181***	-0.194***	-0.181***
	(0.164)	(0.154)	(0.165)	(0.046)	(0.045)	(0.045)
$Basel\_Dum$	-2.119	1.809**	-1.893	1.652***	0.427**	1.670***
	(1.591)	(0.821)	(1.613)	(0.506)	(0.214)	(0.520)
$Basel\_Dum \times Rating_{t-1}$	0.276**		0.251**	-0.082**		-0.084**
	(0.108)		(0.112)	(0.035)		(0.037)
HCC_Dum		3.002**			-0.120	
		(1.357)			(0.408)	
$HCC\_Dum \times Basel\_Dum$		-1.996			0.949***	
		(1.246)			(0.363)	
$Crisis\_Dum$			-4.077*			-2.826***
			(2.268)			(0.689)
$Crisis\_Dum \times Rating_{t-1}$			0.117			0.009
			(0.121)			(0.030)
$Sales\_Growth_{t-1}$	-0.009	-0.009	-0.009	0.000	0.000	0.000
	(0.009)	(0.009)	(0.009)	(0.002)	(0.002)	(0.002)
Log_Sales_{t-1}	-4.395***	-4.420***	-4.397***	-0.021	-0.011	-0.021
	(0.613)	(0.612)	(0.614)	(0.122)	(0.122)	(0.122)
$Leverage_{t-1}$	-0.965***	-0.983***	-0.976***	0.061	0.063	0.06
	(0.313)	(0.318)	(0.314)	(0.089)	(0.089)	(0.089)
$Op.CF\_Asset_{t-1}$	11.692**	12.061**	11.692**	-1.719	-1.661	-1.718
	(5.574)	(5.547)	(5.574)	(1.384)	(1.390)	(1.385)
M/B_{t-1}	0.439***	0.433***	0.440***	-0.074***	-0.073***	-0.074***
	(0.122)	(0.122)	(0.122)	(0.027)	(0.027)	(0.027)
$Tangibility_{t-1}$	2.327	2.213	2.343	-0.093	-0.121	-0.093
	(2.176)	(2.196)	(2.178)	(0.719)	(0.708)	(0.719)
$EBITDA\_Asset_{t-1}$	26.891***	26.588***	26.803***	0.600	0.641	0.592
	(5.647)	(5.653)	(5.644)	(1.425)	(1.426)	(1.422)
$Pvtcredit\_GDP_{t-1}$	0.008	0.010	0.009	0.001	0.001	0.001
	(0.008)	(0.008)	(0.008)	(0.002)	(0.002)	(0.002)
GDP_Growth_{t-1}	-0.031	-0.018	-0.025	-0.025	-0.027*	-0.025
	(0.081)	(0.081)	(0.081)	(0.015)	(0.015)	(0.015)
$Log\_Percapita\_GDP_{t-1}$	5.619***	5.256***	5.588***	-0.706**	-0.628*	-0.708**
	(1.081)	(1.048)	(1.079)	(0.342)	(0.373)	(0.340)
$Constant$	-1.795	-2.693	-1.616	18.316***	17.664***	18.330***
	(9.783)	(10.060)	(9.774)	(3.321)	(3.523)	(3.314)
Firm-year obs.	9,835	9,835	9,835	9,781	9,781	9,781
Fixed effects	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr
R^2	0.086	0.086	0.086	0.108	0.109	0.108

The dependent variable is the incremental debt to assets in the year t in columns (1)-(3), and interest cost of debt in the year t in columns (4)-(6). $Rating$ takes values from 1 to 22 depending on the credit rating of the firm, 1 indicates default and 22 indicates AAA rating. $Basel\_Dum$ is a dummy variable which takes value of 1 if the country of domicile of a firm has implemented Basel II regulations and 0 otherwise. HCC_Dum takes value of 1 if the rating is lower than BB- that invites higher capital charge for banks, and 0 if the rating is BB- or higher. $Crisis\_Dum$ takes value of 1 for the years 2008 and 2009, and 0 for all other years. Robust standard errors clustered at firm-level are presented in the brackets. ***, ** and * indicate p-values at the 1%, 5% and 10% significance levels. The definition of the variables are given in Table 1.

Table 14: **Baseline estimations with control for change in credit rating**

	Overall sample		LPC sample	
	(1)	(2)	(3)	(4)
$Rating_{t-1}$	0.884***	-0.279***	1.231***	-0.334***
	(0.100)	(0.026)	(0.172)	(0.033)
$Basel\_Dum$	-2.006**	1.401***	-4.626**	2.050***
	(0.990)	(0.299)	(2.131)	(0.469)
$Basel\_Dum \times Rating_{t-1}$	0.269***	-0.078***	0.389***	-0.121***
	(0.063)	(0.021)	(0.121)	(0.032)
$\Delta Rating_{t-1}$	-0.117	0.064**	-0.285	0.091**
	(0.150)	(0.027)	(0.213)	(0.040)
$Basel\_Dum \times \Delta Rating_{t-1}$	-0.026	0.004	-0.298	-0.04
	(0.201)	(0.034)	(0.322)	(0.048)
$Sales\_Growth_{t-1}$	0.001	-0.003**	-0.002	-0.003*
	(0.006)	(0.001)	(0.011)	(0.002)
Log_Sales_{t-1}	-5.878***	0.132*	-8.120***	0.210**
	(0.446)	(0.072)	(0.730)	(0.089)
$Leverage_{t-1}$	-0.934***	0.215***	-1.100**	0.260**
	(0.260)	(0.077)	(0.464)	(0.122)
$Op.CF\_Asset_{t-1}$	20.955***	-2.298**	34.728***	-2.274*
	(4.116)	(0.897)	(8.242)	(1.270)
M/B_{t-1}	0.143**	-0.026**	0.362***	-0.040**
	(0.063)	(0.010)	(0.131)	(0.016)
$Tangibility_{t-1}$	1.300	0.410	-4.687	0.472
	(1.583)	(0.417)	(3.236)	(0.480)
$EBITDA\_Asset_{t-1}$	26.672***	-1.022	35.604***	-2.680**
	(4.013)	(0.833)	(7.747)	(1.298)
$Pvtcredit\_GDP_{t-1}$	0.003	0.001	-0.019	0.006**
	(0.007)	(0.002)	(0.016)	(0.003)
GDP_Growth_{t-1}	0.000	-0.023	0.059	-0.003
	(0.077)	(0.016)	(0.138)	(0.025)
$Log\_Percapita\_GDP_{t-1}$	5.973***	-0.451	7.831***	-0.800**
	(0.884)	(0.329)	(1.642)	(0.353)
$Constant$	13.052	14.293***	27.214	16.375***
	(8.994)	(3.263)	(17.010)	(3.543)
Firm-year obs.	23,186	23,102	9,137	9,114
Fixed effects	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr
R^2	0.08	0.146	0.121	0.199

The dependent variable is the incremental debt to assets in the year t in columns (1) and (3) , and interest cost of debt in the year t in columns (2) and (4). $Rating$ takes values from 1 to 22 depending on the credit rating of the firm, 1 indicates default and 22 indicates AAA rating. $Basel\_Dum$ is a dummy variable which takes value of 1 if the country of domicile of a firm has implemented Basel II regulations and 0 otherwise. Robust standard errors clustered at firm-level are presented in the brackets. ***, ** and * indicate p-values at the 1%, 5% and 10% significance levels. The definition of the variables are given in Table 1.

A. Appendix

Table A1: **Basel II implementation timeline and rating statistics**

Country name	Implementation Year	Firm-years	Average Rating	Std. Dev. Rating
Argentina	2013	138	6.80	3.64
Australia	2008	617	14.42	2.20
Austria	2007	66	14.71	2.24
Bahamas	2016	9	7.56	0.53
Bahrain	2008	4	12.50	0.58
Belgium	2007	58	15.55	2.20
Brazil	2013	450	11.24	2.18
Canada	2008	719	13.23	2.91
China	2012	315	11.56	3.05
Colombia	2007	35	13.06	0.68
Cyprus	2007	4	8.00	1.15
Czech Republic	2007	37	15.65	0.82
Denmark	2007	38	15.08	2.44
Finland	2007	112	13.38	2.58
France	2007	674	14.69	2.68
Germany	2007	533	14.16	2.80
Greece	2007	63	11.19	3.20
Hong Kong	2007	391	13.69	3.44
India	2008	144	12.30	1.94
Indonesia	2012	220	8.50	2.67
Ireland	2007	96	13.23	2.69
Israel	2009	22	13.95	1.81
Italy	2007	227	14.17	2.99
Japan	2008	1,482	16.23	2.86
Kazakhstan	2016	18	11.56	0.78
Luxembourg	2007	33	11.45	2.46
Macao	2013	4	11.25	0.96
Malaysia	2008	93	14.59	1.85
Mexico	2008	348	11.91	2.91
Mongolia	2005	5	5.80	2.59
Netherlands	2007	210	14.25	3.47
New Zealand	2008	57	15.67	2.47
Norway	2007	99	14.02	3.71
Peru	2010	44	9.00	4.02
Philippines	2007	27	9.81	2.20
Poland	2007	48	11.44	3.47
Portugal	2007	61	14.64	2.38
Qatar	2006	11	17.18	1.25
Romania	2007	9	12.00	0.87
Russian Federation	2008	301	10.77	2.09
Saudi Arabia	2008	23	16.70	3.48
Singapore	2008	108	15.10	4.63
South Africa	2008	44	12.30	1.34
Spain	2007	183	14.25	3.17
Sri Lanka	2007	13	9.46	0.52
Sweden	2007	258	14.72	2.10
Switzerland	2007	270	15.53	3.35
Thailand	2008	114	13.25	3.19
Turkey	2012	69	10.32	2.19
United Arab Emirates	2009	22	16.64	2.74
United Kingdom	2007	909	14.69	3.03
United States	2009	15,689	12.79	3.29
Overall	-	25,524	13.17	3.39

The Basel II implementation timeline for the BCBS member countries is obtained from the BIS progress reports: https://www.bis.org/bcbs/implementation.htm?m=3%7C14%7C656. The implementation years for all non-member countries has been obtained from https://www.bis.org/fsi/fsiop2015.htm. The implementation timeline have been validated with the implementation years with that of Hasan et al. (2015), who use similar implementation timeline for their analysis on cross-border flows from G-10 countries. All countries with a minimum of 5 firm-year observations are included (the lag ratings requirement reduces the minimum observations to 4).

Table A2: **Placebo tests on the impact of Basel II regulations**

	Late adopters	Placebo-2007	Placebo-2008	Placebo-2001
	(1)	(2)	(3)	(4)
$Rating_{t-1}$	0.876***	1.182***	1.209***	1.222***
	(0.123)	(0.203)	(0.200)	(0.261)
$Impl\_Dum$	-0.735	-29.934***	-25.476***	-1.547
	(1.467)	(7.794)	(8.036)	(2.431)
$Impl\_Dum \times Rating_{t-1}$	0.346***	0.080	-0.500	0.159
	(0.083)	(0.152)	(0.339)	(0.114)
$Crisis\_Dum$	-13.420***	2.918	-2.498	
	(2.497)	(4.566)	(5.415)	
$Crisis\_Dum \times Rating_{t-1}$	0.308***	0.285	0.821**	
	(0.085)	(0.174)	(0.337)	
$Sales\_Growth_{t-1}$	0.011	0.001	0.001	0.009
	(0.007)	(0.010)	(0.010)	(0.011)
Log_Sales_{t-1}	-7.128***	-9.314***	-9.310***	-11.698***
	(0.501)	(0.830)	(0.832)	(1.092)
$Leverage_{t-1}$	-1.279***	-1.040**	-1.027**	-1.071**
	(0.344)	(0.459)	(0.457)	(0.480)
$Op.CF\_Asset_{t-1}$	21.525***	26.618***	26.355***	32.998***
	(5.325)	(8.127)	(8.133)	(8.760)
M/B_{t-1}	0.096	0.029	0.028	0.314**
	(0.069)	(0.112)	(0.112)	(0.134)
$Tangibility_{t-1}$	1.411	2.988	2.874	7.972*
	(1.800)	(2.903)	(2.912)	(4.088)
$EBITDA\_Asset_{t-1}$	28.964***	37.944***	38.071***	44.396***
	(4.835)	(7.629)	(7.630)	(8.052)
$Pvtcredit\_GDP_{t-1}$	0.052**	0.114**	0.134**	-0.036*
	(0.023)	(0.055)	(0.057)	(0.019)
GDP_Growth_{t-1}	0.045	-0.32	-0.302	-0.085
	(0.176)	(0.243)	(0.241)	(0.151)
$Log\_Percapita\_GDP_{t-1}$	9.220***	20.707***	21.229***	16.878***
	(1.750)	(4.027)	(4.017)	(3.424)
$Constant$	-10.978	-111.321**	-120.109***	-19.852
	(18.632)	(45.320)	(45.805)	(35.096)
Firm-year obs.	17,000	9,662	9,662	8,233
Fixed effects	Firm, Yr	Firm, Yr	Firm, Yr	Firm, Yr
R^2	0.09	0.104	0.104	0.135

The dependent variable is the incremental debt to assets in the year t. Columns (1)-(3) show estimations for a subsample of firms based in late adopter countries, which have implemented the Basel II regulations after 2008. The placebo subsample period in columns (2)-(3) is truncated at the respective Basel II implementation year of the respective late adopter country to avoid confounding effects. Column (4) shows estimations for a sub-period (1995 - 2004) of all firms in the baseline sample. $Rating$ takes values from 1 to 22 depending on the credit rating of the firm, 1 indicates default and 22 indicates AAA rating. $Impl\_Dum$ is a dummy variable which takes value of 1 for the implementation years based on the respective placebo years shown in column headings and 0 otherwise. In column (1), f the $Impl\_Dum$ takes the the value of 1 if the firm's country of domicile has implemented Basel-II regulations and 0 otherwise. $Crisis\_Dum$ is a dummy variable which takes the value 1 for the years 2008-2009 and 0 otherwise. Robust standard errors clustered at firm-level are presented in the brackets. ***, ** and * indicate p-values at the 1%, 5% and 10% significance levels. The definition of the variables are given in Table 1.

Table A3: **Baseline estimation with exclusion of speculative grade firms**

	(1)	(2)	(3)	(4)
$Rating_{t-1}$	1.046***	-0.141***	1.046***	-0.141***
	(0.139)	(0.038)	(0.139)	(0.038)
$Basel\_Dum$	-3.174*	2.162***	-3.195*	2.155***
	(1.789)	(0.596)	(1.800)	(0.627)
$Basel\_Dum \times Rating_{t-1}$	0.270**	-0.125***	0.271**	-0.124***
	(0.106)	(0.038)	(0.107)	(0.041)
$Crisis\_Dum$			-0.939	-2.373***
			(2.250)	(0.674)
$Crisis\_Dum \times Rating_{t-1}$			-0.009	-0.003
			(0.123)	(0.037)
$Sales\_Growth_{t-1}$	-0.008	-0.003**	-0.008	-0.003**
	(0.007)	(0.001)	(0.007)	(0.001)
Log_Sales_{t-1}	-4.613***	0.186**	-4.614***	0.186**
	(0.474)	(0.073)	(0.474)	(0.074)
$Leverage_{t-1}$	-0.688**	0.217	-0.688**	0.217
	(0.337)	(0.137)	(0.337)	(0.137)
$Op.CF\_Asset_{t-1}$	22.489***	-1.106	22.491***	-1.105
	(5.976)	(1.046)	(5.975)	(1.044)
M/B_{t-1}	0.154**	-0.043***	0.153**	-0.043***
	(0.075)	(0.015)	(0.075)	(0.015)
$Tangibility_{t-1}$	0.122	0.208	0.122	0.208
	(1.912)	(0.377)	(1.912)	(0.377)
$EBITDA\_Asset_{t-1}$	28.781***	-0.834	28.783***	-0.833
	(5.420)	(0.993)	(5.421)	(0.992)
$Pvtcredit\_GDP_{t-1}$	0.000	0.003	0.000	0.003
	(0.008)	(0.002)	(0.008)	(0.002)
GDP_Growth_{t-1}	-0.044	-0.006	-0.044	-0.006
	(0.072)	(0.016)	(0.072)	(0.016))
$Log\_Percapita\_GDP_{t-1}$	5.508***	-0.474*	5.507***	-0.475*
	(1.004)	(0.285)	(1.004)	(0.286)
$Constant$	-4.887	11.233***	-4.868	11.239***
	(9.763)	(3.000)	(9.763)	(3.011)
Firm-year obs.	15,088	15,035	15,088	15,035
Fixed effects	Firm, yr	Firm, yr	Firm, yr	Firm, yr
R^2	0.077	0.172	0.077	0.172

The dependent variable is the incremental debt to assets in the year t in columns (1) and (3), and interest cost of debt in the year t in columns (2) and (4). $Rating$ takes values from 13 to 22 depending on the credit rating of the firm, 13 indicates BBB- and 22 indicates AAA rating. $Basel\_Dum$ is a dummy variable which takes the value 1 if the firm's country of domicile has implemented Basel-II regulations and 0 otherwise. $Crisis\_Dum$ takes value of 1 for the years 2008 and 2009, and 0 for all other years. Robust standard errors clustered at firm level are presented in the brackets. ***, ** and * indicate p-values at 1%, 5% and 10% levels. The definition of the variables are given in Table 1.